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THE

ENCYCLOPÆDIA BRITANNICA

ELEVENTH EDITION

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THE

ENCYCLOPÆDIA BRITANNICA

A

DICTIONARY

OF

ARTS, SCIENCES, LITERATURE AND GENERAL INFORMATION

ELEVENTH EDITION

VOLUME I

A to ANDROPHAGI

UNIVERSITY OF VIRGINIA
GENERAL

Cambridge, England:
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1910

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GENERAL
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1819

DEDICATED BY PERMISSION

TO

HIS MAJESTY GEORGE THE FIFTH
KING OF GREAT BRITAIN AND IRELAND
AND OF THE BRITISH DOMINIONS BEYOND THE SEAS
EMPEROR OF INDIA

AND TO

WILLIAM HOWARD TAFT
PRESIDENT OF THE UNITED STATES OF AMERICA

PREFATORY NOTE

THE *Encyclopædia Britannica*, of which the Eleventh Edition is now issued by the University of Cambridge, has a history extending over 140 years. The First Edition, in three quarto volumes, was issued in weekly numbers (price 6d. each) from 1768 to 1771 by "a Society of Gentlemen in Scotland." The proprietors were Colin MacFarquhar, an Edinburgh printer, and Andrew Bell, the principal Scottish engraver of that day. It seems that MacFarquhar, a man of wide knowledge and excellent judgment, was the real originator of the work, though his want of capital prevented his undertaking it by himself. The work was edited and in great part written by William Smellie, another Edinburgh printer, who was bold enough to undertake "fifteen capital sciences" for his own share. The numerous plates were engraved by Bell so admirably that some of them have been reproduced in every edition down to the present one.

The plan of the work differed from all preceding "dictionaries of arts and sciences," as encyclopædias were usually called until then in Great Britain; it combined the plan of Dennis de Coetlogon (1745) with that in common use—on the one hand keeping important subjects together, and on the other facilitating reference by numerous and short separate articles arranged in alphabetical order. Though the infant *Encyclopædia Britannica* omitted the whole field of history and biography as beneath the dignity of encyclopædias, it speedily acquired sufficient popularity to justify the preparation of a new edition on a much larger scale. The decision to include history and biography caused the secession of Smellie; but MacFarquhar himself edited the work, with the assistance of James Tytler, famous as the first Scottish aeronaut, and for the first time produced an encyclopædia which covered the whole field of human knowledge. This Second Edition was issued in numbers from June 1777 to September 1784, and was afterwards bound up in ten quarto volumes, containing (8595 pages and 340 plates) more than three times as much material as the First Edition.

These earliest editions of the *Encyclopædia Britannica* consisted mainly of what may be described as compilation; like all their predecessors, from the time of Alsted to that of Ephraim Chambers, they had been put together by one or two men who were still able to take the whole of human knowledge for their province. It was with the Third Edition that the plan of drawing on specialist learning, which has since given the *Encyclopædia Britannica* its high reputation, was first adopted. This edition, which was begun in 1788 and completed, in eighteen volumes, in 1797, was edited by MacFarquhar until his death in 1793, when about two-thirds of the work were completed. Bell, the surviving proprietor, then appointed George Gleig—afterwards Bishop of Brechin—as editor, and it was he who enlisted the assistance, as contributors, of the most eminent men of science then living in Scotland. Professors Robison, Thomas Thomson and Playfair were the most notable of these new specialist contributors, and a Supplement in two volumes was issued in 1801 to allow them to extend their work to those earlier letters of the alphabet which had already been issued by MacFarquhar. It was their labours which first gave the *Encyclopædia Britannica* its pre-eminent standing among works of reference, and prepared the way for it to become, as a later editor claimed, not merely a register but an instrument of research, since thereafter the leading specialists in all departments were invited to contribute their unpublished results to its pages.

In the Fourth Edition, published by Andrew Bell in twenty volumes from 1801 to 1810, the principle of specialist contributions was considerably extended, but it was only brought to such degree of perfection as was possible at the time by Archibald Constable, "the great Napoleon of the realms of print," who purchased the copyright of the *Encyclopædia Britannica* soon after Bell's death in 1809. Constable lavished his energy and his money on the famous "Supplement to the Fourth, Fifth and Sixth Editions," which in 1813 he commissioned Macvey Napier to edit. It was with the appearance of this Supplement that the *Encyclopædia Britannica* ceased to be a purely Scottish undertaking, and blossomed out into that great cosmopolitan or international enterprise which it has since become. The most eminent writers, scholars and men of science in England and on the continent of Europe, as well as in Scotland itself, were enlisted in the work: Sir Walter Scott, Jeffrey, Leslie, Playfair and Sir Humphry Davy, Dugald Stewart—who received the then unprecedented sum of £1000 for a single contribution—Ricardo, Malthus and Thomas Young, with foreign men of science like Arago and Biot. From this time onward, indeed, a list of the contributors to successive editions of the *Encyclopædia Britannica* would be a list of the most eminent British and American writers and thinkers of each generation; the work had become the product of the organized co-operation of acknowledged leaders of the world's thought in every department of human knowledge. For this advance the credit is mainly due to Constable.

The Fifth and Sixth Editions, each in twenty volumes, issued by Constable between 1815 and 1824, were practically reprints of the Fourth, the Supplement—issued in six volumes from 1816 to 1824—being considered adequate to supply their deficiencies. The Seventh Edition, edited by Macvey Napier on the same lines as the Supplement, of which it incorporated a great part, was brought out by a new publisher, Adam Black, who had bought the copyright on Constable's failure. This edition was issued from 1830 to 1842, and was comprised in twenty-one volumes, which included a general index to the whole work. The Eighth Edition, under the editorship of T. Stewart Traill, was issued by the firm of A. & C. Black, from 1853 to 1860, in twenty-one volumes, with a separate index volume.

The Ninth Edition was then undertaken by the same firm on a scale which Adam Black considered so hazardous that he refused to have any part in the undertaking, and he accordingly advertised his retirement from the firm. This Edition began to appear in 1875, under the editorship of Thomas Spencer Baynes, and was completed in 1889 by William Robertson Smith. It consisted of twenty-four volumes, containing 21,572 pages and 302 plates, with a separate index volume. Adam Black's prognostications of failure were signally falsified by the success of the work, of which nearly half a million sets—including American pirated and mutilated editions—were ultimately sold. The great possibilities of popularity for the *Encyclopædia Britannica* in Great

Britain were only realized, however, when in 1898 *The Times* undertook to sell a verbatim reprint of the Ninth Edition at about half the price originally asked for it by the publishers. The success of this reprint led to the publication by *The Times* in 1902 of an elaborate supplement in eleven New Volumes (one containing new maps and one a comprehensive index to the whole work), constituting, with the previous twenty-four volumes, the Tenth Edition. The Eleventh Edition, which supersedes both Ninth and Tenth, and represents in an entirely new and original form a fresh survey of the whole field of human thought and achievement, written by some 1500 eminent specialists drawn from nearly every country of the civilized world, incorporating the results of research and the progress of events up to the middle of 1910, is now published by the University of Cambridge, where it is hoped that the *Encyclopædia Britannica* has at length found a permanent home.

It will be seen from this brief survey of the history of the *Encyclopædia Britannica* that, while the literary and scholarly success of the work has been uniform and continuous, its commercial career has naturally been subject to vicissitudes. Six different publishing firms have been at various times associated with its production; and the increasing magnitude of the work, consequent on the steady growth of knowledge, made this wellnigh inevitable. The *Encyclopædia Britannica* has to-day become something more than a commercial venture, or even a national enterprise. It is a vast cosmopolitan work of learning, which can find no home so appropriate as an ancient university.

The present publication of the new *Encyclopædia Britannica* by the University of Cambridge is a natural step in the evolution of the university as an educational institution and a home of research. The medieval University of Cambridge began its educational labours as an institution intended almost exclusively for the instruction of the clergy, to whose needs its system of studies was necessarily in a large measure accommodated. The Revival of Learning, the Renaissance and the Reformation widened its sphere of intellectual work and its interests, as well as its actual curriculum. The 19th century saw the complete abolition of the various tests which formerly shut the gates of the English universities against a large part of the people. The early establishment in Cambridge of special colleges for women was also a sign of expanding activities. About the same time the University Extension movement, first advocated at Cambridge in 1871 on the ground that the ancient universities were not mere clusters of private establishments but national institutions, led to a wider conception of the possibilities of utilizing the intellectual resources of the universities for the general diffusion of knowledge and culture; and the system of Local Examinations brought the university into close contact with secondary education throughout the country. But the public to which the University of Cambridge thus appealed, though wider than that of the college lecture-rooms, was still necessarily limited. Practically it is only through the medium of the University Press that Cambridge can enter into and maintain direct relations with the whole of the English-speaking world. The present time seems appropriate for an effort towards thus signally extending the intellectual and educational influence of the university.

To this end, the University of Cambridge has undertaken the publication of the *Encyclopædia Britannica*, and now issues the Eleventh Edition of that work. These twenty-eight volumes and index aim at achieving the high ambition of bringing all extant knowledge within the reach of every class of readers. While the work, in its present form, is to some extent based on the preserve the continuity of its historic associations, so far as might be consistent with the public interest, and with what was due to progress in knowledge, was one of the first duties of those responsible for a new edition; and just as the Ninth Edition carried forward, with notable additions or substitutions, work contributed to the Eighth and earlier editions, so it provided matter for utilization in the Eleventh, which in its turn had to accommodate the new knowledge of a later generation.

A new departure.

In considering the treatment, however, of the mass of material thus handed down, the editor of the Eleventh Edition had an entirely new situation to deal with. It is necessary here to explain why it is that the Eleventh Edition is much more than a revision—is, indeed, a new edifice as compared with the structure of the Ninth Edition. In the whole architecture of the latter there was a serious flaw, due to no want of ability in editors or contributors, but to the conditions imposed upon them in the system of publication.

The old system of production.

Defect of division under different dates.

The economic and mechanical obstacles to the production of a great encyclopædia otherwise than in a series of volumes separately issued at intervals during a number of years were formerly considered prohibitive. Thus the Ninth Edition, the first volume of which was published in 1875 and the twenty-fifth in 1889, was incomplete for some sixteen years after its real inception. Not only does such a long interval between the start and the finish involve the possibility of a change in editorial direction and conception such as happened in 1881 when Spencer Baynes was compelled by ill-health to hand over the reins to Robertson Smith; but even if the same editorial policy remained to dominate the work, the continual progress of time was constantly changing the conditions under which it was exercised. With such a system of publication an encyclopædia can have no proper unity of conception or uniformity of treatment. It cannot be planned from the beginning so as to present at its completion a satisfactory synoptic view of any department of knowledge. The historical record is restricted by the accident of the dates at which the separate volumes are published, in such a way that the facts included in one volume may contradict those in another. Individual volumes, the contents of which are arbitrarily determined by the alphabetical order of headings, may indeed be abreast of the learning and accomplishments of their day, but each time a later volume appears the circumstances have altered, and there is every chance that some integral portion of what had previously been published may be stultified. Those who were responsible for the execution of the Ninth Edition of the *Encyclopædia Britannica* did their best under an impossible system. They made it a collection of detached monographs of the highest authority and value. In their day the demand of a modern public for "up-to-date-ness" had not come into existence, and it seemed perfectly reasonable in 1879 to bring the article on the history of England no further than the accession of Queen Victoria. But it was not their failure to appreciate the importance of dealing with the latest events in history that made so much of the Ninth Edition useless in preparing its successor. When only this was in question, later history could be added. It was the fact that, owing to its system of publication, its arrangement was not encyclopædic, and that in preparing an edition which for the first time had the advantage of being systematic in the distribution of its material, there was no way of adapting to its needs what had been written originally on a faulty principle.

Novelty of the method now employed.

Until the year 1902, when, within nine months, nine supplementary volumes of text were issued by *The Times*, no publisher had cared or dared to attempt to produce at one time the whole of any work of similar magnitude. It was the regular practice to issue volume by volume. On this system the public has been furnished with the Oxford *New English Dictionary* (still incomplete in 1910, though work had begun in the early 'sixties and the first volume appeared in 1888) and with the *Dictionary of National Biography*, while the French *La Grande Encyclopédie*, which took even longer than the Ninth Edition of the *Encyclopædia Britannica* to complete, was coming out in its thirty-one volumes between 1885 and 1902. But the proof obtained in 1902 of the practicability of simultaneous production in the case of the supplementary volumes which

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of circumstances render necessary in ordinary cases. We have deemed this homage due to the genius and fame of the illustrious author, whose splendid view of the origin and progress of the dramatic art we have accordingly presented to the reader exactly as it proceeded from his own hand, leaving every contemporaneous allusion and illustration untouched." It may be remarked that this footnote, which was reprinted from the Seventh Edition, was itself carried forward without being brought up to date, apparently in the same spirit; and in another footnote, also reprinted from the Seventh Edition, a reference is made to allusions "on p. 147," which were indeed on p. 147 of the Seventh Edition, but are on p. 137 of the Eighth!

converted the Ninth into the Tenth Edition of the *Encyclopædia Britannica*, made it imperative to extend this limited experiment to the making of an entirely new edition. By this means a new value might be given to a work which aimed not merely at providing a storehouse of facts, but expounding all knowledge as part of an ordered system. For the problem here was bound up with the question of the date of publication to a unique degree. In some other sorts of book the fact that successive volumes appear at certain intervals of time only affects the convenience of the purchaser—as, for instance, in the case of the *Cambridge Modern History*; the various volumes do not cover the same field or touch the same materials. But in an encyclopædia it is only the alphabetization of the headings which causes them to fall in distinct volumes, and the accident of position separates the treatment of the same or closely related subjects in such a way that, if they are discussed from the point of view of widely different dates, the organic unity of the work is entirely lost. Thanks to the enterprising provision of capital, and the co-operation of a far-sighted business management, it was possible to start the preparation of the Eleventh Edition of the *Encyclopædia Britannica* with the knowledge that it would be published as a whole at one date. The separate volumes, whatever their number, would no longer represent so many lapses of time and so many distinct units in executive conception, but merely mechanical divisions for convenience in handling. And arrangements were made so that the printing of the whole edition should eventually take hardly more time than had been required for the printing and correcting of a single volume under the old system.

Peculiar importance to such a work.

The opportunity thus provided was in many ways more appropriate to the making of an entirely new work than to the revision of an old one. For the Ninth Edition was wanting in precisely that character of interdependence in all its parts which could now be given to the various related articles. Moreover, experience had shown that, as compared with other encyclopædias of less ambitious scope, not intended for systematic study or continuous reading, its arrangement as a work of reference had defects which resulted in some injustice being done to its merits as a series of individual contributions to learning. There was no reason why both these purposes should not be served, and attention be paid to distributing the material under the much larger number of headings which are required for rapid and easy reference, when once it was possible to ignore the particular order in which the subjects were treated. Since none of the work was printed or published until the whole of it was ready, new headings could always be introduced with their appropriate matter, according as the examination of what was written under another heading revealed omissions which showed that some related subject required explanation on its own account, or according as the progress of time up to the year of publication involved the emergence of new issues, to which previously no separate reference would have been expected. The execution of the Eleventh Edition, planned on uniform lines as a single organism, and thus admitting of continual improvement in detail, irrespectively of the distribution of matter under this or that letter of the alphabet, could proceed in all its parts *pari passu*, the various articles being kept open for revision or rewriting, so as to represent the collective knowledge and the contemporary standpoint of the date at which the whole was issued.

Mere revision no longer possible.

This new design involved the maintenance, during all the years of preparation, of an active collaboration among a vast body of contributors. The formal structure of the Ninth Edition necessarily disappeared, leaving only its component parts as building material for incorporation in the new edifice to such degree as examination might prove its adaptability. The site—in this case the whole field of knowledge—was mapped out afresh under the advice of specialist departmental advisers, who, in providing for the occupation of the different areas, co-operated with a central editorial staff, comprising many members, each of whom was responsible to the Editor-in-Chief for a particular section of the work. In this manner what, it is hoped, is a more complete articulation of subjects was effected, while co-operation between the contributors who dealt with each homogeneous department of knowledge was combined with the concentration in editorial direction, which alone could make the Eleventh Edition of the *Encyclopædia Britannica* an organic unit.

A new survey of the field of knowledge.

Method and results.

The two sources of authority.

Increased value for reference.

The result of the new survey was a distribution of material under a far larger number of headings than had been included in the Ninth Edition—some 40,000 instead of some 17,000; and the method of simultaneous construction enabled the co-ordination which is of such peculiar importance in a work of reference to be applied systematically by the editorial staff. The authority which attaches to the names of individual contributors remains, as before, an important feature of the Eleventh Edition, but by these means, it is hoped, the authority which attaches to the *Encyclopædia Britannica* itself is more firmly established. When Robertson Smith finally wrote his preface to the Index volume of the Ninth Edition, he said:—"The use of initials (as signatures to articles) was not designed to lighten the responsibility of the editors. No editor can possess the knowledge which would enable him to control the work of his contributors in all the subjects treated of in the *Encyclopædia*, but no effort has been spared on the part of the editorial staff to secure the accuracy and sufficiency of every contribution, and to prevent those repetitions and inconcinnities which necessarily occur where each contributor is absolutely and solely responsible for the articles which bear his name." The principle here enunciated, which represents the tradition of the *Encyclopædia Britannica* in the matter of the correct relationship between editors and contributors, and the responsibility attaching to individual signatures, has been adopted in the Eleventh Edition, but with all the advantages resulting alike from simultaneous production and from the fact that the Editor-in-Chief was assisted by a much larger staff, working under conditions which enabled the editorial control to be effective to a degree unattainable under the earlier system. In concert with the numerous eminent writers whose signatures give individual interest and weight to their contributions, the whole work—and not only the unsigned articles, many of which indeed have equally high authority behind them—passed through the detailed scrutiny of the editorial staff, whose duty it was to see that it provided what those who used any part of the book could reasonably expect to find, to remedy those "inconcinnities" to which Robertson Smith alluded, and to secure the accuracy in the use of names, the inclusion of dates, and similar *minutiæ*, which is essential in a work of reference.

Use of older material.

A great deal of the older fabric was obviously incompatible with the new scheme of treatment; but, where possible, those earlier contributions have been preserved which are of the nature of classics in the world of letters. By a selective process which, it is believed, gives new value to the old material—by the revision, at the hands of their own authors or of later authorities, of such articles or portions of articles as were found to fit accurately into their several places—or by the inclusion under other headings of a consideration of controverted questions on which the writers may have taken a strong personal view, itself of historical interest—their retention has been effected so as to conform to the ideal of making the work as a whole representative of the best thought of a later day.

Questions of Formal Arrangement.

Natural headings.

Correctness and common sense.

Both in the addition of new words for new subjects, and in the employment of different words for old subjects, the progress of the world demands a reconsideration from time to time of the headings under which its accumulated experiences can best be presented in a work which employs the dictionary plan as a key to its contents. No little trouble was therefore expended, in planning the Eleventh Edition, on the attempt to suit the word to the subject in the way most likely to be generally useful for reference. While the selection has at times been, of necessity, somewhat arbitrary, it has been guided from first to last by an endeavour to follow the natural mental processes of the average educated reader. But it was impossible to interpret what is "natural" in this connexion without consideration for the advances which have been made in terminological accuracy, alike in the technicalities of science and in the forms of language adopted by precise writers, whose usage has become or is rapidly becoming part of the common stock. The practice of modern schools and the vocabulary of a modern curriculum, as well as the predominating example of expert authorities, impose themselves gradually on the public mind, and constitute new conventions which are widely assimilated. In forecasting what would be for the convenience of a new generation of readers, it has seemed best to aim at adopting the nearest approach to correct modern terminology, while avoiding mere pedantry on the one hand, and on the other a useless abandonment of well-established English custom.

Pseudonyms.

Personal names and titles.

Use of the Index.

It is easier, however, to lay down principles than to carry them out consistently in face of the obstinacy of the materials with which one is dealing in an encyclopædia which attempts to combine accurate scholarship with general utility and convenience. In the case of biographical articles, for instance, it was decided that the proper headings were the names by which the individuals concerned are in fact commonly known. Thus "George Sand" is now dealt with under her pen-name (Sand, George) and not under that of Madame Dudevant; "George Eliot" is no longer hidden away under her married name of Mrs Cross; and "Mark Twain" is taken as the permanent name by which the world will know Mr Clemens. But it is not only in the case of pseudonyms that there is a difficulty in deciding upon the heading which is most appropriate. In variance with the practice of the *Dictionary of National Biography*, all articles on titled persons are here arranged under the title headings and not the family names. In principle it is believed that this is much the more convenient system, for in most cases the public (especially outside the British Islands) does not know what the family name of an English peer may be. Moreover, the system adopted by the *Dictionary of National Biography* sacrifices a very important feature in connexion with these biographical articles, namely, the history of the title itself, which has often passed through several families and can only be conveniently followed when all the holders are kept together. As a rule, this system of putting peers under the headings of their titles agrees with the principle of adopting the names by which people actually are called; but sometimes it is too glaringly otherwise. Nobody would think of looking for Francis Bacon under the heading of Viscount St Albans, or for Horace Walpole under that of Earl of Orford. In such cases what is believed to be the natural expectation of readers has been consulted. The exceptional use, however, of the family name as a heading for persons of title has been reserved strictly for what may be regarded as settled conventions, and where reasonably possible the rule has been followed; thus Harley and St John are dealt with as Earl of Oxford and Viscount Bolingbroke respectively. On the other hand, when a celebrity is commonly known, not under his family name but under a title which eventually was changed for a different one of higher rank, the more convenient arrangement has seemed to be—notwithstanding general usage—to associate the article with the higher title, and so to bring it into connexion with the historical peerage. Thus the account of the statesman commonly called by his earlier title of Earl of Danby is deliberately placed under his later title of Duke of Leeds, and that of Lord Castlereagh under Marquess of Londonderry. If the result of such exceptions to the rule might seem to be that in certain cases a reader would not know where to turn, the answer is that a reference to the Index, where cross-references are given, will decide. In the text of the work, although a great deal has been done to refer a reader from one article to another, mere cross-references—such as "**Danby, Earl of**; see Leeds, Duke of"—are not included as distinct entries; it was found that the number of such headings would be very large, and they would only have duplicated the proper function of the Index, which now acts in this respect as the real guide to the contents and should be regarded as an integral part of the work.

Progress in treatment of biography.

The reference just made to the *Dictionary of National Biography* may here be supplemented by a few words as to the British biographies in the Eleventh Edition of the *Encyclopædia Britannica*. The whole standard of biographical writing of this kind has undoubtedly been raised by the labours of Sir Leslie Stephen, Dr Sidney Lee, and their collaborators, in the compilation of that invaluable work; and no subsequent publication could fail to profit, both by the scholarly example there set, and by the results of the original research embodied in it. But in the corresponding articles in the *Encyclopædia Britannica* advantage has been taken of the opportunity for further research and the incorporation of later information, and they represent an independent study, the details of which sometimes differ from what is given in the *Dictionary*, but must not for that reason be thought in haste to be incorrect. Allowance being made for a somewhat different standard in the selection of individuals for separate biographies, and for the briefer treatment, the attempt has been made to carry even a step forward the ideals of the *Dictionary* in regard to accuracy of detail and critical judgment. This has largely been made possible by the existence of the *Dictionary*, but the original work done in the Eleventh Edition of the *Encyclopædia Britannica* in the same field—drawing as it can upon a number of biographical articles, already classics, in its earlier editions—gives it an independent authority even in the sphere of British national biography. Moreover, the inclusion of biographies of eminent persons who died after the *Dictionary* was supplemented in 1901, and of others still living in 1910, results in a considerable extension of the biographical area, even as regards individuals of British nationality in the narrowest sense. The articles in the *Encyclopædia Britannica*, however, are of course not limited to personages of the British Islands. Not only are biographies here included of the great men and women of French, German, Italian, Belgian, Dutch, Russian, Scandinavian, Japanese, and other foreign nationalities, as well as of those of the ancient world, but the same standard of selection has been applied to American and British Colonial biography as to English, Welsh, Scottish and Irish. Indeed the *Encyclopædia Britannica* may now claim for the first time to supply a really adequate Dictionary of American National Biography, covering all those with whom the citizens of the United States are nationally concerned. It thus completes its representation of the English-speaking peoples, to all of whom English history, even in its narrower sense, is a common heritage, and in its evolution a common example.

Inclusive character.

Another form of the terminological problem, to which reference was made above, is found in the transliteration of foreign names, and the conversion of the names of foreign places and countries into English equivalents. As regards the latter, there is no English standard which can be said to be universal, though in particular cases there is a convention which it would be absurd to attempt to displace for any reason of supposed superior accuracy. It would be pragmatical in the extreme to force upon the English-speaking world a system of calling all foreign places by their local names, even though it might be thought that each nationality had a right to settle the nomenclature of its country and the towns or districts within it. In general the English conventions must stand. One of these days the world may agree that an international nomenclature is desirable and feasible, but not yet; and the country which its own citizens call *Deutschland* and the French *l'Allemagne* still remains Germany to those who use the English language. Similarly Cologne (*Köln*), Florence (*Firenze*), or Vienna (*Wien*) are bound to retain their English names in an English book. But all cases are not so simple. The world abounds in less important places, for which the English names have no standardized spelling; different English newspapers on a single day, or a single newspaper at intervals of a few weeks or months, give them several varieties of form; and in Asia or Africa the latest explorer always seems to have a preference for a new one which is unlike that adopted by rival geographers. When the Eleventh Edition of the *Encyclopædia Britannica* was started, the suggestion was made that the Royal Geographical Society of London—the premier geographical society of the world—might co-operate in an attempt to secure the adoption of a standard English geographical and topographical nomenclature. The Society, indeed, has a system of its own which to some extent aims at fulfilling this requirement, though it has failed to impose it upon general use; but unfortunately the Society's system breaks down by admitting a considerable number of exceptions and by failing to settle a very large number of cases which really themselves constitute the difficulty. The co-operation of the Royal Geographical Society for the purpose of enabling the *Encyclopædia Britannica* to give prominent literary expression to an authoritative spelling for every place-name included within its articles or maps was found to be impracticable; and it was therefore necessary for the Eleventh Edition to adopt a consistent spelling which would represent its own judgment and authority. It is hoped that by degrees this spelling may recommend itself in other quarters. Where reasonably possible, the local spelling popularized by the usage of post-offices or railways has been preferred to any purely philological system of transliteration, but there are numerous cases where even this test of public convenience breaks down and some form of Anglicization becomes essential to an English gazetteer having an organic unity of its own. Apart from the continuance of English conventions which appeared sufficiently crystallized, the most authori-

English rendering of foreign names.

Difficulty of the problem.

Geography in particular.

tative spelling of the foreign name has been given its simplest English transliteration, preference being given, in cases of doubt, to the form, for instance in African countries, adopted by the European nation in possession or control. In the absence of any central authority or international agreement, the result is occasionally different in some slight degree from any common English variant, but this cannot well be helped when English variants are so capricious, and none persistent; and the names selected are those which for purposes of reference combine the most accuracy with the least disturbance of familiar usage. Thus the German African colony of *Kamerun* is here called Cameroon, an English form which follows the common practice of English transliteration in regard to its initial letter, but departs, in deference to the German official nomenclature, from the older English Cameroons, a plural no longer justifiable, although most English newspapers and maps still perpetuate it.

Method adopted.

Proper names in Oriental languages.

In the case of personal names, wherever an English spelling has become sufficiently established both in literature and in popular usage it has been retained, irrespectively of any strict linguistic value. Foreign names in English shape really become English words, and they are so treated here; *e.g.* Alcibiades (not Alkibiades), Juggernaut (not Jagganath). But discrimination as to where convenience rather than philological correctness should rule has been made all the more difficult, especially with names representing Arabic or other Oriental originals, by the strong views of individual scholars, who from time to time attempt in their own writings to impose their own transliterations upon others, in the face of well-established convention. In the course of the preparation of the Eleventh Edition of the *Encyclopædia Britannica*, various eminent Arabic scholars have given strong expression to their view as to the English form of the name of the Prophet of Islam, preference being given to that of Muḥammad. But the old form Mahomet is a well-established English equivalent; and it is here retained for convenience in identification where the Prophet himself is referred to, the form Mahommed being generally used in distinction for other persons of this name. Purists may be dissatisfied with this concession to popular usage; our choice is, we believe, in the interest of the general public. If only the "correct" forms of many Oriental names had been employed, they would be unrecognizable except to scholars. On the other hand, while the retention of Mahomet is a typical instance of the preference given to a vernacular spelling when there is one, and customary forms are adopted for Arabic and other names in the headings and for ordinary use throughout the work, in every case the more accurate scientific spelling is also given in the appropriate article. While deference has naturally been paid to the opinion of individual scholars, as far as possible, in connexion with articles contributed by them, uniformity throughout the work (a necessity for the purpose of Index-making, if for no other) has been secured by transliterating on the basis of schemes which have been specially prepared for each language; for this purpose the best linguistic opinions have been consulted, but due weight has been given to intelligibility on the part of a public already more or less accustomed to a stereotyped spelling. In the case of Babylonian names, a section of the general article BABYLONIA is specially devoted to an elucidation of the divergences between the renderings given by individual Assyriologists.

Public and Scholar.

While the *Encyclopædia Britannica* has aimed, in this matter of local and personal nomenclature, at conciliating the opinion of scholars with public usage and convenience, and the present edition makes an attempt to solve the problem on reasonable lines, it should be understood that the whole question of the uniform representation in English of foreign place and personal names is still in a highly unsatisfactory condition. Scholars will never get the public to adopt the very peculiar renderings, obscured by complicated accents, which do service in purely learned circles and have a scientific justification as part of a quasi-mathematical device for accurate pronunciation. Any attempt to transliterate into English on a phonetic basis has, moreover, a radical weakness which is too often ignored. So long as pronunciation is not itself standardized, and so long as the human ear does not uniformly carry to a standardized human brain the sound that is uniformly pronounced—and it will be long before these conditions can be fulfilled—even a phonetic system of spelling must adopt *some* convention; and in that case it is surely best, if a well-recognized convention already exists and is in use among the public at large, to adopt it rather than to invent a new one. The point is, indeed, of more than formal importance. So long as scholars and the public are at issue on the very

Need of common ground.

essentials of the comprehension of scholarly books, which are made unreadable by the use of diacritical signs and unpronounceable spellings, culture cannot advance except within the narrowest of sects. This incompatibility is bad for the public, but it is also bad for scholarship. While the general reader is repelled, the Orientalist is neglected,—to the loss of both. This criticism, which substantially applies to many other formal aspects of modern learning, may be unwelcome to the professors, but it is the result of an extended experience in the attempt to bring accurate knowledge into digestible shape for the wide public for whom the *Encyclopædia Britannica* is intended. It is indeed partly because of the tendency of modern science and modern scholarship to put the artificial obstacles of a technical jargon in the path of people even of fairly high education, that it becomes imperative to bring both parties upon a common ground, where the world at large may discover the meaning of the learned research to which otherwise it is apt to be a stranger.

Scientific articles.

Value of the encyclopædia method.

Compared with that of a single treatise.

With regard to the various departments of natural science, there was a tendency in previous editions of the *Encyclopædia Britannica* to make inclusive treatises of the longer articles, and to incorporate under the one general heading of the science itself matter which would more naturally form a separate, if subordinate, subject. An attempt has now been made to arrange the material rather according to the heading under which, in an encyclopædia, students would expect to find it. In any text-book on Light, for instance, the technical aspects of aberration, refraction, reflection, interference, phosphorescence, &c., would be discussed concurrently as part of the whole science, in so many chapters of a continuous treatise. But each such chapter or subdivision in a treatise becomes in an encyclopædia arranged on the dictionary plan, matter to be explained where the appropriate word occurs in the alphabetical order of headings. Under the name of the common subject of the science as a whole, its history and general aspects are discussed, but the details concerned with the separate scientific questions which fall within its subject-matter—on each of which often a single specialist has unique authority—are relegated to distinct articles, to the headings of which the general account becomes, if required, a key or pointer. This arrangement of the scientific material—a general article acting as pointer to subsidiary articles, and the latter relieving the general account of details which would overload it—has been adopted throughout the Eleventh Edition; and in the result it is believed that a more complete and at the same time more authoritative survey has been attained, within the limits possible to such a work, than ever before. The single-treatise plan, which was characteristic of the Ninth Edition, is not only cumbrous in a work of reference, but lent itself to the omission altogether, under the general heading, of specific issues which consequently received no proper treatment at all anywhere in the book; whereas the dictionary plan, by automatically providing headings throughout the work, under which, where appropriate, articles of more or less length may be put, enables every subject to be treated, comprehensively or in detail, yet as part of an organic whole, by means of careful articulation adapted to the requirements of an intelligent reader.

Dictionary headings.

In preparing the Eleventh Edition a useful check on the possibility of such accidental omissions as are apt to occur when the treatise plan is pursued, was provided by the decision, arrived at independently of any question of subdivision, to revert more closely to the original form of the *Encyclopædia Britannica*, and to make separate headings of any words which, purely as words, had any substantial interest either for historical or philological reasons, or as requiring explanation even for English-speaking readers.[1] The labours of Sir James Murray and his colleagues on the Oxford *New English Dictionary*, which has only become accessible since the Ninth Edition of the *Encyclopædia Britannica* was published, have enabled a precise examination to be made of all the possible headings of this kind. Such words, or groups of words, together with proper names, personal, geographical, zoological, etc., obviously exhaust the headings under which the subject matter of an encyclopædia can be subdivided; and thus the dictionary plan, combined with a complete logical analysis of the contents of the various arts and sciences, forms a comprehensive basis for ensuring that no question of any substantial interest can be omitted. As a rule the headings suggested by a logical subdivision of subject, as approved by the professional or scientific expert, follow the usage of words which is natural to any one speaking the English language; but where, owing to the existence of some accepted terminology in any particular line of inquiry, it departs from this ordinary usage, the dictionary plan still enables a cross-reference to guide the reader, and at the same time to impart instruction in the history or technical niceties of a vocabulary which is daily outgrowing the range even of the educated classes. It is highly and increasingly important that mere words should be correctly evaluated, and connected with the facts for which properly they stand.

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[1] Though, in pursuance of the ideal of making the whole book self-explanatory, a great many purely technical terms have been given their interpretation only in the course of the article on the science or art in which they are used, even these are included, with the correct references, among the headings in the Index. Similarly, biographical accounts are given of far more persons than have separate biographies. The Index in all such cases must be consulted, whether for word or name.

Importance of terminological accuracy.

Some Points as to Substance.

The spirit of the historian.

In considering the substance, rather than the form, of the Eleventh Edition, it may be remarked first that, as a work of reference no less than as a work for reading and study, its preparation has been dominated throughout by the historical point of view. Any account which purports to describe what actually goes on to-day, whether in the realm of mind or in that of matter, is inevitably subject to change as years or even months pass by; but what *has been*, if accurately recorded, remains permanently true as such. In the larger sense the historian has here to deal not only with ancient and modern political history, as ordinarily understood, but with past doings in every field, and thus with the steps by which existing conditions have been reached. Geography and exploration, religion and philosophy, pure and applied science, art and literature, commerce and industry, law and economics, war and peace, sport and games,—all subjects are treated in these volumes not only on their merits, but as in continual evolution, the successive stages in which are of intrinsic interest on their own account, but also throw light on what goes before and after. The whole range of history, thus considered, has, however, been immensely widened in the Eleventh Edition as compared with the Ninth. The record of the past, thrown farther and farther back by the triumphs of modern archaeology, is limited on its nearer confines only by the date at which the *Encyclopædia Britannica* is published. Any contemporary description is indeed liable to become inadequate almost as soon as it is in the hands of the reader; but the available resources have been utilized here to the utmost, so that the salient facts up to the autumn of the year 1910 might be included throughout, not merely as isolated events, but as part of a consistent whole, conceived in the spirit of the historian. Thus only can the fleeting present be true to its relation with later developments, which it is no part of the task of an encyclopædia to prophesy.

The use of statistics.

In this connexion it is advisable to explain that while the most recent statistics have been incorporated when they really represented conditions of historic value, the notion that economic development can be truly shown merely by giving statistics for the last year available is entirely false, and for this reason in many cases there has been no attempt merely to be "up-to-date" by inserting them. Statistics are used here as an illustration of the substantial existing conditions and of real progress. For the statistics of one year, and especially for those of the latest year, the inquirer must necessarily go to annual publications, not to an encyclopædia which attempts to show the representative conditions of abiding importance. In such a work statistics are only one useful method of expressing historic evolution; their value varies considerably according to the nature of the subject dealt with; and the figures of the year which by accident is the last before publication would often be entirely misleading, owing to their being subject to some purely temporary influence. In general, far less tabular matter has been included in the Eleventh Edition than in the Ninth. Where it is used, it is not as a substitute for descriptive accounts, which can put the facts in readable form much better, but more appropriately as showing concisely and clearly the differences between the conditions at different periods. As years pass by, and new statistics on all subjects become accessible, those which have been given here for their historical value are, as such, unaffected by the lapse of time; but if they had been slavishly inserted simply because they were the latest in the series of years immediately preceding publication, their precarious connexion with any continuous evolution would soon have made them futile. So much has been done in the Eleventh Edition to bring the record of events, whether in political history or in other articles, down to the latest available date, and thus to complete the picture of the world as it was in 1910, that it is necessary to deprecate any misconception which might otherwise arise from the fact that statistics are inserted not as events in themselves—this they may or may not be, according to the subject-matter—but as a method of expressing the substantial results of human activity; for that purpose they must be given comparatively, selected as representative, and weighed in the balance of the judicious historian.

The spirit of science.

While every individual article in an encyclopædia which aims at authoritative exposition must be informed by the spirit of history, it is no less essential that the spirit of science should move over the construction of the work as a whole. Whatever may be the deficiencies of its execution, the Eleventh Edition has at any rate this advantage to those who use it, that the method of simultaneous preparation, already referred to, has enabled every subject to be treated systematically. Not only in the case of "science" itself, but in history, law, or any other kind of knowledge, its contributors were all assisting to carry out a preconcerted scheme, each aware of the relation of his or her contribution to others in the same field; and the interdependence of the related parts must be remembered by any reader who desires to do justice to the treatment of any large subject. Cross-references and other indications in the text are guides to the system employed, which are supplemented in greater detail by the elaborate Index. But the scientific spirit not only affects the scheme of construction as a whole: it has modified the individual treatment. Attention may perhaps be drawn to two particular points in this connexion,—the increased employment of the comparative method, and the attempt to treat opinion and controversy objectively, without partisanship or sectarianism.

The comparative method.

The title of the *Encyclopædia Britannica* has never meant that it is restricted in its accounts of natural science, law, religion, art, or other subjects, to what goes on in the British dominions; but a considerable extension has been given in the Eleventh Edition to the amount of information it contains concerning the corresponding activities in other countries. By approaching each subject, as far as possible, on its merits, the contributors in every department aim at appraising the achievements of civilization from whatever source they have arisen, and at the same time, by inserting special sections on different countries when this course is appropriate, they show the variations in practice under different systems of government or custom. But the subjects are not only arranged comparatively in this sense: new branches of study have arisen which are of chief importance mainly for the results attained by the comparative method. The impetus given to comparative sociology by Herbert Spencer, the modern interest in comparative law, religion, folklore, anthropology, psychology and philology, have resulted in the accumulation of a mass of detail which it becomes the task of an encyclopædia produced on the plan of organized co-operation to reduce to manageable proportions and intelligible perspective. Comparative bibliography, so much fostered of late years by the growth of great library organizations, undergoes in its turn the same process; and expert selection makes the references to the best books a guide to the student without overwhelming him. To deal here with all the lines of new research which have benefited by the comparative method in recent years would trench unnecessarily upon the scope of the contents of the work, where sufficient is already written. One illustration must suffice of a science in which the new treatment affects both the substance and the form of the articles in the Eleventh Edition of the *Encyclopædia Britannica*. Comparative Anatomy, as a branch of Zoology, can no longer be scientifically separated from Human Anatomy. The various parts of the human body are therefore systematically treated under separate headings, in connexion not only with the arts of medicine and surgery, which depend on a knowledge of each particular structure, but with the corresponding features in the rest of the animal kingdom, the study of which continually leads to a better understanding of the human organism. Thus comparative anatomy and human anatomy take their places, with physiology and pathology, as interdependent and inter-connected branches of the wider science of Zoology, in which all the lines of experimental inquiry and progressive knowledge lead up to a more efficient service of man and society.

The objective view.

In stating "the position taken by the *Encyclopædia Britannica* in relation to the active controversies of the time," Spencer Baynes, in his Preface to the first volume of the Ninth Edition (1875), referred to the conflict of opinion then raging in regard to religion and science. "In this conflict," he said, "a work like the *Encyclopædia* is not called upon to take any direct part. It has to do with knowledge, rather than opinion, and to deal with all subjects from a critical and historical rather than a dogmatic point of view. It cannot be the organ of any sect or party in science, religion or philosophy." The same policy has inspired the Eleventh Edition. The *Encyclopædia Britannica* itself has no side or party; it attempts to give representation to all parties, sects and sides. In a work indeed which deals with opinion and controversy at all, it is manifestly impossible for criticism to be colourless; its value as a source of authoritative exposition would be very different from what it is if individual contributors were not able to state their views fully and fearlessly. But every effort has been made to obtain, impartially, such statements of doctrine and belief in matters of religion and similar questions as are satisfactory to those who hold them, and to deal with these questions, so far as criticism is concerned, in such a way that the controversial points may be understood and appreciated, without prejudice to the argument. The easy way to what is sometimes considered impartiality is to leave controversy out altogether; that would be to avoid responsibility at the cost of perpetuating ignorance, for it is only in the light of the controversies about them that the importance of these questions of doctrine and opinion can be realized. The object of the present work is to furnish accounts of all subjects which shall really explain their meaning to those who desire accurate information. Amid the variety of beliefs which are held with sincere conviction by one set of people or another, impartiality does not consist in concealing criticism, or in withholding the knowledge of divergent opinion, but in an attitude of scientific respect which is precise in stating a belief in the terms, and according to the interpretation, accepted by those who hold it. In order to give the fullest expression to this objective treatment of questions which in their essence are dogmatic, contributors of all shades of opinion have co-operated in the work of the Eleventh Edition of the *Encyclopædia Britannica*. They have been selected as representative after the most careful consideration and under the highest sense of editorial responsibility. The proportion of space devoted to these subjects is necessarily large, because they bulk largely in the minds of thinking people; and while they are treated more comprehensively than before, individual judgments as to their relative claims may naturally vary. The general estimates which prevail among the countries which represent Western civilization are, however, in practical agreement on this point, and this consensus is the only ultimate criterion. In one respect the Eleventh Edition is fortunate in the time of its appearance. Since the completion of the Ninth Edition the controversies which at that time raged round the application of historical and scientific criticism to religion have become less acute, and an objective statement of the problems, for instance, connected with the literary history of the Bible is now less encumbered with the doubts as to the effect on personal religion which formerly prevailed. Science and theology have learnt to dwell together; and a reverent attitude towards religion, and indeed towards all the great religions, may be combined, without *arrière-pensée*, with a scientific comparative study of the phenomena of their institutions and development.

The art of illustration.

Modern scientific progress has naturally affected other aspects of the Eleventh Edition no less than the literary text; and a word may be added here as to the illustrations and maps. Photography and reproductive processes generally now combine to enable much more to be done than was possible a generation ago to assist verbal explanations and descriptions by an appeal to the eye, and to make this appeal scientifically accurate both in form and colour. The older pictorial material in the Ninth Edition has undergone the same critical survey as the text; and a large proportion of what now appears in the Eleventh Edition is not only new, but represents more adequately the modern principles of the art of illustration. The microscope on the one hand, and the museum on the other, have become in an increasing degree the instruments for attaining a scientific presentment in pictorial form of the realities of science and art. Whether for elucidating the technicalities of zoology or engineering machinery, or for showing concrete examples of ancient or modern statuary or painting, the draughtsman or the photographer has co-operated in the Eleventh Edition with the writers of the various articles, so that as far as possible their work may be accurately illustrated, in the correct sense, as distinct from any object of beautifying the book itself by pictures which might merely be interesting on their own account. Similarly the maps are not collected in an atlas, but accompany the topographical articles to which they are appropriate. Whether plate-maps or text-maps, they were all laid out with the scope, orthographical system, and other requirements of the text in view; either the cartographers have worked with the text before them—often representing new geographical authority on the part of the contributors—or they have been directed by the geographical department of the editorial staff as to the sources on which they should draw; and the maps have been indexed as an atlas is, so that any topographical article not accompanied by a map has its appropriate map-reference in the general index. The more important coloured maps have been specially prepared by Messrs Justus Perthes of Gotha, the publishers of *Stieler's Atlas*, which in some instances has served as their basis; and the others have been made under the direction of Mr Emery Walker of London, in collaboration with the editorial staff. Mr Emery Walker's great knowledge and experience in the work of illustration has throughout been put ungrudgingly at the service of the Eleventh Edition.

Conclusion.

In expressing, on behalf of the editorial staff and the publishers, their indebtedness to the large number of contributors who have assisted in carrying the work to its completion, the Editor would be glad to refer to many individuals among the eminent writers who have given of their best. But the list is so long that he must content himself with a word of general thanks. It is more important to give public credit here to those who, without actually being members of the editorial staff, have taken an intimate part with them in planning and organizing the Eleventh Edition. It was necessary for the Editor to be able to rely on authoritative specialists for advice and guidance in regard to particular sciences. Foremost among these stand the subjects of Zoology and Botany, which were under the charge respectively of Dr P. Chalmers Mitchell, Secretary of the Zoological Society of London, and Dr A. B. Rendle, Keeper of the department of Botany, British Museum. Dr Chalmers Mitchell's assistance in regard to Zoology extended also to the connected aspects of Comparative Anatomy (in association with Mr F. G. Parsons), Physiology and Palaeontology. The whole field of Biology was covered by the joint labours of Dr Chalmers Mitchell and Dr Rendle; and their supervision, in all stages of the work, gave unity to the co-operation of the numerous contributors of zoological and botanical articles. The treatment of Geology was planned by Mr H. B. Woodward; and with him were associated Dr J. A. Howe, who took charge of the department of Topographical Geology, Dr J. S. Flett, who covered that of Petrology, and Mr L. J. Spencer and Mr F. W. Rudler, who dealt comprehensively with Mineralogy and Crystallography. The late Dr Simon Newcomb planned and largely helped to carry out the articles dealing with Astronomy. Prof. J. A. Fleming acted in a similar capacity as regards Electricity and Magnetism. Prof. Hugh Callendar was responsible for the treatment of Heat; Prof. Poynting for that of Sound; and the late Prof. C. J. Joly, Royal Astronomer in Ireland, planned the articles dealing with Light and Optics. On literary subjects the Editor had the sympathetic collaboration of Mr Edmund Gosse, Librarian to the House of Lords; and Mr Marion H. Spielmann, on artistic subjects, also gave valuable help.

Advisers on special subjects.

Among those whose association with the editorial staff was particularly close were the Rev. E. M. Walker of Oxford, as regards subjects of ancient Greek history; Mr Stanley Cook of Cambridge, who was the Editor's chief adviser on questions of Old Testament criticism and Semitic learning generally; Dr T. Ashby, Director of the British School of Archaeology at Rome, who dealt with Italian topography and art; and Mr Israel Abrahams, who was consulted on Jewish subjects. Dr Peter Giles of Cambridge undertook the survey of Comparative Philology, and Sir Thomas

Barclay that of International Law. Others who gave valuable advice and assistance in regard to their various subjects were—Lord Rayleigh and Mr W. C. D. Whetham (Physical Science), Sir Archibald Geikie (Geology), Sir E. Maunde Thompson (Palaeography and Bibliology), Mr J. H. Round (History and Genealogy), Mr Phené Spiers (Architecture), Mr W. Burton (Ceramics), Mr T. M. Young of Manchester (Textile Industries), Prof. W. E. Dalby (Engineering), Dr G. A. Grierson (Indian Languages), the Rev. G. W. Thatcher (Arabic), Mr H. Stuart Jones (Roman History and Art), Dr D. G. Hogarth and Prof. Ernest Gardner (Hellenic Archaeology), the late Dr W. Fream (Agriculture), Mr W. F. Sheppard (Mathematics), Mr Arthur H. Smith (Classical Art), Dr Postgate (Latin Literature), Mr Fitzmaurice Kelly (Spanish Literature), Prof. J. G. Robertson (German Literature), Mr J. S. Cotton (India), Mr Edmund Owen (Surgery), Mr Donald Tovey (Music), Prof. H. M. Howe of Columbia University (Mining), Prof. W. M. Davis and Prof. D. W. Johnson of Harvard (American Physiography).

Collective support.

These names may be some indication of the amount of expert assistance and advice on which the editorial staff were able to draw, first when they were engaged in making preparations for the Eleventh Edition, then in organizing the whole body of contributors, and finally in combining their united resources in revising the work so as to present it in the finished state in which it is given to the public. Constituting as they did a college of research, a centre which drew to itself constant suggestions from all who were interested in the dissemination of accurate information, its members had the advantage of communication with many other leaders of opinion, to whose help, whether in Europe or America, it is impossible to do adequate justice here. The interest shown in the undertaking may be illustrated by the fact that his late Majesty King Edward VII. graciously permitted his own unique collection of British and foreign orders to be used for the purpose of making the coloured plates which accompany the article KNIGHTHOOD. Makers of history like Lord Cromer and Sir George Goldie added their authority to the work by assisting its contributors, even while not becoming contributors themselves. Custodians of official records, presidents and secretaries of institutions, societies and colleges, relatives or descendants of the subjects of biographies, governmental or municipal officers, librarians, divines, editors, manufacturers,—from many such quarters answers have been freely given to applications for information which is now embodied in the *Encyclopædia Britannica*.

The Staff.

In the principal Assistant-Editor, Mr Walter Alison Phillips, the Editor had throughout as his chief ally a scholarly historian of wide interests and great literary capacity. Prof. J. T. Shotwell, of Columbia University, U.S.A., in the earlier years of preparation, acted as joint Assistant-Editor; and Mr Ronald McNeill did important work as additional Assistant-Editor while the later stages were in progress. To Mr Charles Crawford Whinery was entrusted the direction of a separate office in New York for the purpose of dealing with American contributors and with articles on American subjects; to his loyal and efficient co-operation, both on the special subjects assigned to the American office, and in the final revision of the whole work, too high a tribute cannot be paid. The other principal members of the editorial staff in London, responsible for different departments, were Mr J. Malcolm Mitchell, Dr T. A. Ingram, Mr H. M. Ross, Mr Charles Everitt, Mr O. J. R. Howarth, Mr F. R. Cana, Mr C. O. Weatherly, Mr J. H. Freese, Mr K. G. Jayne, Mr Roland Truslove, Mr C. F. Atkinson, Mr A. W. Holland, the Rev. A. J. Grieve, Mr. W. E. Garrett Fisher and Mr Arthur B. Atkins, to the last of whom, as private secretary to the Editor-in-Chief, the present writer owes a special debt of gratitude for unfailing assistance in dealing with all the problems of editorial control. On the New York staff Mr Whinery had the efficient help of Mr R. Webster, Dr N. D. Mereness, Dr F. S. Philbrick, Dr W. K. Boyd, Dr W. O. Scroggs, Mr W. T. Arndt, Mr W. L. Corbin and Mr G. Gladden.

The Index.

A word must be added concerning a somewhat original feature in the editorial mechanism, the Indexing department. This department was organized from the first so that it might serve a double purpose. By indexing the articles as they came in, preparation could gradually be made for compiling the Index which would eventually be published; and as the reference-cards gradually accumulated under systematic index-headings, the comparison of work done by different writers might assist the editing of the text itself by discovering inconsistencies or inaccuracies in points of detail or suggesting the incorporation of additional material. The text of the Eleventh Edition owes much in this way to suggestions originating among the staff of ladies concerned, among whom particular mention may be made of Miss Griffiths, Miss Tyler, and Miss Edmonds. The actual Index, as published, represents a concentration and sifting of the work of the Indexing department; and in order to put it into shape a further stage in the organization was necessary, which was carried through under the able direction of Miss Janet Hogarth. The completion of the Index volume, which all those who wish to make full use of the Eleventh Edition of the *Encyclopædia Britannica* should regard as the real guide to its contents, brought finally into play all parts of the editorial machinery which had been engaged in the making of the work itself,—a vast engine of co-operative effort, dedicated to the service of the public.

HUGH CHISHOLM.

LONDON,
December 10, 1910.

INITIALS USED IN VOLUME I. TO IDENTIFY INDIVIDUAL CONTRIBUTORS,[1] WITH THE HEADINGS OF THE ARTICLES IN THIS VOLUME SO SIGNED.

A. A. R.*	Arthur Alcock Rambaut, M.A., D.Sc., F.R.S. Radcliffe Observer, Oxford. Professor of Astronomy in the University of Dublin and Royal Astronomer of Ireland, 1892–1897.	**Airy.**
A. C. L.	Sir Alfred Comyn Lyall, K.C.B. See the biographical article: Lyall, Sir A. C.	**Abdur Rahman;** **Afghanistan:** *History.*
A. D.	Austin Dobson, LL.D. See the biographical article: Dobson, Henry Austin.	**Addison** (*in part*).
A. E. S.	Arthur Everett Shipley, M.A., D.Sc., F.R.S. Fellow and Tutor of Christ's College, Cambridge. Reader in Zoology in Cambridge University. Joint-editor of the *Cambridge Natural History.*	**Acanthocephala.**
A. F. B.	Aldred Farrer Barker, M.Sc. Professor of Textile Industries at Bradford Technical College.	**Alpaca.**
A. F. P.	Albert Frederick Pollard, M.A., F.R.Hist.Soc. Fellow of All Souls' College, Oxford; Professor of English History in the University of London. Assistant-editor of the *Dictionary of National Biography,* 1893–1901.	**Aconcio.**
A. Gir.	Arthur Girault. Professor of Political Economy at the University of Poitiers. Member of the International Colonial Institute. Author of *Principes de colonisation* (1907–1908).	**Algeria:** *History.*
A. G. H.	A. G. Hadcock (late R.A.) Manager of the Gun Department, Elswick Works, Newcastle-on-Tyne.	**Ammunition** (*in part*).
A. H. J. G.	Abel Hendy Jones Greenidge, M.A., D.Litt. (Oxon.) (d. 1905). Formerly Fellow and Lecturer of Hertford College, Oxford, and of St John's College, Oxford. Author of *Infamia in Roman Law*; &c.	**Agrarian Laws** (*in part*).
A. J. B.	Alfred Joshua Butler, M.A., D.Litt. Fellow and Bursar of Brasenose College, Oxford. Fellow of Eton College.	**Abyssinian Church.**
A. J. G.	Rev. Alexander J. Grieve, M.A., B.D. Professor of New Testament and Church History, Yorkshire United Independent College, Bradford.	**Adoptianism; Alford;** **Alsop, V.; Ambrose, St.**
A. Mw.	Allen Mawer, M.A. Professor of English Language and Literature, Armstrong College, Newcastle-on-Tyne; formerly Fellow of Gonville and Caius College, Cambridge.	**Æthelflaed; Æthelred I.;** **Æthelstan; Æthelweard.**
A. M. C.	Agnes Mary Clerke. See the biographical article: Clerke, A. M.	**Algol.**
A. M. Cl.	Agnes Muriel Clay (Mrs Edward Wilde). Late Resident Tutor of Lady Margaret Hall, Oxford. Joint-editor of *Sources of Roman History, 133–70* B.C.	**Agrarian Laws** (*in part*).
A. R. W.	Alfred Russel Wallace, LL.D., D.C.L., F.R.S. See the biographical article: Wallace, A. R.	**Acclimatization.**
A. Si.	Arthur Sidgwick, M.A., LL.D. (Glasgow). Fellow of Corpus Christi College, Oxford; formerly Reader in Greek, Oxford University.	**Aeschylus.**
A. W.*	Arthur Willey, D.Sc., F.R.S. Director of Colombo Museum, Ceylon.	**Amphioxus.**
A. W. H.*	Arthur William Holland. Formerly Scholar of St John's College, Oxford. Bacon Scholar of Gray's Inn, 1900.	**Aberdeen, 4th Earl of.**
B. M.*	Budgett Meakin (d. 1906). Author of *The Moors*; *The Land of the Moors*; *The Moorish Empire*; &c.	**Almohades** (*in part*); **Almoravides** (*in part*).
C. B.*	Charles Bémont, D. ès L., Litt.D. (Oxon.). See the biographical article: Bémont, C.	**Agenais.**
C. E.*	Charles Everitt, M.A., F.C.S., F.G.S., F.R.A.S. Magdalen College, Oxford.	**Algebra:** *History.*
C. F. A.	Charles Francis Atkinson. Formerly Scholar of Queen's College, Oxford. Captain, 1st City of London (Royal Fusiliers). Author of *The Wilderness and Cold Harbour.*	**Alexandria:** *Battle.* **American Civil War;** **Ammunition** (*in part*).

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[1] A complete list, showing all individual contributors, appears in the final volume.

G. P. M.	George Percival Mudge, A.R.C.S., F.Z.S. Lecturer on Biology, London Hospital Medical College, and London School of Medicine for Women.	**Albino.**
G. W. B.	George Willis Botsford, A.M., Ph.D. Professor of History of Greece and Rome in Columbia University, New York. Author of *The Roman Assemblies*; &c.	**Amphictyony.**
G. W. T.	Rev. Griffithes Wheeler Thatcher, M.A., B.D. Warden of Camden College, Sydney, N.S.W Formerly Tutor in Hebrew and Old Testament History at Mansfield College, Oxford.	**Abu-l-'ala; Abu-l-'Atahiya; Abulfaraj; Abulfeda; Abu-l-Qasim; Abu Nuwas; Abu Tammam; Abu Ubaida; Akhtal; Alqama Ibn 'Abada; Amru'-ul-Qais.**
H. B. Wo.	Horace Bolingbroke Woodward, F.R.S., F.G.S. Formerly Assistant Director of the Geological Survey of England and Wales. President Geologists' Association, 1893–1894. Wollaston Medallist, 1908.	**Agassiz, J. L. R.**
H. Ch.	Hugh Chisholm, M.A. Formerly Scholar of Corpus Christi College, Oxford. Editor of the 11th edition of the *Encyclopaedia Britannica*; co-editor of the 10th edition.	**Acton, Lord; Agnosticism; Albert, Prince Consort.**
H. C. C.	Herbert Challice Crouch, M.R.C.S., L.R.C.P. Anaesthetist and Teacher of Anaesthetics at St Thomas's, Samaritan and French Hospitals, London.	**Anaesthesia.**
H. M. R.	Hugh Munro Ross. Formerly Exhibitioner of Lincoln College, Oxford. Editor of the *Times Engineering Supplement*. Author of *British Railways*.	**Alchemy.**
H. M. V.	Herbert M. Vaughan, F.S.A. Keble College, Oxford. Author of *The Last of the Royal Stuarts*; &c.	**Albany, Countess of.**
H. P. J.*	Henry Phelps Johnston. Author of *Royalist History of the Revolution*; *The Yorktown Campaign*; &c.	**American War of Independence:** *Land Operations.*
H. R. H.*	H. R. Haxton.	**Advertisement.**
H. S.-K.	Sir Henry Seton-Karr, C.M.G. Member for St. Helen's, 1885–1906. Author of *The Call to Arms*.	**Ammunition:** *Small Arms.*
H. S. J.	Henry Stuart Jones, M.A. Formerly Fellow of Trinity College, Oxford. Director of the British School at Rome, 1903–1905. Author of *The Roman Empire*.	**Amphitheatre.**
H. V. K.	Captain Howard V. Knox, M.A. Exeter College, Oxford.	**Alps:** *Flora and Fauna.*
H. W. C. D.	Henry William Carless Davis, M.A. Fellow and Tutor of Balliol College, Oxford. Fellow of All Souls', Oxford, 1895–1902.	**Ælred; Alredus; Ambrose.**
H. W. H.	Hope W. Hogg, M.A. Professor of Semitic Languages and Literatures in the University of Manchester.	**Anah.**
H. W. S.	H. Wickham Steed. Correspondent of *The Times* at Rome (1897–1902) and Vienna.	**Amedeo, Ferdinando, of Savoy.**
H. Y.	Sir Henry Yule, K.C.S.I. See the biographical article: Yule, Sir H.	**Afghanistan:** *History.*
J. A. Ba.	J. Arthur Barrett, LL.B. New York Bar, 1880. U.S. Supreme Court Bar, 1901.	**Admiralty Jurisdiction:** *United States.*
J. A. E.	James Alfred Ewing, C.B., LL.D., F.R.S., M.Inst.C.E. Director of (British) Naval Education, 1903. Hon. Fellow of King's College, Cambridge. Professor of Mechanism and Applied Mechanics in the University of Cambridge, 1890–1903.	**Air-Engine.**
J. A. F.	John Ambrose Fleming, M.A., D.Sc., F.R.S. Pender Professor of Electrical Engineering in the University of London. Fellow of University College, London. Formerly Fellow of St John's College, Cambridge, and University Lecturer on Applied Mechanics. Author of *Magnets and Electric Currents*.	**Amperemeter.**
J. A. H.	John Allen Howe, B.Sc. Curator and Librarian at the Museum of Practical Geology, London.	**Albian.**
J. B. B.	John Bagnell Bury, Litt.D., LL.D. See the biographical article: Bury, J. B.	**Alexius I. to III.**
J. D. B.	James David Bourchier, M.A., F.R.G.S. Correspondent of *The Times* in South-Eastern Europe. Officer of the Order of St Alexander of Bulgaria.	**Albania; Alexander of Bulgaria.**
J. D. Pr.	John Dyneley Prince, Ph.D. Professor of Semitic Languages at Columbia University, N.Y. Took part in the Expedition to Southern Babylonia, 1888–89.	**Akkad.**
J. F.-K.	James Fitzmaurice-Kelly, Litt.D., F.R.Hist.S. Fellow of the British Academy. Gilmour Professor of Spanish Language and Literature in the University of Liverpool. Norman MacColl Lecturer in the University of Cambridge. Knight Commander of the Order of Alphonso XII. Author of *A History of Spanish Literature*.	**Acosta, J. de; Alarcon, J. R. de; Alarcon, P. A. de; Aleman; Amadis de Gaula.**
J. F. R.	James Ford Rhodes, LL.D. See the biographical article: Rhodes, J. Ford.	**Adams, C. F.**
J. G. C. A.	John George Clark Anderson, M.A. Student, Censor and Tutor of Christ Church, Oxford. Craven Fellow, 1896. Formerly Fellow of Lincoln College, Oxford.	**Ancyra.**

J. G. Gr.	John G. Griffiths. Fellow and late President, Institute of Chartered Accountants.	**Accountants.**
J. G. Sc.	Sir James George Scott, K.C.I.E. Superintendent and Political Officer, Southern Shan States. Author of *Burma*; &c.	**Akyab.**
J. H. P.	John Henry Poynting, M.A., D.Sc., F.R.S. Mason Professor of Physics and Dean of the Faculty of Science, Birmingham University. Sometime Fellow of Trinity College, Cambridge.	**Acoustics.**
J. H. R.	John Horace Round, M.A., LL.D. (Edin.). Author of *Feudal England*; *Peerage and Pedigree*; &c.	**Abeyance; Aids.**
J. I.	Jules Isaac. Professor of History at the Lycée of Lyons, France.	**Amboise, G. d'.**
J. L.*	Sir Joseph Larmor, M.A., D.Sc., LL.D., D.C.L., F.R.A.S. Fellow of St John's College, Cambridge. Lucasian Professor of Mathematics in Cambridge University. Secretary of the Royal Society. Author of *Aether and Matter*; &c.	**Aether.**
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J. M. M.	John Malcolm Mitchell. Formerly Scholar of Queen's College, Oxford. Lecturer in Classics, East London College (University of London). Joint-editor of Grote's *History of Greece*.	**Anaxagoras** (*in part*).
J. P.-B.	James George Joseph Penderel-Brodhurst Editor of the *Guardian* (London).	**Adam, Robert.**
J. P. Pe.	John Punnett Peters, Ph.D., D.D. Canon Residentiary, Cathedral of New York. Formerly Professor of Hebrew in the University of Pennsylvania. In charge of the University Expedition to Babylonia, 1888–1895. Author of *Nippur, or Explorations and Adventures on the Euphrates*.	**Anbar.**
J. R. C.	Joseph Rogerson Cotter, M.A. Assistant to the Professor of Physics, Trinity College, Dublin. Editor of 2nd edition of Preston's *Theory of Heat*.	**Absorption of Light.**
J. R. D.	Colonel John Richard Dodd, M.D., F.R.C.S., R.A.M.C. Administrative Medical Officer of Cork Military District.	**Ambulance.**
J. S.	James Sully, LL.D. See the biographical article: Sully, J.	**Aesthetics.**
J. S. F.	John Smith Flett, D.Sc., F.G.S. Petrographer to the Geological Survey. Formerly Lecturer on Petrology in Edinburgh University.	**Agglomerate; Amphibolite; Andesite.**
J. S. K.	John Scott Keltie, LL.D., F.S.S., F.S.A. (Scot.). Sec. Royal Geog. Soc. Hon. Memb. Geographical Societies of Paris, Berlin, Rome, &c. Editor of *Statesman's Year-book*. Editor of the *Geographical Journal*.	**Abbadie; Africa:** *History*.
J. T. Be.	John T. Bealby. Joint-author of *Stanford's Europe*. Formerly editor of the *Scottish Geographical Magazine*. Translator of Sven Hedin's *Through Asia*, *Central Asia and Tibet*; &c.	**Altai.**
J. T. C.	Joseph Thomas Cunningham, M.A., F.Z.S. Lecturer on Zoology at South-Western Polytechnic, London. Formerly Fellow of University College, Oxford. Assistant Professor of Natural History in the University of Edinburgh. Naturalist to the Marine Biological Association.	**Anchovy.**
J. T. S.*	James Thomson Shotwell, Ph.D. Professor of History in Columbia University, New York City.	**Abelard** (*in part*).
J. V. B.	J. Vernon Bartlet, M.A., D.D. Professor of Church History, Mansfield College, Oxford.	**Acts of the Apostles.**
Jno. W.	John Westlake, K.C., LL.D., D.C.L. Professor of International Law, Cambridge, 1888–1908. One of the Members for United Kingdom of International Court of Arbitration under the Hague Convention, 1900–1906. Author of *A Treatise on Private International Law, or the Conflict of Laws*; *Chapters on the Principles of International Law*, part i. "Peace," part ii. "War."	**Alien; Allegiance.**
J. W. D.	Captain J. Whitly Dixon, R.N. Nautical Assessor to the Court of Appeal.	**Anchor.**
K. S.	Kathleen Schlesinger. Author of *The Instruments of the Orchestra*; &c.	**Accordion; Aeolian Harp; Alpenhorn.**
L. D.*	Louis Marie Olivier Duchesne. See the biographical article: Duchesne, L. M. O.	**Adrian I., II., III.; Alexander I., II. (popes).**
L. J. S.	Leonard James Spencer. Department of Mineralogy, British Museum. Formerly Scholar of Sidney Sussex College, Cambridge, and Harkness Scholar. Editor of the *Mineralogical Magazine*.	**Albite; Alunite; Amblygonite; Ampibole; Analcite; Anatase; Andalusite.**
L. V.*	Luigi Villari. Italian Foreign Office (Emigration Dept.). Formerly Newspaper Correspondent in east of Europe; Italian Vice-Consul in New Orleans, 1906, Philadelphia, 1907, and Boston, U.S.A., 1907–1910. Author of *Italian Life in Town and Country*; &c.	**Accoramboni; Alexander VI. (pope); Amari.**

M. Br.	MARGARET BRYANT.	**Alexander the Great:** *Legends.*
M. G.	MOSES GASTER, PH.D. (Leipzig). Chief Rabbi of the Sephardic communities of England. Vice-President, Zionist Congress, 1898, 1899, 1900. Ilchester Lecturer at Oxford on Slavonic and Byzantine Literature, 1886 and 1891. President, Folklore Society of England. Vice-President, Anglo-Jewish Association. Author of *History of Rumanian Popular Literature; The Hebrew Version of the Secretum Secretorum of Aristotle.*	**Alecsandri.**
M. G. D.	RT. HON. SIR MOUNTSTUART ELPHINSTONE GRANT-DUFF, G.C.S.I., F.R.S. (1829–1906). M.P. for the Elgin Burghs, 1857–1881. Under-Secretary of State for India, 1868–1874. Under-Secretary of State for the Colonies, 1880–1881. Governor of Madras, 1881–1886. President of the Royal Geographical Society, 1889–1893. President of the Royal Historical Society, 1892–1899. Author of *Studies in European Politics; Notes from a Diary;* &c.	**Ampthill, Baron.**
M. Ha.	MARCUS HARTOG, M.A., D.Sc. (Lond.), F.L.S. Professor of Zoology in University College, Cork. Formerly Professor of Natural History in Queen's College, Cork, and Fellow of the Royal University of Ireland.	**Amoeba.**
M. H. C.	MONTAGUE HUGHES CRACKANTHORPE, M.A., K.C., D.C.L. President of the Eugenics Education Society. Formerly Member of the General Council of the Bar and Council of Legal Education. Late Chairman, Incorporated Council of Law Reporting. Chairman of Quarter Sessions, Westmorland. Honorary Fellow, St John's College, Oxford.	**"Alabama" Arbitration.**
M. Ja.	MORRIS JASTROW, JR., PH.D. Professor of Semitic Languages, University of Pennsylvania, U.S.A. Author of *Religion of the Babylonians and Assyrians;* &c.	**Adad.**
M. M. Bh.	SIR MANCHERJEE MERWANJEE BHOWNAGGREE, K.C.I.E. Fellow of Bombay University. M.P. (C.) Bethnal Green, North-East, 1895–1906. Author of *Small History of the East India Company.*	**Aga Khan.**
M. N. T.	MARCUS NIEBUHR TOD, M.A. Fellow and Lecturer of Oriel College, Oxford. University Lecturer in Greek Epigraphy. Corresponding Member of the German Imperial Archaeological Institute. Joint-author of *Catalogue of the Sparta Museum.*	**Agesilaus;** **Agis.**
M. O. B. C.	MAX OTTO BISMARCK CASPARI, M.A. Reader in Ancient History at London University. Lecturer in Greek at Birmingham University, 1905–1908.	**Acarnania; Achaean League;** **Actium; Aetolia; Ambracia.**
M. P.*	LÉON JACQUES MAXIME PRINET. Formerly Archivist to the French National Archives. Auxiliary of the Institute of France (Academy of Moral and Political Sciences).	**Albret;** **Alençon, Counts of.**
N. V.	JOSEPH MARIE NOEL VALOIS. Member of Académie des Inscriptions et Belles-lettres, Paris. Honorary Archivist at the Archives Nationales. Formerly President of the Société de l'Histoire de France, and of the Société de l'École de Chartes.	**Ailly;** **Alexander V. (pope).**
O. E.	S. OTTO EPPENSTEIN, PH.D. Member of Scientific Staff at Zeiss's optical works, Jena. Editor of 2nd ed. of *Grundzüge der Theorie der optischen Instrumente nach Abbe.*	**Aberration.**
O. H.*	OTTO HEHNER, PH.D. Formerly President of the Society of Analytical Chemists.	**Adulteration.**
O. T. M.	OTIS TUFTON MASON (d. 1908). Curator, Department of Anthropology, National Museum, Washington, 1884–1908. Author of *Woman's Share in Primitive Culture; Primitive Travel and Transportation;* &c.	**America:** *Ethnology and Archaeology.*
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P. A. A.	PHILIP A. ASHWORTH, M.A., D.JURIS. New College, Oxford. Barrister-at-Law.	**Alsace-Lorraine.**
P. A. G.	P. ANDERSON GRAHAM. Editor of *Country Life.* Author of *The Rural Exodus: the Problem of the Village and the Town.*	**Allotments.**
P. A. K.	PRINCE PETER ALEXEIVITCH KROPOTKIN. See the biographical article: KROPOTKIN, P. A.	**Altai; Amur:** *District;* **Anarchism.**
P. A. M.	PERCY ALEXANDER MACMAHON, D.Sc., F.R.S., LATE MAJOR R.A. Deputy Warden of the Standards, Board of Trade. Joint General Secretary, British Association. Formerly Professor of Physics, Ordnance College. President of London Mathematical Society, 1894–1896.	**Algebraic Forms.**
P. C. M.	PETER CHALMERS MITCHELL, F.R.S., D.Sc., LL.D. Secretary to the Zoological Society of London from 1903. University Demonstrator in Comparative Anatomy and Assistant to Linacre Professor at Oxford, 1888–1891. Lecturer on Biology at Charing Cross Hospital, 1892–1894; at London Hospital, 1894. Examiner in Biology to the Royal College of Physicians, 1892–1896, 1901–1903. Examiner in Zoology to the University of London, 1903.	**Abiogenesis; Actinozoa;** **Alimentary Canal;** **Amphibia** *(in part).*
P. C. Y.	PHILIP CHESNEY YORKE, M.A. Magdalen College, Oxford.	**Aberdeen, 1st Earl of;** **Allestree, R.**
P. Gi.	PETER GILES, M.A., LL.D. Fellow and Classical Lecturer of Emmanuel College, Cambridge, and University Reader in Comparative Philology.	**A; Accent;** **Alphabet.**

P. La.	Philip Lake, M.A., F.G.S. Lecturer on Physical and Regional Geography in Cambridge University. Formerly of the Geological Survey of India. Author of *Monograph of British Cambrian Trilobites.* Translator and editor of Kayser's *Comparative Geology.*	**Alps:** *Geology.*
R. A. S. M.	Robert Alexander Stewart Macalister, M.A., F.S.A. Director of Excavations for the Palestine Exploration Fund.	**Acre; Ai; Altar.**
R. K. D.	Sir Robert Kennaway Douglas. Formerly Keeper of Oriental Printed Books and MSS. at the British Museum; Professor of Chinese, King's College, London. Author of *The Language and Literature of China*; &c.	**Alcock, Sir R.**
R. L.*	Richard Lydekker, F.R.S., Author of *Catalogues of Fossil Mammals, Reptiles and Birds in British Museum*; *The Deer of all Lands*; *The Game Animals of Africa*; &c.	**Amblypoda;** **Ancylopoda.**
R. N. B.	Robert Nisbet Bain (d. 1909). Assistant Librarian, British Museum, 1883–1909. Author of *Scandinavia: the Political History of Denmark, Norway and Sweden, 1513–1900*; *The First Romanovs, 1613 to 1725*; *Slavonic Europe: the Political History of Poland and Russia from 1469 to 1796*, &c.	**Aagesen; Absalon;** **Adolphus Frederick;** **Alexander Nevsky;** **Alexius Mikhailovich;** **Alexius Petrovich;** **Alin; Andrassy, Count;** **Andrew II. of Hungary.**
R. P. S.	R. Phené Spiers, F.S.A., F.R.I.B.A. Past President of Architectural Association. Associate and Fellow of King's College, London. Editor of *Fergusson's History of Architecture.* Author of *Architecture: East and West*; &c.	**Aisle.**
R. S. C.	Robert Seymour Conway, M.A., Litt.D. Professor of Latin, Victoria University of Manchester; formerly Professor of Latin in University College, Cardiff.	**Aequi.**
R. Tr.	Roland Truslove, M.A. Dean, Fellow and Lecturer, Worcester College, Oxford. Formerly Scholar of Christ Church, Oxford.	**Agriculture** (*in part*).
R. V. H.	Admiral Sir Richard Vesey Hamilton, G.C.B. Senior Naval Lord of Admiralty, 1889–1891. President, Royal Naval College, Greenwich, 1891–1894.	**Admiralty Administration** (*British*).
R. W. P.	Reginald W. Phillips, D.Sc., F.L.S. Professor of Botany in the University College of North Wales. Author of *Morphology of the Algae*, &c.	**Algae.**
S. A. C.	Stanley Arthur Cook, M.A. Lecturer in Hebrew and Syriac, and formerly Fellow, Gonville and Caius College, Cambridge. Examiner in Hebrew and Aramaic, London University, 1904–1908. Council of Royal Asiatic Society, 1904–1905. Editor for Palestine Exploration Fund. Author of *Critical Notes on Old Testament History*; *Religion of Ancient Palestine*; &c.	**Aaron; Abimelech;** **Abraham; Ahab;** **Amalekites;** **Ammonites.**
S. E. B.	Simeon Eben Baldwin, M.A., LL.D. Professor of Constitutional and Private International Law in the University of Yale. Chief Justice of the Supreme Court of Errors, Connecticut. President of the International Law Association. President of the American Historical Association.	**American Law.**
T. As.	Thomas Ashby, M.A., D.Litt. (Oxon.), F.S.A. Formerly Scholar of Christ Church, Oxford. Director of British School of Archaeology at Rome.	**Adria; Aemilia Via;** **Agrigentum; Alba Fucens;** **Alba Longa; Aletrium;** **Anagnia; Ancona.**
T. A. I.	Thomas Allan Ingram, M.A., LL.D. Trinity College, Dublin.	**Affiliation.**
T. A. J.	T. Athol Joyce, M.A. Assistant in Department of Ethnography, British Museum. Hon. Sec. Anthropological Society.	**Ababda;** **Africa:** *Ethnology.*
T. H.	Thomas Hodgkin, LL.D., D.Litt. See the biographical article: Hodgkin, T.	**Alaric.**
T. H. H.	Thomas Henry Huxley, F.R.S. See the biographical article: Huxley, Thomas H.	**Amphibia** (*in part*).
T. H. H.*	Colonel Sir Thomas Hungerford Holdich, K.C.M.G., K.C.I.E., Hon. D.Sc. Superintendent, Frontier Surveys, India, 1892–1898. Author of *The Indian Borderland*; *The Countries of the King's Award*; *India*; *Tibet*; &c.	**Afghanistan:** *Geography*; **Afghan Turkestan.**
T. K. C.	Rev. Thomas Kelly Cheyne, D.Litt., D.D. See the biographical article: Cheyne, T. K.	**Adam; Amos.**
T. W. R. D.	T. W. Rhys Davids, LL.D., Ph.D. Professor of Comparative Religion in Manchester University. President of the Pali Text Society. Fellow of the British Academy. Secretary and Librarian of Royal Asiatic Society, 1885–1902. Author of *Buddhism*; &c.	**Abhidhamma;** **Ajanta;** **Ananda.**
V. B. L.	Vivian Byam Lewes, F.I.C., F.C.S. Professor of Chemistry, Royal Naval College. Chief Superintendent Gas Examiner to the Corporation of the City of London.	**Acetylene.**
W.	Sir Joseph Walton (d. 1910). Formerly Judge of the King's Bench Div. Chairman of the General Council of the Bar, 1899.	**Affreightment.**

W. A. B. C.	Rev. William Augustus Brevoort Coolidge, M.A., F.R.G.S., D.Ph. (Bern). Fellow of Magdalen College, Oxford. Professor of English History, St David's College, Lampeter, 1880–1881. Author of *Guide du Haut Dauphiné*; *The Range of the Tödi*; *Guide to Grindelwald*; *Guide to Switzerland*; *The Alps in Nature and in History*; &c. Editor of the *Alpine Journal*, 1880–1889; &c.	**Aar; Aarau; Aargau; Adda; Adige; Albula Pass; Alp; Alpes Maritimes; Alps; Altdorf.**
W. A. P.	Walter Alison Phillips, M.A. Formerly Exhibitioner of Merton College and Senior Scholar of St John's College, Oxford. Author of *Modern Europe*; &c.	**Abbot; Aix-la-Chapelle:** *Congresses*; **Alexander I. of Russia; Ali, of Iannina; Alliance; Ambassador.**
W. Ba.	William Bacher, Ph.D. Professor at the Rabbinical Seminary, Buda-Pest.	**Abenezra.**
W. C. R.-A.	Sir William Chandler Roberts-Austen, K.C.B., D.C.L., F.R.S. See the biographical article: Roberts-Austen, Sir W. C.	**Alloys** (*in part*).
W. E. G.	Sir William Edmund Garstin, G.C.M.G. Governing Director, Suez Canal Co. Formerly Inspector-General of Irrigation, Egypt. Under-Secretary of State for Public Works. Adviser to the Ministry of Public Works in Egypt, 1904–1908.	**Albert Edward Nyanza;** **Albert Nyanza** (*in part*).
W. Fr.	William Fream, LL.D., F.G.S., F.L.S., F.S.S. (d. 1907). Author of *Handbook of Agriculture*.	**Agriculture** (*in part*).
W. F. Sh.	William Fleetwood Sheppard, M.A. Senior Examiner in the Board of Education. Formerly Fellow of Trinity College, Cambridge. Senior Wrangler, 1884.	**Algebra.**
W. G.*	Walcot Gibson, D.Sc., F.G.S. H.M. Geological Survey. Author of *The Gold-Bearing Rocks of the S. Transvaal*; *Mineral Wealth of Africa*; *The Geology of Coal and Coalmining*; &c.	**Africa:** *Geology*; **Algeria:** *Geology*.
W. G. F. P.	Sir Walter George Frank Phillimore, Bart., D.C.L., LL.D. Judge of the King's Bench Div. President of International Law Association, 1905. Author of *Book of Church Law*. Edited 2nd ed. of *Phillimore's Ecclesiastical Law*, and 3rd ed. of vol. iv. of *Phillimore's International Law*.	**Admiralty, High Court of;** **Admiralty Jurisdiction.**
W. Ht.	Walter Hibbert, A.M.I.C.E., F.I.C., F.C.S. Lecturer on Physics and Electro-Technology, Polytechnic, Regent Street, London.	**Accumulator.**
W. M. D.	William Morris Davis, D.Sc., Ph.D. Professor of Geology in Harvard University. Formerly Professor of Physical Geography. Author of *Physical Geography*; &c.	**America:** *Physical Geography*.
W. M. F. P.	William M. Flinders Petrie, D.C.L., Litt.D., LL.D., Ph.D. See the biographical article: Petrie, W. M. F.	**Abydos.**
W. M. R.	William Michael Rossetti. See the biographical article: Rossetti, Dante Gabriel.	**Andrea del Sarto.**
W. O. B.	Ven. Winfrid Oldfield Burrows, M.A. Archdeacon of Birmingham. Formerly Tutor of Christ Church, Oxford, 1884–1891, and Principal of Leeds Clergy School, 1891–1900.	**Absolution.**
W. Ri.	William Ridgeway, M.A., D.Sc., Litt.D. Disney Professor of Archaeology, Cambridge University, and Brereton Reader in Classics. Fellow of Caius College, Cambridge. Fellow of the British Academy. President of Royal Anthropological Institute, 1908. Author of *The Early Age of Greece*, &c.	**Achaeans.**
W. S.	William Spalding. See the biographical article: Spalding, W.	**Addison** (*in part*).
W. T. S.	Rear-Admiral W. T. Sampson, LL.D. See the biographical article: Sampson, W. T.	**Admiralty Administration** (*United States*).
W. W.	William Wallace. See the biographical article: Wallace, William (1844–1897).	**Anaxagoras** (*in part*).
W. W. F.*	William Warde Fowler, M.A. Fellow of Lincoln College, Oxford. Sub-Rector, 1881–1904. Gifford Lecturer, Edinburgh University, 1908. Author of *The City-State of the Greeks and Romans*.	**Ambarvalia.**
W. W. R.*	William Walker Rockwell, Ph.D. Assistant Professor of Church History, Union Theological Seminary, New York.	**Adrian IV., V., VI.;** **Alexander III., IV., VII., VIII.;** **Ancyra, Synod of.**

PRINCIPAL UNSIGNED ARTICLES

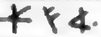
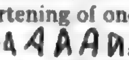
Abbreviation.
Acid.
Aconite.
Addison's Disease.
Adoption.
Advocate.
Advowson.
Aeronautics.
Aerotherapeutics.
Agapemonites.
Age.
Alabama.
Alaska.
Alb.
Albumin.
Alcohol.
Alcohols.
Aldehydes.
Alexandrian School.
Alhambra.
Alimony.
Alismaceae.
Almanac.
Aloe.
Alum.
Amazons.
Ambo.
Ammonia.
Amsterdam.
Ana.
Andaman Islands.
Andes.

ENCYCLOPÆDIA BRITANNICA

ELEVENTH EDITION

VOLUME I

A This letter of ours corresponds to the first symbol in the Phoenician alphabet and in almost all its descendants. In Phoenician, *a*, like the symbols for *e* and for *o*, did not represent a vowel, but a breathing; the vowels originally were not represented by any symbol. When the alphabet was adopted by the Greeks it was not very well fitted to represent the sounds of their language. The breathings which were not required in Greek were accordingly employed to represent some of the vowel sounds, other vowels, like *i* and *u*, being represented by an adaptation of the symbols for the semi-vowels *y* and *w*. The Phoenician name, which must have corresponded closely to the Hebrew *Aleph*, was taken over by the Greeks in the form *Alpha* (ἄλφα). The earliest authority for this, as for the names of the other Greek letters, is the grammatical drama (γραμματικὴ θεωρία) of Callias, an earlier contemporary of Euripides, from whose works four trimeters, containing the names of all the Greek letters, are preserved in Athenaeus x. 453 d.

The form of the letter has varied considerably. In the earliest of the Phoenician, Aramaic and Greek inscriptions (the oldest Phoenician dating about 1000 B.C., the oldest Aramaic from the 8th, and the oldest Greek from the 8th or 7th century B.C.) A rests upon its side thus—. In the Greek alphabet of later times it generally resembles the modern capital letter, but many local varieties can be distinguished by the shortening of one leg, or by the angle at which the cross line is set—, &c. From the Greeks of the west the alphabet was borrowed by the Romans and from them has passed to the other nations of western Europe. In the earliest Latin inscriptions, such as the inscription found in the excavation of the Roman Forum in 1899, or that on a golden *fibula* found at Praeneste in 1886 (see ALPHABET), the letters are still identical in form with those of the western Greeks. Latin develops early various forms, which are comparatively rare in Greek, as , or unknown, as . Except possibly Faliscan, the other dialects of Italy did not borrow their alphabet directly from the western Greeks as the Romans did, but received it at second hand through the Etruscans. In Oscan, where the writing of early inscriptions is no less careful than in Latin, the A takes the form , to which the nearest parallels are found in north Greece (Boeotia, Locris and Thessaly, and there only sporadically).

In Greek the symbol was used for both the long and the short sound, as in English *father* (ā) and German *Ratte* (ă); English, except in dialects, has no sound corresponding precisely to the Greek short *a*, which, so far as can be ascertained, was a mid-back-wide sound, according to the terminology of H. Sweet (*Primer of Phonetics*, p. 107). Throughout the history of Greek the short sound remained practically unchanged. On the other hand, the long sound of *a* in the Attic and Ionic dialects passed into an open *ē*-sound, which in the Ionic alphabet was represented by the same symbol as the original *ē*-sound (see ALPHABET: *Greek*). The vowel sounds vary from language to language, and the *a* symbol has, in consequence, to represent in many cases sounds which are not identical with the Greek *a* whether long or short, and also to represent several different vowel sounds in the same language. Thus the *New English Dictionary* distinguishes about twelve separate vowel sounds, which are represented by *a* in English. In general it may be said that the chief changes which affect the *a*-sound in different languages arise from (1) rounding, (2) fronting, *i.e.* changing from a sound produced far back in the mouth to a sound produced farther forward. The rounding is often produced by combination with rounded consonants (as in English *was*, *wall*, &c.), the rounding of the preceding consonant being continued into the formation of the vowel sound. Rounding has also been produced by a following *l*-sound, as in the English *fall*, *small*, *bald*, &c. (see Sweet's *History of English Sounds*, 2nd ed., §§ 906, 784). The effect of fronting is seen in the Ionic and Attic dialects of Greek, where the original name of the Medes, *Mādoi*, with *ā* in the first syllable (which survives in Cyprian Greek as Μᾶδοι), is changed into *Mēdoi* (Μῆδοι), with an open *ē*-sound instead of the earlier *ā*. In the later history of Greek this sound is steadily narrowed till it becomes identical with *ī* (as in English *seed*). The first part of the process has been almost repeated by literary English, *ā* (*ah*) passing into *ē* (*eh*), though in present-day pronunciation the sound has developed further into a diphthongal *ei* except before *r*, as in *hare* (Sweet, *op. cit.* § 783).

In English *a* represents unaccented forms of several words, e.g. *ān* (one), *of*, *have*, *he*, and of various prefixes the history of which is given in detail in the *New English Dictionary* (Oxford, 1888), vol. i. p. 4. (P. Gi.)

As a symbol the letter is used in various connexions and for various technical purposes, *e.g.* for a note in music, for the first of the seven dominical letters (this use is derived from its being the first of the *litterae nundinales* at Rome), and generally as a sign of priority.

In Logic, the letter A is used as a symbol for the universal affirmative proposition in the general form "all *x* is *y*." The letters I, E and O are used respectively for the particular affirmative "some *x* is *y*," the universal negative "no *x* is *y*," and the particular negative "some *x* is not *y*." The use of these letters is generally derived from the vowels of the two Latin verbs *AffIrmo* (or *AIo*), "I assert," and *nEgO*, "I deny." The use of the symbols dates from the 13th century, though some authorities trace their origin to the Greek logicians. A is also used largely in abbreviations (*q.v.*).

In Shipping, A1 is a symbol used to denote quality of construction and material. In the various shipping registers ships are classed and given a rating after an official examination, and assigned a classification mark, which appears in addition to other particulars in those registers after the name of the ship. See SHIPBUILDING. It is popularly used to indicate the highest degree of excellence.

AA, the name of a large number of small European rivers. The word is derived from the Old German *aha*, cognate to the Latin *aqua*, water (cf. Ger. *-ach*; Scand. *å*, *aa*, pronounced *ô*). The following are the more important streams of this name:—Two rivers in the west of Russia, both falling into the Gulf of Riga, near Riga, which is situated between them; a river in the north of France, falling into the sea below Gravelines, and navigable as far as St Omer; and a river of Switzerland, in the cantons of Lucerne and Aargau, which carries the waters of Lakes Baldegger and Hallwiler into the Aar. In Germany there are the Westphalian Aa, rising in the Teutoburger Wald, and joining the Werre at Herford, the Münster Aa, a tributary of the Ems, and others.

AAGESEN, ANDREW (1826–1879), Danish jurist, was educated for the law at Kristianshavn and Copenhagen, and interrupted his studies in 1848 to take part in the first Schleswig war, in which he served as the leader of a reserve battalion. In 1855 he became professor of jurisprudence at the university of Copenhagen. In 1870 he was appointed a member of the commission for drawing up a maritime and commercial code, and the navigation law of 1882 is mainly his work. In 1879 he was elected a member of the Landsthing; but it is as a teacher at the university that he won his reputation. Among his numerous juridical works may be mentioned: *Bidrag til Laeren om Overdragelse af Ejendomsret*, *Bemaerkinger om Rettigheder over Ting* (Copenhagen, 1866, 1871–1872); *Fortegnelse over Retssamlinger, Retslitteratur i Danmark, Norge, Sverige* (Copenhagen, 1876). Aagesen was Hall's successor as lecturer on Roman law at the university, and in this department his researches were epoch-making. All his pupils were profoundly impressed by his exhaustive examination of the sources, his energetic demonstration of his subject and his stringent search after truth. His noble, imposing, and yet most amiable personality won for him, moreover, universal affection and respect.

See C. F. Bricka, *Dansk. Biog. Lex.* vol. i. (Copenhagen, 1887); *Samlade Skrifter*, edited by F. C. Bornemann (Copenhagen, 1863). (R. N. B.)

AAL, also known as A'L, ACH, or AICH, the Hindustani names for the *Morinda tinctoria* and *Morinda citrifolia*, plants extensively cultivated in India on account of the reddish dye-stuff which their roots contain. The name is also applied to the dye, but the common trade name is *Suranji*. Its properties are due to the presence of a glucoside known as *Morindin*, which is compounded from glucose and probably a trioxy-methyl-anthraquinone.

AALBORG, a city and seaport of Denmark, the seat of a bishop, and chief town of the *amt* (county) of its name, on the south bank of the Limfjord, which connects the North Sea and the Cattegat. Pop. (1901) 31,457. The situation is typical of the north of Jutland. To the west the Limfjord broadens into an irregular lake, with low, marshy shores and many islands. North-west is the Store Vildmose, a swamp where the mirage is seen in summer. South-east lies the similar Lille Vildmose. A railway connects Aalborg with Hjörring, Frederikshavn and Skagen to the north, and with Aarhus and the lines from Germany to the south. The harbour is good and safe, though difficult of access. Aalborg is a growing industrial and commercial centre, exporting grain and fish. An old castle and some picturesque houses of the 17th century remain. The Budolphi church dates mostly from the middle of the 18th century, while the Frue church was partially burnt in 1894, but the foundation of both is of the 14th century or earlier. There are also an ancient hospital and a museum of art and antiquities. On the north side of the fjord is Nörre Sundby, connected with Aalborg by a pontoon and also by an iron railway bridge, one of the finest engineering works in the kingdom. Aalborg received town-privileges in 1342, and the bishopric dates from 1554.

AALEN, a town of Germany, in the kingdom of Württemberg, pleasantly situated on the Kocher, at the foot of the Swabian Alps, about 50 m. E. of Stuttgart, and with direct railway communication with Ulm and Cannstatt. Pop. 10,000. Woollen and linen goods are manufactured, and there are ribbon looms and tanneries in the town, and large iron works in the neighbourhood. There are several schools and churches, and a statue of the poet Christian Schubart. Aalen was a free imperial city from 1360 to 1802, when it was annexed to Württemberg.

AALESUND, a seaport of Norway, in Romsdal *amt* (county), 145 m. N. by E. from Bergen. Pop. (1900) 11,672. It occupies two of the outer islands of the west coast, Aspö and Nörvö, which enclose the picturesque harbour. Founded in 1824, it is the principal shipping-place of Söndmöre district, and one of the chief stations of the herring fishery. Aalesund is adjacent to the Jörund and Geiranger fjords, frequented by tourists. From Öje at the head of Jörund a driving-route strikes south to the Nordfjord, and from Merok on Geiranger another strikes inland to Otta, on the railway to Lillehammer and Christiania. Aalesund is a port of call for steamers between Bergen, Hull, Newcastle and Hamburg, and Trondhjem. A little to the south of the town are the ruins of the reputed castle of Rollo, the founder, in the 9th century, of the dynasty of the dukes of Normandy. On the 23rd of January 1904, Aalesund was the scene of one of the most terrible of the many conflagrations to which Norwegian towns, built largely of wood, have been subject. Practically the whole town was destroyed, a gale aiding the flames, and the population had to leave the place in the night at the notice of a few minutes. Hardly any lives were lost, but the sufferings of the people were so terrible that assistance was sent from all parts of the kingdom, and by the German government, while the British government also offered it.

AALI, MEHEMET, Pasha (1815–1871), Turkish statesman, was born at Constantinople in 1815, the son of a government official. Entering the diplomatic service of his country soon after reaching manhood, he became successively secretary of the Embassy in Vienna, minister in London, and foreign minister under Reshid Pasha. In 1852 he was promoted to the post of grand vizier, but after a short time retired into private life. During the Crimean War he was recalled in order to take the portfolio of foreign affairs for a second time under Reshid Pasha, and in this capacity took part in 1855 in the conference of Vienna. Again becoming in that year grand vizier, an office he filled no less than five times, he represented Turkey at the congress of Paris in 1856. In 1867 he was appointed regent of Turkey during the sultan's visit to the Paris Exhibition. Aali Pasha was one of the most zealous advocates of the introduction of Western reforms under the sultans Abdul Mejid and Abdul Aziz. A scholar and a linguist, he was a match for the diplomats of the Christian powers, against whom he successfully defended the interests of his country. He died at Erenkeni in Asia Minor on the 6th of September 1871.

AAR, or AARE, the most considerable river which both rises and ends entirely within Switzerland. Its total length (including all bends) from its source to its junction with the Rhine is about 181 m., during which distance it descends 5135 ft., while its drainage area is 6804 sq. m. It rises in the great Aar glaciers, in the canton of Bern, and W. of the Grimsel Pass. It runs E. to the Grimsel Hospice, and then N.W. through the Hasli valley, forming on the way the magnificent waterfall of the Handegg (151 ft.), past Guttannen, and pierces the limestone barrier of the Kirchet by a grand gorge, before reaching Meiringen, situated in a plain. A little beyond, near Brienz, the river expands into the lake of Brienz, where it becomes navigable. Near the west end of that lake it receives its first important affluent, the Lütschine (left), and then runs across the swampy plain of the Bödeli, between Interlaken (left) and Unterseen (right), before again expanding in order to form the Lake of Thun. Near the west end of that lake it receives on the left the Kander, which has just before been joined by the Simme; on flowing out of the lake it passes Thun, and then circles the lofty bluff on which the town of Bern is built. It soon changes its north-westerly for a due westerly direction, but after receiving the Saane or Sarine (left) turns N. till near Aarberg its stream is diverted W. by the Hagneck Canal into the Lake of Bienne, from the upper end of which it issues through the Nidau Canal and then runs E. to Büren. Henceforth its course is N.E. for a long distance, past Soleure (below which the Grosse Emme flows in on the right), Aarburg (where it is joined by the Wigger, right), Olten, Aarau, near which is the junction with the Suhr on the right, and Wildegg, where the Hallwiler Aa falls in on the right. A short way beyond, below Brugg, it receives first the Reuss (right), and very shortly afterwards the Limmat or Linth (right). It now turns due N., and soon becomes itself an affluent of the Rhine (left), which it surpasses in volume when they unite at Coblenz, opposite Waldshut. (W. A. B. C.)

AARAU, the capital of the Swiss canton of Aargau. In 1900 it had 7831 inhabitants, mostly German-speaking, and mainly Protestants. It is situated in the valley of the Aar, on the right bank of that river, and at the southern foot of the range of the Jura. It is about 50 m. by rail N.E. of Bern, and 31 m. N.W. of Zürich. It is a well-built modern town, with no remarkable features about it. In the Industrial Museum there is (besides collections of various kinds) some good painted glass of the 16th century, taken from the neighbouring Benedictine monastery of Muri (founded 1027, suppressed 1841—the monks are now quartered at Gries, near Botzen, in Tirol). The cantonal library contains many works relating to Swiss history and many MSS. coming from the suppressed Argovian monasteries. There are many industries in the town, especially silk-ribbon weaving, foundries, and factories for the manufacture of cutlery and scientific instruments. The popular novelist and historian, Heinrich Zschokke (1771–1848), spent most of his life here, and a bronze statue has been erected to his memory. Aarau is an important military centre. The slopes of the Jura are covered with vineyards. Aarau, an ancient fortress, was taken by the Bernese in 1415, and in 1798 became for a time the capital of the Helvetic republic. Eight miles by rail N.E. are the famous sulphur baths of Schinznach, just above which is the ruined castle of Habsburg, the original home of that great historical house. (W. A. B. C.)

AARD-VARK (meaning "earth-pig"), the Dutch name for the mammals of genus *Orycteropus*, confined to Africa (see EDENTATA). Several species have been named. Among them is the typical form, *O. capensis*, or Cape ant-bear from South Africa, and the northern aard-vark (*O. aethiopicus*) of north-eastern Africa, extending into Egypt. In form these animals are somewhat pig-like; the body is stout, with arched back; the limbs are short and stout, armed with strong, blunt claws; the ears disproportionately long; and the tail very thick at the base and tapering gradually. The greatly elongated head is set on a short thick neck, and at the extremity of the snout is a disk in which the nostrils open. The mouth is small and tubular, furnished with a long extensile tongue. The measurements of a female, taken in the flesh, were head and body 4 ft., tail 17½ in.; but a large individual measured 6 ft. 8 in. over all. In colour the Cape aard-vark is pale sandy or yellow, the hair being scanty and allowing the skin to show; the northern aard-vark has a still thinner coat, and is further distinguished by the shorter tail and longer head and ears. These animals are of nocturnal and burrowing habits, and generally to be found near ant-hills. The strong claws make a hole in the side of the ant-hill, and the insects are collected on the extensile tongue. Aard-varks are hunted for their skins; but the flesh is valued for food, and often salted and smoked.

AARD-WOLF (earth-wolf), a South and East African carnivorous mammal (*Proteles cristatus*), in general appearance like a small striped hyena, but with a more pointed muzzle, sharper ears, and a long erectile mane down the middle line of the neck and back. It is of nocturnal and burrowing habits, and feeds on decomposed animal substances, larvae and termites.

AARGAU (Fr. *Argovie*), one of the more northerly Swiss cantons, comprising the lower course of the river Aar (*q.v.*), whence its name. Its total area is 541·9 sq. m., of which 517·9 sq. m. are classed as "productive" (forests covering 172 sq. m. and vineyards 8·2 sq. m.). It is one of the least mountainous Swiss cantons, forming part of a great table-land, to the north of the Alps and the east of the Jura, above which rise low hills. The surface of the country is beautifully diversified, undulating tracts and well-wooded hills alternating with fertile valleys watered mainly by the Aar and its tributaries. It contains the famous hot sulphur springs of Baden (*q.v.*) and Schinznach, while at Rheinfelden there are very extensive saline springs. Just below Brugg the Reuss and the Limmat join the Aar, while around Brugg are the ruined castle of Habsburg, the old convent of Königsfelden (with fine painted medieval glass) and the remains of the Roman settlement of Vindonissa [Windisch]. The total population in 1900 was 206,498, almost exclusively German-speaking, but numbering 114,176 Protestants to 91,039 Romanists and 990 Jews. The capital of the canton is Aarau (*q.v.*), while other important towns are Baden (*q.v.*), Zofingen (4591 inhabitants), Reinach (3668 inhabitants), Rheinfelden (3349 inhabitants), Wohlen (3274 inhabitants), and Lenzburg (2588 inhabitants). Aargau is an industrious and prosperous canton, straw-plaiting, tobacco-growing, silk-ribbon weaving, and salmon-fishing in the Rhine being among the chief industries. As this region was, up to 1415, the centre of the Habsburg power, we find here many historical old castles (*e.g.* Habsburg, Lenzburg, Wildegg), and former monasteries (*e.g.* Wettingen, Muri), founded by that family, but suppressed in 1841, this act of violence being one of the main causes of the civil war called the "Sonderbund War," in 1847 in Switzerland. The cantonal constitution dates mainly from 1885, but since 1904 the election of the executive council of five members is made by a direct vote of the people. The legislature consists of members elected in the proportion of one to every 1100 inhabitants. The "obligatory referendum" exists in the case of all laws, while 5000 citizens have the right of "initiative" in proposing bills or alterations in the cantonal constitution. The canton sends 10 members to the federal *Nationalrat*, being one for every 20,000, while the two *Ständeräte* are (since 1904) elected by a direct vote of the people. The canton is divided into eleven administrative districts, and contains 241 communes.

In 1415 the Aargau region was taken from the Habsburgs by the Swiss Confederates. Bern kept the south-west portion (Zofingen, Aarburg, Aarau, Lenzburg, and Brugg), but some districts, named the *Freie Ämter* or "free bailiwicks" (Mellingen, Muri, Villmergen, and Bremgarten), with the county of Baden, were ruled as "subject lands" by all or certain of the Confederates. In 1798 the Bernese bit became the canton of Aargau of the Helvetic Republic, the remainder forming the canton of Baden. In 1803, the two halves (plus the Frick glen, ceded in 1802 by Austria to the Helvetic Republic) were united under the name of Kanton Aargau, which was then admitted a full member of the reconstituted Confederation.

See also *Argovia* (published by the Cantonal Historical Society), Aarau, from 1860; F. X. Bronner, *Der Kanton Aargau*, 2 vols., St Gall and Bern, 1844; H. Lehmann, *Die argauische Strohindustrie*, Aarau, 1896; W. Merz, *Die mittelalt. Burganlagen und Wehrbauten d. Kant. Argau* (fine illustrated work on castles), Aarau, 2 vols., 1904–1906; W. Merz and F. E. Welti, *Die Rechtsquellen d. Kant. Argau*, 3 vols., Aarau, 1898–1905; J. Müller, *Der Aargau*, 2 vols., Zürich, 1870; E. L. Rochholz, *Aargauer Weistkümer*, Aarau, 1877; E. Zschokke, *Geschichte des Aargaus*, Aarau, 1903. (W. A. B. C.)

AARHUS, a seaport and bishop's see of Denmark, on the east coast of Jutland, of which it is the principal port; the second largest town in the kingdom, and capital of the *amt* (county) of Aarhus. Pop. (1901) 51,814. The district is low-lying, fertile and well wooded. The town is the junction of railways from all parts of the country. The harbour is good and safe, and agricultural produce is exported, while coal and iron are among the chief imports. The cathedral of the 13th century (extensively restored) is the largest church in Denmark. There is a museum of art and antiquities. To the south-west (13 m. by rail), a picturesque region extends west from the railway junction of Skanderborg, including several lakes, through which flows the Gudenaa, the largest river in Jutland, and rising ground exceeding 500 ft. in the Himmelbjerg. The railway traverses this pleasant district of moorland and wood to Silkeborg, a modern town having one of the most attractive situations in the kingdom. The bishopric of Aarhus dates at least from 951.

AARON, the traditional founder and head of the Jewish priesthood, who, in company with Moses, led the Israelites out of Egypt (see EXODUS; MOSES). The greater part of his life-history is preserved in late Biblical narratives, which carry back existing conditions and beliefs to the time of the Exodus, and find a precedent for contemporary hierarchical institutions in the events of that period. Although Aaron was said to have been sent by Yahweh (Jehovah) to meet Moses at the "mount of God" (Horeb, Ex. iv. 27), he plays only a secondary part in the incidents at Pharaoh's court. After the "exodus" from Egypt a striking account is given of the vision of the God of Israel vouchsafed to him and to his sons Nadab and Abihu on the same holy mount (Ex. xxiv. 1 seq. 9-11), and together with Hur he was at the side of Moses when the latter, by means of his wonder-working rod, enabled Joshua to defeat the Amalekites (xvii. 8-16). Hur and Aaron were left in charge of the Israelites when Moses and Joshua ascended the mount to receive the Tables of the Law (xxiv. 12-15), and when the people, in dismay at the prolonged absence of their leader, demanded a god, it was at the instigation of Aaron that the golden calf was made (see CALF, GOLDEN). This was regarded as an act of apostasy which, according to one tradition, led to the consecration of the Levites, and almost cost Aaron his life (cp. Deut. ix. 20). The incident paves the way for the account of the preparation of the new tables of stone which contain a series of laws quite distinct from the Decalogue (*q.v.*) (Ex. xxxiii. seq.). Kadesh, and not Sinai or Horeb, appears to have been originally the scene of these incidents (Deut. xxxiii. 8 seq. compared with Ex. xxxii. 26 sqq.), and it was for some obscure offence at this place that both Aaron and Moses were prohibited from entering the Promised Land (Num. xx.). In what way they had not "sanctified" (an allusion in the Hebrew to *Kādēsh* "holy") Yahweh is quite uncertain, and it would appear that it was for a similar offence that the sons of Aaron mentioned above also met their death (Lev. x. 3; cp. Num. xx. 12, Deut. xxxii. 51). Aaron is said to have died at Moserah (Deut. x. 6), or at Mt. Hor; the latter is an unidentified site on the border of Edom (Num. xx. 23, xxxiii. 37; for Moserah see *ib.* 30-31), and consequently not in the neighbourhood of Petra, which has been the traditional scene from the time of Josephus (*Ant.* iv. 4. 7).

Several difficulties in the present Biblical text appear to have arisen from the attempt of later tradition to find a place for Aaron in certain incidents. In the account of the contention between Moses and his sister Miriam (Num. xii.), Aaron occupies only a secondary position, and it is very doubtful whether he was originally mentioned in the older surviving narratives. It is at least remarkable that he is only thrice mentioned in Deuteronomy (ix. 20, x. 6, xxxii. 50). The post-exilic narratives give him a greater share in the plagues of Egypt, represent him as high-priest, and confirm his position by the miraculous budding of his rod alone of all the rods of the other tribes (Num. xvii.; for parallels see Gray, *comm. ad loc.*, p. 217). The latter story illustrates the growth of the older exodus-tradition along with the development of priestly ritual: the old account of Korah's revolt against the authority of Moses has been expanded, and now describes (*a*) the divine prerogatives of the Levites in general, and (*b*) the confirmation of the superior privileges of the Aaronites against the rest of the Levites, a development which can scarcely be earlier than the time of Ezekiel (xliv. 15 seq.).

Aaron's son Eleazar was buried in an Ephraimite locality known after the grandson as the "hill of Phinehas" (Josh. xxiv. 33). Little historical information has been preserved of either. The name Phinehas (apparently of Egyptian origin) is better known as that of a son of Eli, a member of the priesthood of Shiloh, and Eleazar is only another form of Eliezer the son of Moses, to whose kin Eli is said to have belonged. The close relation between Aaronite and Levitical names and those of clans related to Moses is very noteworthy, and it is a curious coincidence that the name of Aaron's sister Miriam appears in a genealogy of Caleb (1 Chron. iv. 17) with Jether (cp. JETHRO) and Heber (cp. KENITES). In view of the confusion of the traditions and the difficulty of interpreting the details sketched above, the recovery of the *historical* Aaron is a work of peculiar intricacy. He may well have been the traditional head of the priesthood, and R. H. Kennett has argued in favour of the view that he was the founder of the cult at Bethel (*Journ. of Theol. Stud.*, 1905, pp. 161 sqq.), corresponding to the Mosaite founder of Dan (*q.v.*). This throws no light upon the *name*, which still remains quite obscure; and unless Aaron (*Aharon*) is based upon *Ārōn*, "ark" (Redslob, R. P. A. Dozy, J. P. N. Land), it must be placed in a line with the other un-Hebraic and difficult names associated with Moses and Aaron, which are, apparently, of South Palestinian (or North-Arabian) origin.

For the literature and a general account of the Jewish priesthood, see the articles LEVITES and PRIEST. (S. A. C.)

AARON'S ROD, the popular name given to various tall flowering plants ("hag taper," "golden rod," &c.). In architecture the term is given to an ornamental rod with sprouting leaves, or sometimes with a serpent entwined round it (from the Biblical references in Exodus vii. 10 and Numbers xvii. 8).

AARSSENS, or AARSSEN, **FRANCIS VAN** (1572–1641), a celebrated diplomatist and statesman of the United Provinces. His talents commended him to the notice of Advocate Johan van Oldenbarneveldt, who sent him, at the age of 26 years, as a diplomatic agent of the states-general to the court of France. He took a considerable part in the negotiations of the twelve years' truce in 1606. His conduct of affairs having displeased the French king, he was recalled from his post by Oldenbarneveldt in 1616. Such was the hatred he henceforth conceived against his former benefactor, that he did his very utmost to effect his ruin. He was one of the packed court of judges who in 1619 condemned the aged statesman to death. For his share in this judicial murder a deep stain rests on the memory of Aarssens. He afterwards became the confidential counsellor of Maurice, prince of Orange, and afterwards of Frederick Henry, prince of Orange, in their conduct of the foreign affairs of the republic. He was sent on special embassies to Venice, Germany and England, and displayed so much diplomatic skill and finesse that Richelieu ranked him among the three greatest politicians of his time.

AASEN, IVAR (1813–1896), Norwegian philologist and lexicographer, was born at Aasen i Örsten, in Söndmöre, Norway, on the 5th of August 1813. His father, a small peasant-farmer named Ivar Jonssön, died in 1826. He was brought up to farm-work, but he assiduously cultivated all his leisure in reading, and when he was eighteen he opened an elementary school in his native parish. In 1833 he entered the household of H. C. Thoresen, the husband of the eminent writer Magdalene Thoresen, in Herö, and here he picked up the elements of Latin. Gradually, and by dint of infinite patience and concentration, the young peasant became master of many languages, and began the scientific study of their structure. About 1841 he had freed himself from all the burden of manual labour, and could occupy his thoughts with the dialect of his native district, the Söndmöre; his first publication was a small collection of folk-songs in the Söndmöre language (1843). His remarkable abilities now attracted general attention, and he was helped to continue his studies undisturbed. His *Grammar of the Norwegian Dialects* (1848) was the result of much labour, and of journeys taken to every part of the country. Aasen's famous *Dictionary of the Norwegian Dialects* appeared in its original form in 1850, and from this publication dates all the wide cultivation of the popular language in Norwegian, since Aasen really did no less than construct, out of the different materials at his disposal, a popular language or definite *folke-maal* for Norway. With certain modifications, the most important of which were introduced later by Aasen himself, this artificial language is that which has been adopted ever since by those who write in dialect, and which later enthusiasts have once more endeavoured to foist upon Norway as her official language in the place of Dano-Norwegian. Aasen composed poems and plays in the composite dialect to show how it should be used; one of these dramas, *The Heir* (1855) was frequently acted, and may be considered as the pioneer of all the abundant dialect-literature of the last half-century, from Vinje down to Garborg. Aasen continued to enlarge and improve his grammars and his dictionary. He lived very quietly in lodgings in Christiania, surrounded by his books and shrinking from publicity, but his name grew into wide political favour as his ideas about the language of the peasants became more and more the watchword of the popular party. Quite early in his career, 1842, he had begun to receive a stipend to enable him to give his entire attention to his philological investigations; and the Storthing—conscious of the national importance of his work—treated him in this respect with more and more generosity as he advanced in years. He continued his investigations to the last, but it may be said that, after the 1873 edition of his *Dictionary*, he added but little to his stores. Ivar Aasen holds perhaps an isolated place in literary history as the one man who has invented, or at least selected and constructed, a language which has pleased so many thousands of his countrymen that they have accepted it for their schools, their sermons and their songs. He died in Christiania on the 23rd of September 1896, and was buried with public honours. (E. G.)

AB, the fifth month of the ecclesiastical and the eleventh of the civil year of the Jews. It approximately corresponds to the period of the 15th of July to the 15th of August. The word is of Babylonian origin, adopted by the Jews with other calendar names after the Babylonian exile. Tradition ascribes the death of Aaron to the first day of Ab. On the ninth is kept the Fast of Ab, or the Black Fast, to bewail the destruction of the first temple by Nebuchadrezzar (586 B.C.) and of the second by Titus (A.D. 70).

ABA. (1) A form of altazimuth instrument, invented by, and called after, Antoine d'Abbadie; (2) a rough homespun manufactured in Bulgaria; (3) a long coarse shirt worn by the Bedouin Arabs.

ABĀBDA (the Gebadei of Pliny, probably the Troglodytes of classical writers), a nomad tribe of African "Arabs" of Hamitic origin. They extend from the Nile at Assuan to the Red Sea, and reach northward to the Kena-Kosseir road, thus occupying the southern border of Egypt east of the Nile. They call themselves "sons of the Jinns." With some of the clans of the Bisharin (*q.v.*) and possibly the Hadendoa (*q.v.*) they represent the Blemmyes of classic geographers, and their location to-day is almost identical with that assigned them in Roman times. They were constantly at war with the Romans, who at last subsidized them. In the middle ages they were known as Beja (*q.v.*), and convoyed pilgrims from the Nile valley to Aidhab, the port of embarkation for Jedda. From time immemorial they have acted as guides to caravans through the Nubian desert and up the Nile valley as far as Sennar. To-day many of them are employed in the telegraph service across the Arabian desert. They intermarried with the Nuba, and settled in small colonies at Shendi and elsewhere long before the Egyptian invasion (A.D. 1820–1822). They are still great trade carriers, and visit very distant districts. The Abābda of Egypt, numbering some 30,000, are governed by an hereditary "chief." Although nominally a vassal of the Khedive he pays no tribute. Indeed he is paid a subsidy, a portion of the road-dues, in return for his safeguarding travellers from Bedouin robbers. The sub-sheikhs are directly responsible to him. The Abābda of Nubia, reported by Joseph von Russegger, who visited the country in 1836, to number some 40,000, have since diminished, having probably amalgamated with the Bisharin, their hereditary enemies when they were themselves a powerful nation. The Abābda generally speak Arabic (mingled with Barabra [Nubian] words), the result of their long-continued contact wth Egypt; but the southern and south-eastern portion of the tribe in many cases still retain their Beja dialect, To-Bedawiet. Those of Kosseir will not speak this before strangers, as they believe that to reveal the mysterious dialect would bring ruin on them. Those nearest the Nile have much fellah blood in them. As a tribe they claim an Arab origin, apparently through their sheikhs. They have adopted the dress and habits of the fellahin, unlike their kinsmen the Bisharin and Hadendoa, who go practically naked. They are neither so fierce nor of so fine a physique as these latter. They are lithe and well built, but small: the average height is little more than 5 ft., except in the sheikh clan, who are obviously of Arab origin. Their complexion is more red than black, their features angular, noses straight and hair luxuriant. They bear the character of being treacherous and faithless, being bound by no oath, but they appear to be honest in money matters and hospitable, and, however poor, never beg. Formerly very poor, the Abābda became wealthy after the British occupation of Egypt. Their chief settlements are in Nubia, where they live in villages and employ themselves in agriculture. Others of them fish in the Red Sea and then hawk the salt fish in the interior. Others are pedlars, while charcoal-burning, wood-gathering and trading in gums and drugs, especially in senna leaves, occupy many. Unlike the true Arab, the Abābda do not live in tents, but build huts with hurdles and mats, or live in natural caves, as did their ancestors in classic times. They have few horses, using the camel as beast of burden or their "mount" in war. They live chiefly on milk and durra, the latter eaten either raw or roasted. They are very superstitious, believing, for example, that evil would overtake a family if a girl member should, after her marriage, ever set eyes on her mother: hence the Abābda husband has to make his home far from his wife's village. In the Mahdist troubles (1882–1898) many "friendlies" were recruited from the tribe.

For their earlier history see BEJA; see also BISHARIN, HADENDOA, KABBABISH; and the following authorities:—Sir F. R. Wingate, *Mahdism and the Egyptian Sudan* (Lond. 1891); Giuseppe Sergi, *Africa: Antropologia della Stirpe Camitica* (Turin, 1897); A. H. Keane, *Ethnology of Egyptian Sudan* (Lond. 1884); *Anglo-Egyptian Sudan*, edited by Count Gleichen (Lond. 1905); Joseph von Russegger, *Die Reisen in Afrika* (Stuttgart, 1841–1850). (T. A. J.)

ABACA, or ABAKA, a native name for the plant *Musa textilis*, which produces the fibre called Manila Hemp (*q.v.*).

ABACUS (Gr. *ἄβαξ*, a slab; Fr. *abaque, tailloir*), in architecture, the upper member of the capital of a column. Its chief function is to provide a larger supporting surface for the architrave or arch it has to carry. In the Greek Doric order the abacus is a plain square slab. In the Roman and Renaissance Doric orders it is crowned by a moulding. In the Archaic-Greek Ionic order, owing to the greater width of the capital, the abacus is rectangular in plan, and consists of a carved ovolo moulding. In later examples the abacus is square, except where there are angle volutes, when it is slightly curved over the same. In the Roman and Renaissance Ionic capital, the abacus is square with a fillet on the top of an ogee moulding, but curved over angle volutes. In the Greek Corinthian order the abacus is moulded, its sides are concave and its angles canted (except in one or two exceptional Greek capitals, where it is brought to a sharp angle); and the same shape is adopted in the Roman and Renaissance Corinthian and Composite capitals, in some cases with the ovolo moulding carved. In Romanesque architecture the abacus is square with the lower edge splayed off and moulded or carved, and the same was retained in France during the medieval period; but in England, in Early English work, a circular deeply moulded abacus was introduced, which in the 14th and 15th centuries was transformed into an octagonal one. The diminutive of Abacus, ABACISCUS, is applied in architecture to the chequers or squares of a tessellated pavement. "Abacus" is also the name of an instrument employed by the ancients for arithmetical calculations; pebbles, bits of bone or coins being used as counters. Fig. 1 shows a Roman abacus taken

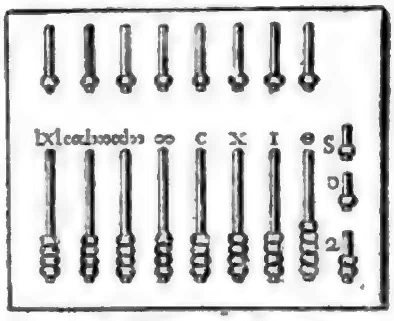


FIG. 1.—Roman Abacus.

from an ancient monument. It contains seven long and seven shorter rods or bars, the former having four perforated beads running on them and the latter one. The bar marked I indicates units, X tens, and so on up to millions. The beads on the shorter bars denote fives,—five units, five tens, &c. The rod Θ and corresponding short rod are for marking ounces; and the short quarter rods for fractions of an ounce.

The *Swan-Pan* of the Chinese (fig. 2) closely resembles the Roman abacus in its construction and use. Computations are made with it by means of balls of bone or ivory running on slender bamboo rods, similar to the simpler board, fitted up with beads strung on wires, which is employed in teaching the rudiments of arithmetic in English schools.

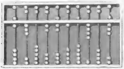


Fig. 2.—Chinese Swan-Pan.

The name of "abacus" is also given, in logic, to an instrument, often called the "logical machine," analogous to the mathematical abacus. It is constructed to show all the possible combinations of a set of logical terms with their negatives, and, further, the way in which these combinations are affected by the addition of attributes or other limiting words, *i.e.* to simplify mechanically the solution of logical problems. These instruments are all more or less elaborate developments of the "logical slate," on which were written in vertical columns all the combinations of symbols or letters which could be made logically out of a definite number of terms. These were compared with any given premises, and those which were incompatible were crossed off. In the abacus the combinations are inscribed each on a single slip of wood or similar substance, which is moved by a key; incompatible combinations can thus be mechanically removed at will, in accordance with any given series of premises. The principal examples of such machines are those of W. S. Jevons (*Element. Lessons in Logic*, c. xxiii.), John Venn (see his *Symbolic Logic*, 2nd ed., 1894, p. 135), and Allan Marquand (see *American Academy of Arts and Sciences*, 1885, pp. 303–7, and *Johns Hopkins University Studies in Logic*, 1883).

ABADDON, a Hebrew word meaning "destruction." In poetry it comes to mean "place of destruction," and so the underworld or Sheol (cf. Job xxvi. 6; Prov. xv. 11). In Rev. ix. 11 Abaddon (*'Αβαδδών*) is used of hell personified, the prince of the underworld. The term is here explained as Apollyon (*q.v.*), the "destroyer." W. Baudissin (Herzog-Hauck, *Realencyklopädie*) notes that Hades and Abaddon in Rabbinic writings are employed as personal names, just as *shemayya* in Dan. iv. 23, *shāmayim* ("heaven"), and *mākōm* ("place") among the Rabbins, are used of God.

ABADEH, a small walled town of Persia, in the province of Fars, situated at an elevation of 6200 ft. in a fertile plain on the high road between Isfahan and Shiraz, 140 m. from the former and 170 m. from the latter place. Pop. 4000. It is the chief place of the Abadeh-Iklid district, which has 30 villages; it has telegraph and post offices, and is famed for its carved wood-work, small boxes, trays, sherbet spoons, &c., made of the wood of pear and box trees.

ABAE ("Αβαι), a town in the N.E. corner of Phocis, in Greece, famous in early times for its oracle of Apollo, one of those consulted by Croesus (Herod. i. 46). It was rich in treasures (Herod. viii. 33), but was sacked by the Persians, and the temple remained in a ruined state. The oracle was, however, still consulted, *e.g.* by the Thebans before Leuctra (Paus. iv. 32. 5). The temple seems to have been burnt again during the Sacred War, and was in a very dilapidated state when seen by Pausanias (x. 35), though some restoration, as well as the building of a new temple, was undertaken by Hadrian. The sanctity of the shrine ensured certain privileges to the people of Abae (*Bull. Corresp. Hell.* vi. 171), and these were confirmed by the Romans. The polygonal walls of the acropolis may still be seen in a fair state of preservation on a circular hill standing about 500 ft. above the little plain of Exarcho; one gateway remains, and there are also traces of town walls below. The temple site was on a low spur of the hill, below the town. An early terrace wall supports a precinct in which are a stoa and some remains of temples; these were excavated by the British School at Athens in 1894, but very little was found.

See also W. M. Leake, *Travels in Northern Greece*, ii. p. 163; *Journal of Hellenic Studies*, xvi. pp. 291-312 (V. W. Yorke).

(E. Gr.)

ABAKANSK, a fortified town of Siberia, in the Russian government of Yeniseisk, on the river Yenisei, 144 m. S.S.W. of Krasnoyarsk, in lat. 54°20′ N., long. 91°40′ E. This is considered the mildest and most salubrious place in Siberia, and is remarkable for certain tumuli (of the Li Kitai) and statues of men from seven to nine feet high, covered with hieroglyphics. Peter the Great had a fort built here in 1707. Pop. 2000.

ABALONE, the Spanish name used in California for various species of the shell-fish of the Haliotidae family, with a richly coloured shell yielding mother-of-pearl. This sort of Haliotis is also commonly called "ear-shell," and in Guernsey "ormer" (Fr. *ormier*, for *oreille de mer*). The abalone shell is found especially at Santa Barbara and other places on the southern Californian coast, and when polished makes a beautiful ornament. The mollusc itself is often eaten, and dried for consumption in China and Japan.

ABANA (or Amanah, classical *Chrysorrhoas*) and **PHARPAR**, the "rivers of Damascus" (2 Kings v. 12), now generally identified with the Barada (*i.e.* "cold") and the A'waj (*i.e.* "crooked") respectively, though if the reference to Damascus be limited to the city, as in the Arabic version of the Old Testament, Pharpar would be the modern Taura. Both streams run from west to east across the plain of Damascus, which owes to them much of its fertility, and lose themselves in marshes, or lakes, as they are called, on the borders of the great Arabian desert. John M'Gregor, who gives an interesting description of them in his *Rob Roy on the Jordan*, affirmed that as a work of hydraulic engineering, the system and construction of the canals, by which the Abana and Pharpar were used for irrigation, might be considered as one of the most complete and extensive in the world. As the Barada escapes from the mountains through a narrow gorge, its waters spread out fan-like, in canals or "rivers," the name of one of which, Nahr Banias, retains a trace of Abana.

ABANCOURT, CHARLES XAVIER JOSEPH DE FRANQUEVILLE D' (1758–1792), French statesman, and nephew of Calonne. He was Louis XVI.'s last minister of war (July 1792), and organized the defence of the Tuileries for the 10th of August. Commanded by the Legislative Assembly to send away the Swiss guards, he refused, and was arrested for treason to the nation and sent to Orleans to be tried. At the end of August the Assembly ordered Abancourt and the other prisoners at Orleans to be transferred to Paris with an escort commanded by Claude Fournier, "the American." At Versailles they learned of the massacres at Paris, and Abancourt and his fellow-prisoners were murdered in cold blood on the 8th of September 1792. Fournier was unjustly charged with complicity in the crime.

ABANDONMENT (Fr. *abandonnement*, from *abandonner*, to abandon, relinquish; *abandonner* was originally equivalent to *mettre à bandon*, to leave to the jurisdiction, *i.e.* of another, *bandon* being from Low Latin *bandum*, *bannum*, order, decree, "ban"), in law, the relinquishment of an interest, claim, privilege or possession. Its signification varies according to the branch of the law in which it is employed, but the more important uses of the word are summarized below.

Abandonment of an Action is the discontinuance of proceedings commenced in the High Court of Justice either because the plaintiff is convinced that he will not succeed in his action or for other reasons. Previous to the Judicature Act of 1875, considerable latitude was allowed as to the time when a suitor might abandon his action, and yet preserve his right to bring another action on the same suit (see Nonsuit); but since 1875 this right has been considerably curtailed, and a plaintiff who has delivered his reply (see Pleading), and afterwards wishes to abandon his action, can generally obtain leave so to do only on condition of bringing no further proceedings in the matter.

Abandonment in marine insurance is the surrender of the ship or goods insured to the insurers, in the case of a constructive total loss of the thing insured. For the requisites and effects of abandonment in this sense see Insurance, Marine.

Abandonment of wife and children is dealt with under Desertion, and the *abandonment or exposure* of a young child under the age of two, which is an indictable misdemeanour, is dealt with under Children, Cruelty to.

Abandonment of domicile is the ceasing to reside permanently in a former domicile coupled with the intention of choosing a new domicile. The presumptions which will guide the court in deciding whether a former domicile has been abandoned or not must be inferred from the facts of each individual case. See Domicile.

Abandonment of an easement is the relinquishment of some accommodation or right in another's land, such as right of way, free access of light and air, &c. See Easement.

Abandonment of railways has a legal signification in England recognized by statute, by authority of which the Board of Trade may, under certain circumstances, grant a warrant to a railway authorizing the abandonment of its line or part of it.

ABANO, PIETRO D' (1250–1316), known also as Petrus de Apono or Aponensis, Italian physician and philosopher, was born at the Italian town from which he takes his name in 1250, or, according to others, in 1246. After studying medicine and philosophy at Paris he settled at Padua, where he speedily gained a great reputation as a physician, and availed himself of it to gratify his avarice by refusing to visit patients except for an exorbitant fee. Perhaps this, as well as his meddling with astrology, caused him to be charged with practising magic, the particular accusations being that he brought back into his purse, by the aid of the devil, all the money he paid away, and that he possessed the philosopher's stone. He was twice brought to trial by the Inquisition; on the first occasion he was acquitted, and he died (1316) before the second trial was completed. He was found guilty, however, and his body was ordered to be exhumed and burned; but a friend had secretly removed it, and the Inquisition had, therefore, to content itself with the public proclamation of its sentence and the burning of Abano in effigy. In his writings he expounds and advocates the medical and philosophical systems of Averroes and other Arabian writers. His best known works are the *Conciliator differentiarum quae inter philosophos et medicos versantur* (Mantua, 1472; Venice, 1476), and *De venenis eorumque remediis* (1472), of which a French translation was published at Lyons in 1593.

ABANO BAGNI, a town of Venetia, Italy, in the province of Padua, on the E. slope of the Monti Euganei; it is 6 m. S.W. by rail from Padua. Pop. (1901) 4556. Its hot springs and mud baths are much resorted to, and were known to the Romans as *Aponi fons* or *Aquae Patavinae*. Some remains of the ancient baths have been discovered (S. Mandruzzato, *Trattato dei Bagni d' Abano*, Padua, 1789). An oracle of Geryon lay near, and the so-called *sortes Praenestinae* (*C.I.L.* i., Berlin, 1863; 1438–1454), small bronze cylinders inscribed, and used as oracles, were perhaps found here in the 16th century.

ABARIS, a Scythian or Hyperborean, priest and prophet of Apollo, who is said to have visited Greece about 770 B.C., or two or three centuries later. According to the legend, he travelled throughout the country, living without food and riding on a golden arrow, the gift of the god; he healed the sick, foretold the future, worked miracles, and delivered Sparta from a plague (Herod. iv. 36; Iamblichus, *De Vit. Pythag.* xix. 28). Suidas credits him with several works: Scythian oracles, the visit of Apollo to the Hyperboreans, expiatory formulas and a prose theogony.

ABATED, an ancient technical term applied in masonry and metal work to those portions which are sunk beneath the surface, as in inscriptions where the ground is sunk round the letters so as to leave the letters or ornament in relief.

ABATEMENT (derived through the French *abattre*, from the Late Latin *battere*, to beat), a beating down or diminishing or doing away with; a term used especially in various legal phrases.

Abatement of a nuisance is the remedy allowed by law to a person or public authority injured by a public nuisance of destroying or removing it, provided no breach of the peace is committed in doing so. In the case of private nuisances abatement is also allowed provided there be no breach of the peace, and no damage be occasioned beyond what the removal of the nuisance requires. (See Nuisance.)

Abatement of freehold takes place where, after the death of the person last seised, a stranger enters upon lands before the entry of the heir or devisee, and keeps the latter out of possession. It differs from intrusion, which is a similar entry by a stranger on the death of a tenant for life, to the prejudice of the reversioner, or remainder man; and from disseisin, which is the forcible or fraudulent expulsion of a person seised of the freehold. (See Freehold.)

Abatement of debts and legacies. When the equitable assets (see Assets) of a deceased person are not sufficient to satisfy fully all the creditors, their debts must abate proportionately, and they must accept a dividend. Also, in the case of legacies when the funds or assets out of which they are payable are not sufficient to pay them in full, the legacies abate in proportion, unless there is a priority given specially to any particular legacy (see Legacy). Annuities are also subject to the same rule as general legacies.

Abatement in pleading, or plea in abatement, was the defeating or quashing of a particular action by some matter of fact, such as a defect in form or the personal incompetency of the parties suing, pleaded by the defendant. It did not involve the merits of the cause, but left the right of action subsisting. In criminal proceedings a plea in abatement was at one time a common practice in answer to an indictment, and was set up for the purpose of defeating the indictment as framed, by alleging misnomer or other misdescription of the defendant. Its effect for this purpose was nullified by the Criminal Law Act 1826, which required the court to amend according to the truth, and the Criminal Procedure Act 1851, which rendered description of the defendant unnecessary. All pleas in abatement are now abolished (R.S.C. Order 21, r. 20). See Pleading.

Abatement in litigation. In civil proceedings, no action abates by reason of the marriage, death or bankruptcy of any of the parties, if the cause of action survives or continues, and does not become defective by the assignment, creation or devolution of any estate or title *pendente lite* (R.S.C. Order 17, r. 1). Criminal proceedings do not abate on the death of the prosecutor, being in theory instituted by the crown, but the crown itself may bring about their termination without any decision on the merits and without the assent of the prosecutor.

Abatement of false lights. By the Merchant Shipping Act 1854, the general lighthouse authority (see Lighthouse) has power to order the extinguishment or screening of any light which may be mistaken for a light proceeding from a lighthouse.

Abatement in commerce is a deduction sometimes made at a custom-house from the fixed duties on certain kinds of goods, on account of damage or loss sustained in warehouses. The rate and conditions of such deductions are regulated, in England, by the Customs Consolidation Act 1853. (See also Drawback; Rebate.)

Abatement in heraldry is a badge in coat-armour, indicating some kind of degradation or dishonour. It is called also *rebatement*.

ABATI, or Dell' Abbato, **NICCOLO** (1512–1571), a celebrated fresco-painter of Modena, whose best works are there and at Bologna. He accompanied Primaticcio to France, and assisted in decorating the palace at Fontainebleau (1552–1571). His pictures exhibit a combination of skill in drawing, grace and natural colouring. Some of his easel pieces in oil are in different collections; one of the finest, in the Dresden Gallery, represents the martyrdom of St Peter and St Paul.

ABATIS, Abattis or Abbattis (a French word meaning a heap of material thrown), a term in field fortification for an obstacle formed of the branches of trees laid in a row, with the tops directed towards the enemy and interlaced or tied with wire. The abatis is used alone or in combination with wire-entanglements and other obstacles.

ABATTOIR (from *abattre*, to strike down), a French word often employed in English as an equivalent of "slaughter-house" (*q.v.*), the place where animals intended for food are killed.

ABAUZIT, FIRMIN (1679–1767), a learned Frenchman, was born of Protestant parents at Uzès, in Languedoc. His father died when he was but two years of age; and when, on the revocation of the edict of Nantes in 1685, the authorities took steps to have him educated in the Roman Catholic faith, his mother contrived his escape. For two years his brother and he lived as fugitives in the mountains of the Cevennes, but they at last reached Geneva, where their mother afterwards joined them on escaping from the imprisonment in which she was held from the time of their flight. Abauzit at an early age acquired great proficiency in languages, physics and theology. In 1698 he went to Holland, and there became acquainted with Pierre Bayle, P. Jurieu and J. Basnage. Proceeding to England, he was introduced to Sir Isaac Newton, who found in him one of the earliest defenders of his discoveries. Sir Isaac corrected in the second edition of his *Principia* an error pointed out by Abauzit, and, when sending him the *Commercium Epistolicum*, said, "You are well worthy to judge between Leibnitz and me." The reputation of Abauzit induced William III. to request him to settle in England, but he did not accept the king's offer, preferring to return to Geneva. There from 1715 he rendered valuable assistance to a society that had been formed for translating the New Testament into French. He declined the offer of the chair of philosophy in the university in 1723, but accepted, in 1727, the sinecure office of librarian to the city of his adoption. Here he died at a good old age, in 1767. Abauzit was a man of great learning and of wonderful versatility. Whatever chanced to be discussed, it used to be said of Abauzit, as of Professor W. Whewell of more modern times, that he seemed to have made it a subject of particular study. Rousseau, who was jealously sparing of his praises, addressed to him, in his *Nouvelle Héloïse*, a fine panegyric; and when a stranger flatteringly told Voltaire he had come to see a great man, the philosopher asked him if he had seen Abauzit. Little remains of the labours of this intellectual giant, his heirs having, it is said, destroyed the papers that came into their possession, because their own religious opinions were different. A few theological, archaeological and astronomical articles from his pen appeared in the *Journal Helvétique* and elsewhere, and he contributed several papers to Rousseau's *Dictionnaire de musique* (1767). He wrote a work throwing doubt on the canonical authority of the Apocalypse, which called forth a reply from Dr Leonard Twells. He also edited and made valuable additions to J. Spon's *Histoire de la république de Genève*. A collection of his writings was published at Geneva in 1770 (*Œuvres de feu M. Abauzit*), and another at London in 1773 (*Œuvres diverses de M. Abauzit*). Some of them were translated into English by Dr Edward Harwood (1774).

Information regarding Abauzit will be found in J. Senebier's *Histoire Littéraire de Genève*, Harwood's *Miscellanies*, and W. Orme's *Bibliotheca Biblica* (1824).

'ABAYE, the name of a Babylonian *'amora* (*q.v.*), born in the middle of the 3rd century. He died in 339.

'ABBA 'ARIKA, the name of the Babylonian *'amora* (*q.v.*) of the 3rd century, who established at Sura the systematic study of the Rabbinic traditions which, using the Mishnah as text, led to the compilation of the Talmud. He is commonly known as Rab.

ABBADIDES, a Mahommedan dynasty which arose in Spain on the downfall of the western caliphate. It lasted from about 1023 till 1091, but during the short period of its existence was singularly active and typical of its time. The founder of the house was Abd-ul-Qāsim Mahommed, the cadi of Seville in 1023. He was the chief of an Arab family settled in the city from the first days of the conquest. The Beni-abbad were not of ancient descent, though the poets, whom they paid largely, made an illustrious pedigree for them when they had become powerful. They were, however, very rich. Abd-ul-Qāsim gained the confidence of the townsmen by organizing a successful resistance to the Berber soldiers of fortune who were grasping at the fragments of the caliphate. At first he professed to rule only with the advice of a council formed of the nobles, but when his power became established he dispensed with this show of republican government, and then gave himself the appearance of a legitimate title by protecting an impostor who professed to be the caliph Hisham II. When Abd-ul-Qāsim died in 1042 he had created a state which, though weak in itself, was strong as compared to the little powers about it. He had made his family the recognized leaders of the Mahommedans of Arab and native Spanish descent against the Berber element, whose chief was the king of Granada. Abbad, surnamed El Motaḍḍid, his son and successor, is one of the most remarkable figures in Spanish Mahommedan history. He had a striking resemblance to the Italian princes of the later middle ages and the early renaissance, of the stamp of Filipo Maria Visconti. El Motaḍḍid was a poet and a lover of letters, who was also a poisoner, a drinker of wine, a sceptic and treacherous to the utmost degree. Though he waged war all through his reign he very rarely appeared in the field, but directed the generals, whom he never trusted, from his "lair" in the fortified palace, the Alcazar of Seville. He killed with his own hand one of his sons who had rebelled against him. On one occasion he trapped a number of his enemies, the Berber chiefs of the Ronda, into visiting him, and got rid of them by smothering them in the hot room of a bath. It was his taste to preserve the skulls of the enemies he had killed—those of the meaner men to be used as flower-pots, while those of the princes were kept in special chests. His reign until his death on the 28th of February 1069 was mainly spent in extending his power at the expense of his smaller neighbours, and in conflicts with his chief rival the king of Granada. These incessant wars weakened the Mahommedans, to the great advantage of the rising power of the Christian kings of Leon and Castile, but they gave the kingdom of Seville a certain superiority over the other little states. After 1063 he was assailed by Fernando El Magno of Castile and Leon, who marched to the gates of Seville, and forced him to pay tribute. His son, Mahommed Abd-ul-Qāsim Abenebet—who reigned by the title of El Motamid—was the third and last of the Abbadides. He was a no less remarkable person than his father and much more amiable. Like him he was a poet, and a favourer of poets. El Motamid went, however, considerably further in patronage of literature than his father, for he chose as his favourite and prime minister the poet Ibn Ammar. In the end the vanity and featherheadedness of Ibn Ammar drove his master to kill him. El Motamid was even more influenced by his favourite wife, Romaica, than by his vizir. He had met her paddling in the Guadalquivir, purchased her from her master, and made her his wife. The caprices of Romaica, and the lavish extravagance of Motamid in his efforts to please her, form the subject of many stories. In politics he carried on the feuds of his family with the Berbers, and in his efforts to extend his dominions could be as faithless as his father. His wars and his extravagance exhausted his treasury, and he oppressed his subjects by taxes. In 1080 he brought down upon himself the vengeance of Alphonso VI. of Castile by a typical piece of flighty oriental barbarity. He had endeavoured to pay part of his tribute to the Christian king with false money. The fraud was detected by a Jew, who was one of the envoys of Alphonso. El Motamid, in a moment of folly and rage, crucified the Jew and imprisoned the Christian members of the mission. Alphonso retaliated by a destructive raid. When Alphonso took Toledo in 1085, El Motamid called in Yusef ibn Tashfin, the Almoravide (see SPAIN, *History*, and ALMORAVIDES). During the six years which preceded his deposition in 1091, El Motamid behaved with valour on the field, but with much meanness and political folly. He endeavoured to curry favour with Yusef by betraying the other Mahommedan princes to him, and intrigued to secure the alliance of Alphonso against the Almoravide. It was probably during this period that he surrendered his beautiful daughter Zaida to the Christian king, who made her his concubine, and is said by some authorities to have married her after she bore him a son, Sancho. The vacillations and submissions of El Motamid did not save him from the fate which overtook his fellow-princes. Their scepticism and extortion had tired their subjects, and the mullahs gave Yusef a "fetva" authorizing him to remove them in the interest of religion. In 1091 the Almoravides stormed Seville. El Motamid, who had fought bravely, was weak enough to order his sons to surrender the fortresses they still held, in order to save his own life. He died in prison in Africa in 1095.

AUTHORITIES.—Dozy, *Histoire des Musulmans d'Espagne*, Leiden, 1861; and *Historia Abbadidarum* (Scriptorum Arabum loci de Abbadidio), Leiden, 1846. (D. H.)

ABBADIE, ANTOINE THOMSON D' (1810–1897), and **ARNAUD MICHEL D'** (1815–1893), two brothers notable for their travels in Abyssinia during the first half of the 19th century. They were both born in Dublin, of a French father and an Irish mother, Antoine in 1810 and Arnaud in 1815. The parents removed to France in 1818, and there the brothers received a careful scientific education. In 1835 the French Academy sent Antoine on a scientific mission to Brazil, the results being published at a later date (1873) under the title of *Observations relatives à la physique du globe faites au Brésil et en Éthiopie*. The younger Abbadie spent some time in Algeria before, in 1837, the two brothers started for Abyssinia, landing at Massawa in February 1838. They visited various parts of Abyssinia, including the then little-known districts of Ennarea and Kaffa, sometimes together and sometimes separately. They met with many difficulties and many adventures, and became involved in political intrigues, Antoine especially exercising such influence as he possessed in favour of France and the Roman Catholic missionaries. After collecting much valuable information concerning the geography, geology, archaeology and natural history of Abyssinia, the brothers returned to France in 1848 and began to prepare their materials for publication. The younger brother, Arnaud, paid another visit to Abyssinia in 1853. The more distinguished brother, Antoine, became involved in various controversies relating both to his geographical results and his political intrigues. He was especially attacked by C. T. Beke, who impugned his veracity, especially with reference to the journey to Kaffa. But time and the investigations of subsequent explorers have shown that Abbadie was quite trustworthy as to his facts, though wrong in his contention—hotly contested by Beke—that the Blue Nile was the main stream. The topographical results of his explorations were published in Paris in 1860–1873 in *Géodésie d'Éthiopie*, full of the most valuable information and illustrated by ten maps. Of the *Géographie de l'Éthiopie* (Paris, 1890) only one volume has been published. In *Un Catalogue raisonné de manuscrits éthiopiens* (Paris, 1859) is a description of 234 Ethiopian manuscripts collected by Antoine. He also compiled various vocabularies, including a *Dictionnaire de la langue amarinna* (Paris, 1881), and prepared an edition of the *Shepherd of Hermas*, with the Latin version, in 1860. He published numerous papers dealing with the geography of Abyssinia, Ethiopian coins and ancient inscriptions. Under the title of *Reconnaissances magnétiques* he published in 1890 an account of the magnetic observations made by him in the course of several journeys to the Red Sea and the Levant. The general account of the travels of the two brothers was published by Arnaud in 1868 under the title of *Douze ans dans la Haute-Éthiopie*. Both brothers received the grand medal of the Paris Geographical Society in 1850. Antoine was a knight of the Legion of Honour and a member of the Academy of Sciences. He died in 1897, and bequeathed an estate in the Pyrenees, yielding 40,000 francs a year, to the Academy of Sciences, on condition of its producing within fifty years a catalogue of half-a-million stars. His brother Arnaud died in 1893. (J. S. K.)

ABBADIE, JAKOB (1654?–1727), Swiss Protestant divine, was born at Nay in Bern. He studied at Sedan, Saumur and Puylaurens, with such success that he received the degree of doctor in theology at the age of seventeen. After spending some years in Berlin as minister of a French Protestant church, where he had great success as a preacher, he accompanied Marshal Schomberg, in 1688, to England, and next year became minister of the French church in the Savoy, London. His strong attachment to the cause of King William appears in his elaborate defence of the Revolution (*Défense de la nation britannique*, 1692) as well as in his history of the conspiracy of 1696 (*Histoire de la grande conspiration d'Angleterre*). The king promoted him to the deanery of Killaloe in Ireland. He died in London in 1727. Abbadie was a man of great ability and an eloquent preacher, but is best known by his religious treatises, several of which were translated from the original French into other languages and had a wide circulation throughout Europe. The most important of these are *Traité de la vérité de la religion chrétienne* (1684); its continuation, *Traité de la divinité de Jésus-Christ* (1689); and *L'Art de se connaître soi-même* (1692).

'ABBAHU, the name of a Palestinian *'amora* (*q.v.*) who flourished *c.* 279–320. 'Abbahu encouraged the study of Greek by Jews. He was famous as a collector of traditional lore, and is very often cited in the Talmud.

ABBA MARI (in full, Abba Mari ben Moses ben Joseph), French rabbi, was born at Lunel, near Montpellier, towards the end of the 13th century. He is also known as Yarhi from his birthplace (Heb. Yerah, *i.e.* moon, *lune*), and he further took the name Astruc, Don Astruc or En Astruc of Lunel. The descendant of men learned in rabbinic lore, Abba Mari devoted himself to the study of theology and philosophy, and made himself acquainted with the writing of Moses Maimonides and Nachmanides as well as with the Talmud. In Montpellier, where he lived from 1303 to 1306, he was much distressed by the prevalence of Aristotelian rationalism, which, through the medium of the works of Maimonides, threatened the authority of the Old Testament, obedience to the law, and the belief in miracles and revelation. He, therefore, in a series of letters (afterwards collected under the title *Minhat Kenaot*, *i.e.* "Jealousy Offering") called upon the famous rabbi Solomon ben Adret of Barcelona to come to the aid of orthodoxy. Ben Adret, with the approval of other prominent Spanish rabbis, sent a letter to the community at Montpellier proposing to forbid the study of philosophy to those who were less than thirty years of age, and, in spite of keen opposition from the liberal section, a decree in this sense was issued by ben Adret in 1305. The result was a great schism among the Jews of Spain and southern France, and a new impulse was given to the study of philosophy by the unauthorized interference of the Spanish rabbis. On the expulsion of the Jews from France by Philip IV. in 1306, Abba Mari settled at Perpignan, where he published the letters connected with the controversy. His subsequent history is unknown. Beside the letters, he was the author of liturgical poetry and works on civil law.

AUTHORITIES.—Edition of the *Minhat Kenaot* by M. L. Bislichis (Pressburg, 1838); E. Renan, *Les rabbins français*, pp. 647 foll.; Perles, *Salomo ben Abraham ben Adereth*, pp. 15-54; *Jewish Encyclopaedia*, *s.v.* "Abba Mari."

ABBAS I. (1813–1854), pasha of Egypt, was a son of Tusun Pasha and grandson of Mehemet Ali, founder of the reigning dynasty. As a young man he fought in Syria under Ibrahim Pasha (*q.v.*), his real or supposed uncle. The death of Ibrahim in November 1848 made Abbas regent of Egypt, and in August following, on the death of Mehemet Ali—who had been deposed in July 1848 on account of mental weakness,—Abbas succeeded to the pashalik. He has been generally described as a mere voluptuary, but Nubar Pasha spoke of him as a true Turkish gentleman of the old school. He was without question a reactionary, morose and taciturn, and spent nearly all his time shut up in his palace. He undid, as far as lay in his power, the works of his grandfather, good and bad. Among other things he abolished trade monopolies, closed factories and schools, and reduced the strength of the army to 9000 men. He was inaccessible to adventurers bent on plundering Egypt, but at the instance of the British government allowed the construction of a railway from Alexandria to Cairo. In July 1854 he was murdered in Benha Palace by two of his slaves, and was succeeded by his uncle, Said Pasha.

ABBAS II. (1874–), khedive of Egypt. Abbas Hilmi Pasha, great-great-grandson of Mehemet Ali, born on the 14th of July 1874, succeeded his father, Tewfik Pasha, as khedive of Egypt on the 8th of January 1892. When a boy he visited England, and he had an English tutor for some time in Cairo. He then went to school in Lausanne, and from there passed on to the Theresianum in Vienna. In addition to Turkish, his mother tongue, he acquired fluency in Arabic, and a good conversational knowledge of English, French and German. He was still at college in Vienna when the sudden death of his father raised him to the Khedivate; and he was barely of age according to Turkish law, which fixes majority at eighteen in cases of succession to the throne. For some time he did not co-operate very cordially with Great Britain. He was young and eager to exercise his new power. His throne and life had not been saved for him by the British, as was the case with his father. He was surrounded by intriguers who were playing a game of their own, and for some time he appeared almost disposed to be as reactionary as his great-uncle Abbas I. But in process of time he learnt to understand the importance of British counsels. He paid a second visit to England in 1900, during which he frankly acknowledged the great good the British had done in Egypt, and declared himself ready to follow their advice and to co-operate with the British officials administering Egyptian affairs. The establishment of a sound system of native justice, the great remission of taxation, the reconquest of the Sudan, the inauguration of the stupendous irrigation works at Assuan, the increase of cheap, sound education, each received his approval and all the assistance he could give. He displayed more interest in agriculture than in statecraft, and his farm of cattle and horses at Koubah, near Cairo, would have done credit to any agricultural show in England; at Montaza, near Alexandria, he created a similar establishment. He married the Princess Ikbal Hanem and had several children. Mahommed Abdul Mouneim, the heir-apparent, was born on the 20th of February 1899.

ABBAS I. (*c.* 1557–1628 or 1629), shah of Persia, called the Great, was the son of shah Mahommed (d. 1586). In the midst of general anarchy in Persia, he was proclaimed ruler of Khorasan, and obtained possession of the Persian throne in 1586. Determined to raise the fallen fortunes of his country, he first directed his efforts against the predatory Uzbegs, who occupied and harassed Khorasan. After a long and severe struggle, he regained Meshed, defeated them in a great battle near Herat in 1597, and drove them out of his dominions. In the wars he carried on with the Turks during nearly the whole of his reign, his successes were numerous, and he acquired, or regained, a large extent of territory. By the victory he gained at Bassora in 1605 he extended his empire beyond the Euphrates; sultan Ahmed I. was forced to cede Shirvan and Kurdistan in 1611; the united armies of the Turks and Tatars were completely defeated near Sultanieh in 1618, and Abbas made peace on very favourable terms; and on the Turks renewing the war, Bagdad fell into his hands after a year's siege in 1623. In 1622 he took the island of Ormuz from the Portuguese, by the assistance of the British, and much of its trade was diverted to the town of Bander-Abbāsi, which was named after the shah. When he died, his dominions reached from the Tigris to the Indus. Abbas distinguished himself, not only by his successes in arms, and by the magnificence of his court and of the buildings which he erected, but also by his reforms in the administration of his kingdom. He encouraged commerce, and, by constructing highways and building bridges, did much to facilitate it. To foreigners, especially Christians, he showed a spirit of tolerance; two Englishmen, Sir Anthony and Sir Robert Shirley, or Sherley, were admitted to his confidence. His fame is tarnished, however, by numerous deeds of tyranny and cruelty. His own family, especially, suffered from his fits of jealousy; his eldest son was slain, and the eyes of his other children were put out, by his orders.

See *The Three Brothers, or Travels of Sir Anthony, Sir Robert Sherley, &c.* (London, 1825); Sir C. R. Markham, *General Sketch of the History of Persia* (London, 1874).

ABBASIDS, the name generally given to the caliphs of Bagdad, the second of the two great dynasties of the Mahommedan empire. The Abbasid caliphs officially based their claim to the throne on their descent from Abbas (A.D. 566–652), the eldest uncle of Mahomet, in virtue of which descent they regarded themselves as the rightful heirs of the Prophet as opposed to the Omayyads, the descendants of Omayya. Throughout the second period of the Omayyads, representatives of this family were among their most dangerous opponents, partly by the skill with which they undermined the reputation of the reigning princes by accusations against their orthodoxy, their moral character and their administration in general, and partly by their cunning manipulation of internecine jealousies among the Arabic and non-Arabic subjects of the empire. In the reign of Merwan II. this opposition culminated in the rebellion of Ibrahīm the Imam, the fourth in descent from Abbas, who, supported by the province of Khorasan, achieved considerable successes, but was captured (A.D. 747) and died in prison (as some hold, assassinated). The quarrel was taken up by his brother Abdallah, known by the name of Abu'l-Abbas as-Saffāh, who after a decisive victory on the Greater Zab (750) finally crushed the Omayyads and was proclaimed caliph.

The history of the new dynasty is marked by perpetual strife and the development of luxury and the liberal arts, in place of the old-fashioned austerity of thought and manners. Mansur, the second of the house, who transferred the seat of government to Bagdad, fought successfully against the peoples of Asia Minor, and the reigns of Harun al-Rashid (786–809) and Mamun (813–833) were periods of extraordinary splendour. But the empire as a whole stagnated and then decayed rapidly. Independent monarchs established themselves in Africa and Khorasan (Spain had remained Omayyad throughout), and in the north-west the Greeks successfully encroached. The ruin of the dynasty came, however, from those Turkish slaves who were constituted as a royal bodyguard by Moqtasim (833–842). Their power steadily grew until Radi (934–941) was constrained to hand over most of the royal functions to Mahommed b. Raik. Province after province renounced the authority of the caliphs, who were merely lay figures, and finally Hulagu, the Mongol chief, burned Bagdad (Feb. 28th, 1258). The Abbasids still maintained a feeble show of authority, confined to religious matters, in Egypt under the Mamelukes, but the dynasty finally disappeared with Motawakkil III., who was carried away as a prisoner to Constantinople by Selim I.

See CALIPHATE (Sections B, 14 and C), where a detailed account of the dynasty will be found.

ABBAS MIRZA (*c.* 1783–1833), prince of Persia, was a younger son of the shah, Feth Ali, but on account of his mother's royal birth was destined by his father to succeed him. Entrusted with the government of a part of Persia, he sought to rule it in European fashion, and employed officers to reorganize his army. He was soon at war with Russia, and his aid was eagerly solicited by both England and Napoleon, anxious to checkmate one another in the East. Preferring the friendship of France, Abbas continued the war against Russia, but his new ally could give him very little assistance, and in 1814 Persia was compelled to make a disadvantageous peace. He gained some successes during a war between Turkey and Persia which broke out in 1821, but cholera attacked his army, and a treaty was signed in 1823. His second war with Russia, which began in 1825, was attended with the same want of success as the former one, and Persia was forced to cede some territory. When peace was made in 1828 Abbas then sought to restore order in the province of Khorasan, which was nominally under Persian supremacy, and while engaged in the task died at Meshed in 1833. In 1834 his eldest son, Mahommed Mirza, succeeded Feth Ali as shah. Abbas was an intelligent prince, possessed some literary taste, and is noteworthy on account of the comparative simplicity of his life.

ABBAS-TUMAN, a spa in Russian Transcaucasia, government of Tiflis, 50 m. S.W. of the Borzhom railway station and 65 m. E. of Batum, very picturesquely situated in a cauldron-shaped valley. It has hot sulphur baths (93½°–118¾° Fahr.) and an astronomical observatory (4240 ft.).

ABBAZIA, a popular summer and winter resort of Austria, in

Istria, 56 m. S.E. of Trieste by rail. Pop. (1900) 2343. It is situated on the Gulf of Quarnero in a sheltered position at the foot of the Monte Maggiore (4580 ft.), and is surrounded by beautiful woods of laurel. The average temperature is 50° Fahr. in winter, and 77° Fahr. in summer. The old abbey, San Giacomo della Priluca, from which the place derives its name, has been converted into a villa. Abbazia is frequented annually by about 16,000 visitors. The whole sea-coast to the north and south of Abbazia is rocky and picturesque, and contains several smaller winter-resorts. The largest of them is Lovrana (pop. 513), situated 5 m. to the south.

ABBESS (Lat. *abbatissa*, fem. form of *abbas*, abbot), the female superior of an abbey or convent of nuns. The mode of election, position, rights and authority of an abbess correspond generally with those of an abbot (*q.v.*). The office is elective, the choice being by the secret votes of the sisters from their own body. The abbess is solemnly admitted to her office by episcopal benediction, together with the conferring of a staff and pectoral cross, and holds for life, though liable to be deprived for misconduct. The council of Trent fixed the qualifying age at forty, with eight years of profession. Abbesses have a right to demand absolute obedience of their nuns, over whom they exercise discipline, extending even to the power of expulsion, subject, however, to the bishop. As a female an abbess is incapable of performing the spiritual functions of the priesthood belonging to an abbot. She cannot ordain, confer the veil, nor excommunicate. In England abbesses attended ecclesiastical councils, *e.g.* that of Becanfield in 694, where they signed before the presbyters.

By Celtic usage abbesses presided over joint-houses of monks and nuns. This custom accompanied Celtic monastic missions to France and Spain, and even to Rome itself. At a later period, A.D. 1115, Robert, the founder of Fontevraud, committed the government of the whole order, men as well as women, to a female superior.

In the German Evangelical church the title of abbess (*Aebtissin*) has in some cases—*e.g.* Itzehoe—survived to designate the heads of abbeys which since the Reformation have continued as *Stifte*, *i.e.* collegiate foundations, which provide a home and an income for unmarried ladies, generally of noble birth, called canonesses (*Kanonissinen*) or more usually *Stiftsdamen*. This office of abbess is of considerable social dignity, and is sometimes filled by princesses of the reigning houses.

ABBEVILLE, a town of northern France, capital of an arrondissement in the department of Somme, on the Somme, 12 m. from its mouth in the English Channel, and 28 m. N.W. of Amiens on the Northern railway. Pop. (1901) 18,519; (1906) 18,971. It lies in a pleasant and fertile valley, and is built partly on an island and partly on both sides of the river, which is canalized from this point to the estuary. The streets are narrow, and the houses are mostly picturesque old structures, built of wood, with many quaint gables and dark archways. The most remarkable building is the church of St Vulfran, erected in the 15th, 16th and 17th centuries. The original design was not completed. The nave has only two bays and the choir is insignificant. The façade is a magnificent specimen of the flamboyant Gothic style, flanked by two Gothic towers. Abbeville has several other old churches and an hôtel-de-ville, with a belfry of the 13th century. Among the numerous old houses, that known as the Maison de François Ier, which is the most remarkable, dates from the 16th century. There is a statue of Admiral Courbet (d. 1885) in the chief square. The public institutions include tribunals of first instance and of commerce, a board of trade-arbitrators, and a communal college. Abbeville is an important industrial centre; in addition to its old-established manufacture of cloth, hemp-spinning, sugar-making, ship-building and locksmiths' work are carried on; there is active commerce in grain, but the port has little trade.

Abbeville, the chief town of the district of Ponthieu, first appears in history during the 9th century. At that time belonging to the abbey of St Riquier, it was afterwards governed by the counts of Ponthieu. Together with that county, it came into the possession of the Alençon and other French families, and afterwards into that of the house of Castille, from whom by marriage it fell in 1272 to Edward I., king of England. French and English were its masters by turns till 1435 when, by the treaty of Arras, it was ceded to the duke of Burgundy. In 1477 it was annexed by Louis XI., king of France, and was held by two illegitimate branches of the royal family in the 16th and 17th centuries, being in 1696 reunited to the crown.

ABBEY, EDWIN AUSTIN (1852-), American painter, was born at Philadelphia, Pennsylvania, on the 1st of April 1852. He left the schools of the Pennsylvania Academy of Fine Arts at the age of nineteen to enter the art department of the publishing house of Harper & Brothers in New York, where, in company with such men as Howard Pyle, Charles Stanley Reinhart, Joseph Pennell and Alfred Parsons, he became very successful as an illustrator. In 1878 he was sent by the Harpers to England to gather material for illustrations of the poems of Robert Herrick. These, published in 1882, attracted much attention, and were followed by illustrations for Goldsmith's *She Stoops to Conquer* (1887), for a volume of *Old Songs* (1889), and for the comedies (and a few of the tragedies) of Shakespeare. His water-colours and pastels were no less successful than the earlier illustrations in pen and ink. Abbey now became closely identified with the art life of England, and was elected to the Royal Institute of Painters in Water-Colours in 1883. Among his water-colours are "The Evil Eye" (1877); "The Rose in October" (1879); "An Old Song" (1886); "The Visitors" (1890), and "The Jongleur" (1892). Possibly his best known pastels are "Beatrice," "Phyllis," and "Two Noble Kinsmen." In 1890 he made his first appearance with an oil painting, "A May Day Morn," at the Royal Academy in London. He exhibited "Richard duke of Gloucester and the Lady Anne" at the Royal Academy in 1896, and in that year was elected A.R.A., becoming a full R.A. in 1898. Apart from his other paintings, special mention must be made of the large frescoes entitled "The Quest of the Holy Grail," in the Boston Public Library, on which he was occupied for some years; and in 1901 he was commissioned by King Edward VII. to paint a picture of the coronation, containing many portraits elaborately grouped. The dramatic subjects, and the brilliant colouring of his oil pictures, gave them pronounced individuality among the works of contemporary painters. Abbey became a member not only of the Royal Academy, but also of the National Academy of Design of New York, and honorary member of the Royal Bavarian Society, the Société Nationale des Beaux Arts (Paris), the American Water-Colour Society, etc. He received first class gold medals at the International Art Exhibition of Vienna in 1898, at Philadelphia in 1898, at the Paris Exhibitions of 1889 and 1900, and at Berlin in 1903; and was made a chevalier of the French Legion of Honour.

ABBEY (Lat. *abbatia*; from Syr. *abba*, father), a monastery, or conventual establishment, under the government of an ABBOT or an ABBESS. A *priory* only differed from an abbey in that the superior bore the name of *prior* instead of *abbot*. This was the case in all the English conventual cathedrals, *e.g.* Canterbury, Ely, Norwich, &c., where the archbishop or bishop occupied the abbot's place, the superior of the monastery being termed prior. Other priories were originally offshoots from the larger abbeys, to the abbots of which they continued subordinate; but in later times the actual distinction between abbeys and priories was lost.

The earliest Christian monastic communities (see MONASTICISM) with which we are acquainted consisted of groups of cells or huts collected about a common centre, which was usually the abode of some anchorite celebrated for superior holiness or singular asceticism, but without any attempt at orderly arrangement. The formation of such communities in the East does not date from the introduction of Christianity. The example had been already set by the Essenes in Judea and the Therapeutae in Egypt.

In the earliest age of Christian monasticism the ascetics were accustomed to live singly, independent of one another, at no great distance from some village, supporting themselves by the labour of their own hands, and distributing the surplus after the supply of their own scanty wants to the poor. Increasing religious case. On the south side of the cloister stood the refectory (P), an immense building, 100 ft. long and 60 ft. wide, accommodating six longitudinal and three transverse rows of tables. It was adorned with the portraits of the chief benefactors of the abbey, and with Scriptural subjects. The end wall displayed the Last Judgment. We are unhappily unable to identify any other of the principal buildings (N). The abbot's residence (K), still partly standing, adjoined the entrance-gate. The guest-house (L) was close by. The bakehouse (M), also remaining, is a detached building of immense size.

English Cluniac.

The first English house of the Cluniac order was that of Lewes, founded by the earl of Warren, *c.* A.D. 1077. Of this only a few fragments of the domestic buildings exist. The best preserved Cluniac houses in England are Castle Acre, Norfolk, and Wenlock, Shropshire. Ground-plans of both are given in Britton's *Architectural Antiquities*. They show several departures from the Benedictine arrangement. In each the prior's house is remarkably perfect. All Cluniac houses in England were French colonies, governed by priors of that nation. They did not secure their independence nor become "abbeys" till the reign of Henry VI. The Cluniac revival, with all its brilliancy, was but short-lived. The celebrity of this, as of other orders, worked its moral ruin. With their growth in wealth and dignity the Cluniac foundations became as worldly in life and as relaxed in discipline as their predecessors, and a fresh reform was needed.

Cistercian.

The next great monastic revival, the Cistercian, arising in the last years of the 11th century, had a wider diffusion, and a longer and more honourable existence. Owing its real origin, as a distinct foundation of reformed Benedictines, in the year 1098, to Stephen Harding (a native of Dorsetshire, educated in the monastery of Sherborne), and deriving its name from Cîteaux (*Cistercium*), a desolate and almost inaccessible forest solitude, on the borders of Champagne and Burgundy, the rapid growth and wide celebrity of the order are undoubtedly to be attributed to the enthusiastic piety of St Bernard, abbot of the first of the monastic colonies, subsequently sent forth in such quick succession by the first Cistercian houses, the far-famed abbey of Clairvaux (de Clara Valle), A.D. 1116. The rigid self-abnegation, which was the ruling principle of this reformed congregation of the Benedictine order, extended itself to the churches and other buildings erected by them. The characteristic of the Cistercian abbeys was the extremest simplicity and a studied plainness. Only one tower—a central one—was permitted, and that was to be very low. Unnecessary pinnacles and turrets were prohibited. The triforium was omitted. The windows were to be plain and undivided, and it was forbidden to decorate them with stained glass. All needless ornament was proscribed. The crosses must be of wood; the candlesticks of iron. The renunciation of the world was to be evidenced in all that met the eye. The same spirit manifested itself in the choice of the sites of their monasteries. The more dismal, the more savage, the more hopeless a spot appeared, the more did it please their rigid mood. But they came not merely as ascetics, but as improvers. The Cistercian monasteries are, as a rule, found placed in deep well-watered valleys. They always stand on the border of a stream; not rarely, as at Fountains, the buildings extend over it. These valleys, now so rich and productive, wore a very different aspect when the brethren first chose them as the place of their retirement. Wide swamps, deep morasses, tangled thickets, wild impassable forests, were their prevailing features. The "bright valley," *Clara Vallis* of St Bernard, was known as the "valley of Wormwood," infamous as a den of robbers. "It was a savage dreary solitude, so utterly barren that at first Bernard and his companions were reduced to live on beech leaves."—(Milman's *Lat. Christ.* vol. iii. p. 335.)

Clairvaux.

All Cistercian monasteries, unless the circumstances of the locality forbade it, were arranged according to one plan. The general arrangement and distribution of the various buildings, which went to make up one of these vast establishments, may be gathered from that of St Bernard's own abbey of Clairvaux, which is here given. It will be observed that the abbey precincts are surrounded by a strong wall, furnished at intervals with watch-towers and other defensive works. The wall is nearly encircled by a stream of water, artificially diverted from the small rivulets which flow through the precincts, furnishing the establishment with an abundant supply in every part, for the irrigation of the gardens and orchards, the sanitary requirements of the brotherhood and for the use of the offices and workshops.

The precincts are divided across the centre by a wall, running from N. to S., into an outer and inner ward,—the former containing the menial, the latter the monastic buildings. The precincts are entered by a gateway (P), at the extreme western extremity, giving admission to the lower ward. Here the barns, granaries, stables, shambles, workshops and workmen's lodgings were placed, without any regard to symmetry, convenience being the only consideration. Advancing eastwards, we have before us the wall separating the outer and inner ward, and the gatehouse (D) affording communication between the two. On passing through the gateway, the outer court of the inner ward was entered, with the western façade of the monastic church in front. Immediately on the right of entrance was the abbot's house (G), in close proximity to the guest-house (F). On the other side of the court were the stables, for the accommodation of the horses of the guests and their attendants (H). The church occupied a central position. To the south was the great cloister (A), surrounded by the chief monastic buildings, and farther to the east the smaller cloister, opening out of which were the infirmary, novices' lodgings and quarters for the aged monks. Still farther to the east, divided from the monastic buildings by a wall, were the vegetable gardens and orchards, and tank for fish. The large fish-ponds, an indispensable adjunct to any ecclesiastical foundation, on the formation of which the monks lavished extreme care and pains, and which often remain as almost the only visible traces of these vast establishments, were placed outside the abbey walls.

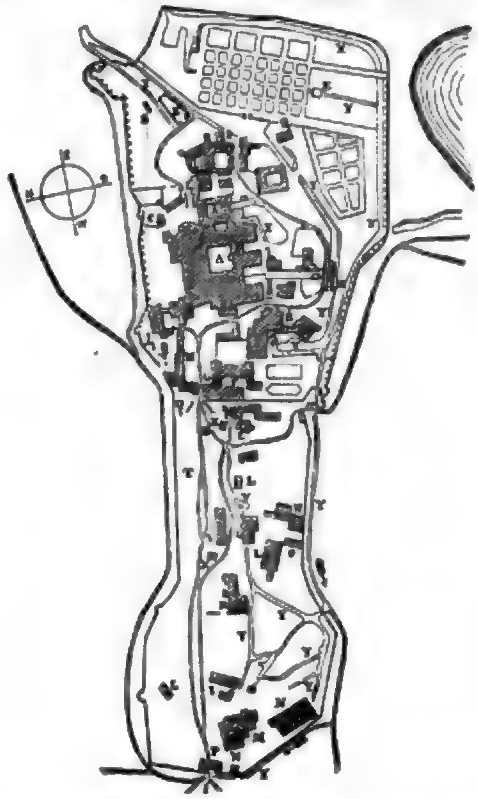


FIG. 6.—Clairvaux, No. 1 (Cistercian), General Plan.

A. Cloisters.
B. Ovens, and corn and oil mills.
C. St Bernard's cell.
D. Chief entrance.
E. Tanks for fish.
F. Guest-house.
G. Abbot's house.
H. Stables.
I. Wine-press and hay-chamber.
K. Parlour.
L. Workshops and workmen's lodgings.
M. Slaughter-house.
N. Barns and stables.
O. Public presse.
P. Gateway.
R. Remains of old monastery.
S. Oratory.
V. Tile-works.
X. Tile-kiln.
Y. Water-courses.

Plan No. 2 furnishes the ichnography of the distinctly monastic buildings on a larger scale. The usually unvarying arrangement of the Cistercian houses allows us to accept this as a type of the monasteries of this order. The church (A) is the chief feature. It consists of a vast nave of eleven bays, entered by a narthex, with a transept and short apsidal choir. (It may be remarked that the eastern limb in all unaltered Cistercian churches is remarkably short, and usually square.) To the east of each limb of the transept are two square chapels, divided according to Cistercian rule by solid walls. Nine radiating chapels, similarly divided, surround the apse. The stalls of the monks, forming the ritual choir, occupy the four eastern bays of the nave. There was a second range of stalls in the extreme western bays of the nave for the *fratres conversi*, or lay brothers. To the south of the church, so as to secure as much sun as possible, the cloister was invariably placed, except when local reasons forbade it. Round the cloister (B) were ranged the buildings connected with the monks' daily life. The chapter-house (C) always opened out of the east walk of the cloister in a line with the south transept. In Cistercian houses this was quadrangular, and was divided by pillars and arches into two or three aisles. Between it and the transept we find the sacristy (X), and a small book-room (Y), *armariolum*, where the brothers deposited the volumes borrowed from the library. On the other side of the chapter-house, to the south, is a passage (D) communicating with the courts and buildings beyond. This was sometimes known as the *parlour*, *colloquii locus*, the monks having the privilege of conversation here. Here also, when discipline became relaxed, traders, who had the liberty of admission, were allowed to display their goods. Beyond this we often find the *calefactorium* or *day-room*—an apartment warmed by flues beneath the pavement, where the brethren, half frozen during the night offices, betook themselves after the conclusion of lauds, to gain a little warmth, grease their sandals and get themselves ready for the work of the day. In the plan before us this apartment (E) opens from the south cloister walk, adjoining the refectory. The place usually assigned to it is occupied by the vaulted substructure of the *dormitory* (Z). The *dormitory*, as a rule, was placed on the east side of the cloister, running over the *calefactory* and *chapter-house*, and joined the south transept, where a flight of steps admitted the brethren into the church for nocturnal services. Opening out of the dormitory was always the *necessarium*, planned with the greatest regard to health and cleanliness, a water-course invariably running from end to end. The refectory opens out of the south cloister at G. The position of the refectory is usually a marked point of difference between Benedictine and Cistercian abbeys. In the former, as at Canterbury, the refectory ran east and west parallel to the nave of the church, on the side of the cloister farthest removed from it. In the Cistercian monasteries, to keep the noise and smell of dinner still farther away from the sacred building, the refectory was built north and south, at right angles to the axis of the church. It was often divided, sometimes into two, sometimes, as here, into three aisles. Outside the refectory door, in the cloister, was the *lavatory*, where the monks washed their hands at dinner-time. The buildings belonging to the material life of the monks lay near the refectory, as far as possible from the church, to the S.W. With a distinct entrance from the outer court was the kitchen court (F), with its buttery, scullery and larder, and the important adjunct of a stream of running water. Farther to the west, projecting beyond the line of the west front of the church, were vast vaulted apartments (SS), serving as cellars and storehouses, above which was the dormitory of the *conversi*. Detached from these, and separated entirely from the monastic buildings, were various workshops, which convenience required to be banished to the outer precincts, a saw-mill and oil-mill (UU) turned by water, and a currier's shop (V), where the sandals and leathern girdles of the monks were made and repaired.

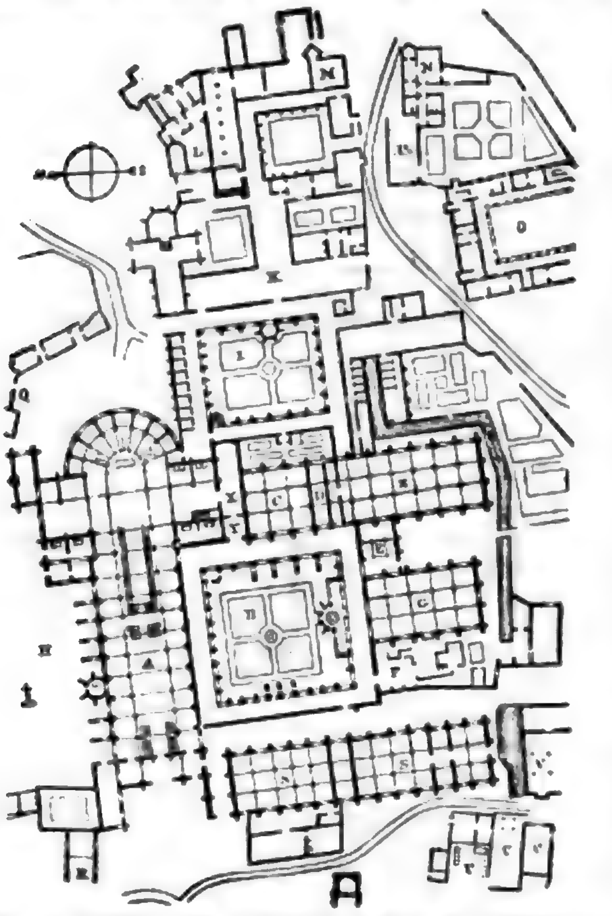


FIG. 7.—Clairvaux, No. 2 (Cistercian), Monastic Buildings.

A. Church.
B. Cloister.
C. Chapter-house.
D. Monks' parlour.
E. Calefactory.
F. Kitchen and court.
G. Refectory.
H. Cemetery.
I. Little cloister.
K. Infirmary.
L. Lodgings of novices.
M. Old guest-house.
N. Old abbot's lodgings.
O. Cloister of supernumerary monks.
P. Abbot's hall.
Q. Cell of St Bernard.
R. Stables.
S. Cellars and storehouses.
T. Water-course.
U. Saw-mill and oil-mill.
V. Currier's workshop.
X. Sacristy.
Y. Little library.
Z. Undercroft of dormitory.

Returning to the cloister, a vaulted passage admitted to the small cloister (I), opening from the north side of which were eight small cells, assigned to the scribes employed in copying works for the library, which was placed in the upper story, accessible by a turret staircase. To the south of the small cloister a long hall will be noticed. This was a *lecture-hall*, or rather a hall for the religious disputations customary among the Cistercians. From this cloister opened the *infirmary* (K), with its hall, chapel, cells, blood-letting house and other dependencies. At the eastern verge of the vast group of buildings we find the *novices' lodgings* (L), with a third cloister near the novices' quarters and the original guest-house (M). Detached from the great mass of the monastic edifices was the original abbot's house (N), with its dining-hall (P). Closely adjoining to this, so that the eye of the father of the whole establishment should be constantly over those who stood the most in need of his watchful care,—those who were training for the monastic life, and those who had worn themselves out in its duties,—was a fourth cloister (O), with annexed buildings, devoted to the aged and infirm members of the establishment. The cemetery, the last resting-place of the brethren, lay to the north side of the nave of the church (H).

It will be seen from the above account that the arrangement of a Cistercian monastery was in accordance with a clearly defined system, and admirably adapted to its purpose. The base court nearest to the outer wall contained the buildings belonging to the functions of the body as agriculturists and employers of labour. Advancing into the inner court, the buildings devoted to hospitality are found close to the entrance; while those connected with the supply of the material wants of the brethren,—the kitchen, cellars, &c.,—form a court of themselves outside the cloister and quite detached from the church. The church refectory, dormitory and other buildings belonging to the professional life of the brethren surround the great cloister. The small cloister beyond, with its scribes' cells, library, hall for disputations, &c., is the centre of the literary life of the community. The requirements of sickness and old age are carefully provided for in the infirmary cloister and that for the aged and infirm members of the establishment. The same group contains the quarters of the novices.

This stereotyped arrangement is further shown by the illustration of the mother establishmet of Citeaux.

Citeaux.

A cross (A), planted on the high road, directs travellers to the gate of the monastery, reached by an avenue of trees. On one side of the gate-house (B) is a long building (C), probably the almonry, with a dormitory above for the lower class of guests. On the other side is a chapel(D). As soon as the porter heard a stranger knock at the gate, he rose, saying, *Deo gratias*, the opportunity for the exercise of hospitality being regarded as a cause for thankfulness. On opening the door he welcomed the new arrival with a blessing—*Benedicite*. He fell on his knees before him, and then went to inform the abbot. However important the abbot's occupations might be, he at once hastened to receive him whom heaven had sent. He also threw himself at his guest's feet, and conducted him to the chapel (D) purposely built close to the gate. After a short prayer, the abbot committed the guest to the care of the brother hospitaller, whose duty it was to provide for his wants and conduct the beast on which he might be riding to the stable (F), built adjacent to the inner gate-house (E). This inner gate conducted into the base court (T), round which were placed the barns, stables, cow-sheds, &c. On the eastern side stood the dormitory of the lay brothers, *fratres conversi* (G), detached from the cloister, with cellars and storehouses below. At H, also outside the monastic buildings proper, was the abbot's house, and annexed to it the guest-house. For these buildings there was a separate door of entrance into the church (S). The large cloister, with its surrounding arcades, is seen at V. On the south end projects the refectory (K), with its kitchen at I, accessible from the base court. The long gabled building on the east side of the cloister contained on the ground floor the chapter-house and calefactory, with the monks' dormitory above (M), communicating with the south transept of the church. At L was the staircase to the dormitory. The small cloister is at W, where were the *carols* or cells of the scribes, with the library (P) over, reached by a turret staircase. At R we see a portion of the infirmary. The whole precinct is surrounded by a strong buttressed wall (XXX), pierced with arches, through which streams of water are introduced. It will be noticed that the choir of the church is short, and has a square end instead of the usual apse. The tower, in accordance with the Cistercian rule, is very low. The windows throughout accord with the studied simplicity of the order.

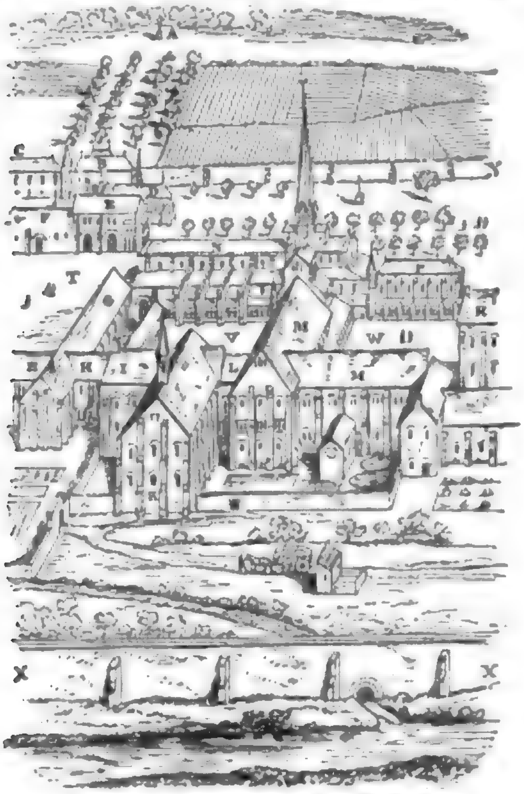


FIG. 8.—Bird's-eye view of Citeaux.

A. Cross.
B. Gate-house.
C. Almonry.
D. Chapel.
E. Inner gate-house.
F. Stable.
G. Dormitory of lay brethren.
H. Abbot's house.
I. Kitchen.
K. Refectory.
L. Staircase to dormitory.
M. Dormitory.
N. Church.
P. Library.
R. Infirmary.
S. Door to the church for the lay brothers.
T. Base court.
V. Great cloister.
W. Small cloister.
X. Boundary wall.

The English Cistercian houses, of which there are such extensive and beautiful remains at Fountains, Rievaulx, Kirkstall, Tintern, Netley, &c., were mainly arranged after the same plan, with slight local variations. As an example, we give the ground-plan of Kirkstall Abbey, which is one of the best preserved.

Kirkstall Abbey.

The church here is of the Cistercian type, with a short chancel of two squares, and transepts with three eastward chapels to each, divided by solid walls (2 2 2). The whole is of the most studied plainness. The windows are unornamented, and the nave has no triforium. The cloister to the south (4) occupies the whole length of the nave. On the east side stands the two-aisled chapter-house (5), between which and the south transept is a small sacristy (3), and on the other side two small apartments, one of which was probably the parlour (6). Beyond this stretches southward the calefactory or day-room of the monks (14). Above this whole range of building runs the monks' dormitory, opening by stairs into the south transept of the church. At the other end were the necessaries. On the south side of the cloister we have the remains of the old refectory (11), running, as in Benedictine houses, from east to west, and the new refectory (12), which, with the increase of the inmates of the house, superseded it, stretching, as is usual in Cistercian houses, from north to south. Adjacent to this apartment are the remains of the kitchen, pantry and buttery. The arches of the lavatory are to be seen near the refectory entrance. The western side of the cloister is, as usual, occupied by vaulted cellars, supporting on the upper story the dormitory of the lay brothers (8). Extending from the south-east angle of the main group of buildings are the walls and foundations of a secondary group of considerable extent. These have been identified either with the hospitium or with the abbot's house, but they occupy the position in which the infirmary is more usually found. The hall was a very spacious apartment, measuring 83 ft. in length by 48 ft. 9 in. in breadth, and was divided by two rows of columns. The fish-ponds lay between the monastery and the river to the south. The abbey mill was situated about 80 yards to the north-west. The mill-pool may be distinctly traced, together with the gowt or mill stream.

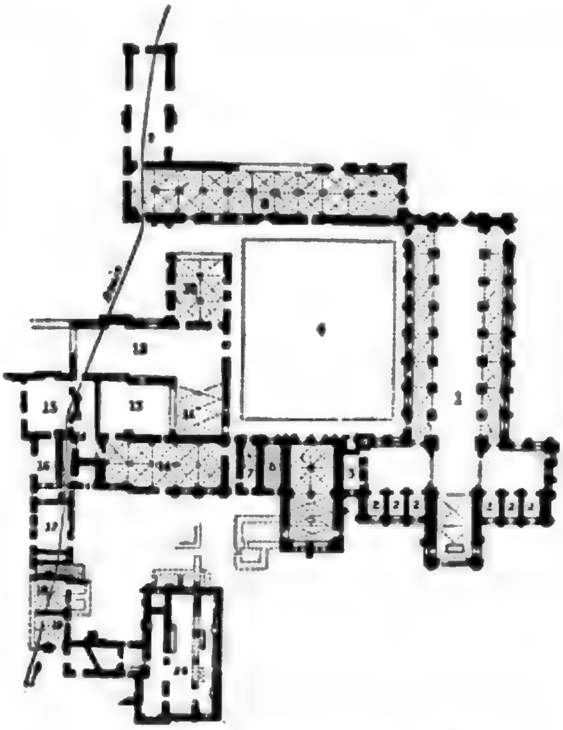


FIG. 9.—Kirkstall Abbey, Yorkshire (Cistercian).

1. Church.
2. Chapels.
3. Sacristy.
4. Cloister.
5. Chapter-house.
6. Parlour.
7. Punishment cell (?).
8. Cellars, with dormitories for *conversi* over.
9. Guest-house.
10. Common room.
11. Old refectory.
12. New refectory.
13. Kitchen court.
14. Calefactory or day-room.
15. Kitchen and offices.
16-19. Uncertain; perhaps offices connected with the infirmary.
20. Infirmary or abbot's house.

Fountains Abbey.

Fountains Abbey, first founded A.D. 1132, is one of the largest and best preserved Cistercian houses in England. But the earlier buildings received considerable additions and alterations in the later period of the order, causing deviations from the strict Cistercian type. The church stands a short distance to the north of the river Skell, the buildings of the abbey stretching down to and even across the stream. We have the cloister (H) to the south, with the three-aisled chapter-house (I) and calefactory (L) opening from its eastern walk, and the refectory (S), with the kitchen (Q) and buttery (T) attached, at right angles to its southern walk.

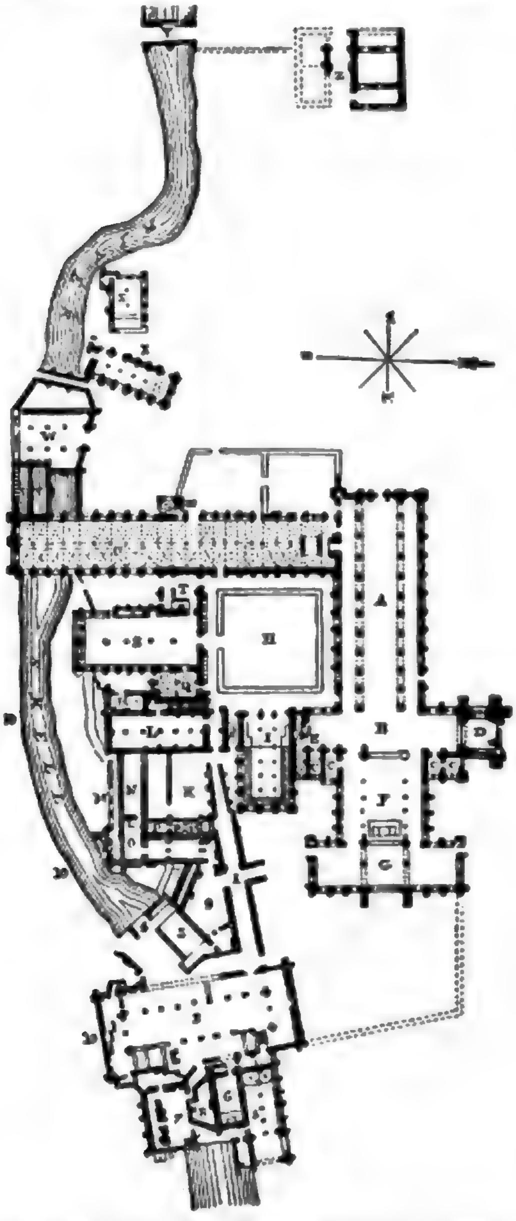


Fig. 10.—Ground-plan of Fountains Abbey, Yorkshire.

A. Nave of the church.
B. Transept.
C. Chapels.
D. Tower.
E. Sacristy.
F. Choir.
G. Chapel of nine altars.
H. Cloister.
I. Chapter-house.
K. Base court.
L. Calefactory.
M. Water-course.

N. Cellar.
O. Brewhouse.
P. Prisons.
Q. Kitchen.
R. Offices.
S. Refectory.
T. Buttery.
U. Cellars and store-houses.
V. Necessary.
W. Infirmary (?).
X. Guest-houses.
Y. Mill bridge.

Z. Gate-house.

Abbot's House.

1. Passage.
2. Great hall.
3. Refectory.
4. Buttery.
5. Storehouse.
6. Chapel.
7. Kitchen.
8. Ashpit.
9. Yard.
10. Kitchen tank.

Parallel with the western walk is an immense vaulted substructure (U), incorrectly styled the cloisters, serving as cellars and store-rooms, and supporting the dormitory of the *conversi* above. This building extended across the river. At its S.W. corner were the necessaries (V), also built, as usual, above the swiftly flowing stream. The monks' dormitory was in its usual position above the chapter-house, to the south of the transept. As peculiarities of arrangement may be noticed the position of the kitchen (Q), between the refectory and calefactory, and of the infirmary (W) (unless there is some error in its designation) above the river to the west, adjoining the guest-houses (XX). We may also call attention to the greatly lengthened choir, commenced by Abbot John of York, 1203–1211, and carried on by his successor, terminating, like Durham Cathedral, in an eastern transept, the work of Abbot John of Kent, 1220–1247, and to the tower (D), added not long before the dissolution by Abbot Huby, 1494–1526, in a very unusual position at the northern end of the north transept. The abbot's house, the largest and most remarkable example of this class of buildings in the kingdom, stands south to the east of the church and cloister, from which it is divided by the kitchen court (K), surrounded by the ordinary domestic offices. A considerable portion of this house was erected on arches over the Skell. The size and character of this house, probably, at the time of its erection, the most spacious house of a subject in the kingdom, not a castle, bespeaks the wide departure of the Cistercian order from the stern simplicity of the original foundation. The hall (2) was one of the most spacious and magnificent apartments in medieval times, measuring 170 ft. by 70 ft. Like the hall in the castle at Winchester, and Westminster Hall, as originally built, it was divided by 18 pillars and arches, with 3 aisles. Among other apartments, for the designation of which we must refer to the ground-plan, was a domestic oratory or chapel, 46½ ft. by 23 ft. and a kitchen (7), 50 ft. by 38 ft. The whole arrangements and character of the building bespeak the rich and powerful feudal lord, not the humble father of a body of hard-working brethren, bound by vows to a life of poverty and self-denying toil. In the words of Dean Milman, "the superior, once a man bowed to the earth with humility, care-worn, pale, emaciated, with a coarse habit bound with a cord, with naked feet, had become an abbot on his curvetting palfrey, in rich attire, with his silver cross before him, travelling to take his place amid the lordliest of the realm." —(*Lat. Christ.* vol. iii. p. 330.)

Austin Canons.

The buildings of the *Austin canons* or *Black canons* (so called from the colour of their habit) present few distinctive peculiarities. This order had its first seat in England at Colchester, where a house for Austin canons was founded about A.D. 1105, and it very soon spread widely. As an order of regular clergy, holding a middle position between monks and secular canons, almost resembling a community of parish priests living under rule, they adopted naves of great length to accommodate large congregations. The choir is usually long, and is sometimes, as at Llanthony and Christ Church (Twynham), shut off from the aisles, or, as at Bolton, Kirkham, &c., is destitute of aisles altogether. The nave in the northern houses, not unfrequently, had only a north aisle, as at Bolton, Brinkburn and Lanercost. The arrangement of the monastic buildings followed the ordinary type. The prior's lodge was almost invariably attached to the S.W. angle of the nave. The annexed plan of the Abbey of St Augustine's at Bristol, now the cathedral church of that city, shows the arrangement of the buildings, which departs very little from the ordinary Benedictine type. The Austin canons' house at Thornton, in Lincolnshire, is remarkable for the size and magnificence of its gate-house, the upper floors of which formed the guest-house of the establishment, and for possessing an octagonal chapter-house of Decorated date.

Bristol Cathedral.

Premonstratensians.

The *Premonstratensian* regular canons, or White canons, had as many as 35 houses in England, of which the most perfect remaining are those of Easby, Yorkshire, and Bayham, Kent. The head house of the order in England was Welbeck. This order was a reformed branch of the Austin canons, founded, A.D. 1119, by Norbert (born at Xanten, on the Lower Rhine, *c.* 1080) at Prémontré, a secluded marshy valley in the forest of Coucy in the diocese of Laon. The order spread widely. Even in the founder's lifetime it possessed houses in Syria and Palestine. It long maintained its rigid austerity, till in the course of years wealth impaired its discipline, and its members sank into indolence and luxury. The Premonstratensians were brought to England shortly after A.D. 1140, and were first settled at Newhouse, in Lincolnshire, near the Humber. The ground-plan of Easby Abbey, owing to its situation on the edge of the steeply sloping banks of a river, is singularly irregular. The cloister is duly placed on the south side of the church, and the chief buildings occupy their usual positions round it. But the cloister garth, as at Chichester, is not rectangular, and all the surrounding buildings are thus made to sprawl in a very awkward fashion. The church follows the plan adopted by the Austin canons in their northern abbeys, and has only one aisle to the nave—that to the north; while the choir is long, narrow and aisleless. Each transept has an aisle to the east, forming three chapels.

The church at Bayham was destitute of aisles either to nave or choir. The latter terminated in a three-sided apse. This church is remarkable for its exceeding narrowness in proportion to its length. Extending in longitudinal dimensions 257 ft., it is not more than 25 ft. broad. Stern Premonstratensian canons wanted no congregations, and cared for no possessions; therefore they built their church like a long room.

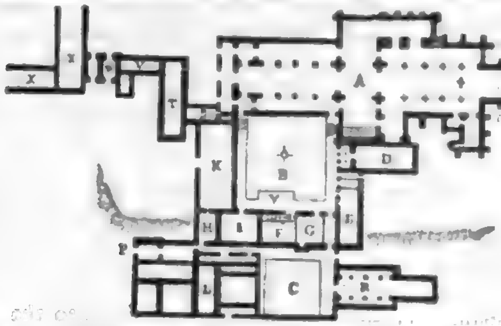


FIG. 11.—St Augustine's Abbey, Bristol (Bristol Cathedral).

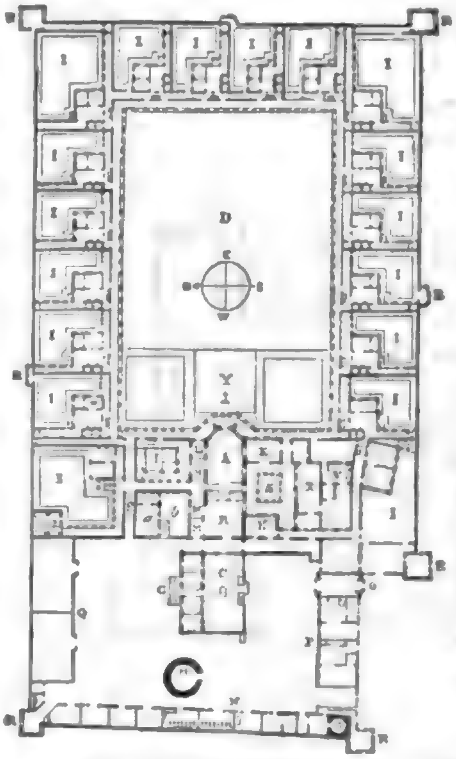
A.	Church.	H.	Kitchen.	S.	Friars' lodging.
B.	Great cloister.	I.	Kitchen court.	T.	King's hall.
C.	Little cloister.	K.	Cellars.	V.	Guest-house.
D.	Chapter-house.	L.	Abbot's hall.	W.	Abbey gateway.
E.	Calefactory.	P.	Abbot's gateway.	X.	Barns, stables, &c.
F.	Refectory.	R.	Infirmary.	Y.	Lavatory.
G.	Parlour.				

Carthusians.

The *Carthusian* order, on its establishment by St Bruno, about A.D. 1084, developed a greatly modified form and arrangement of a monastic institution. The principle of this order, which combined the coenobitic with the solitary life, demanded the erection of buildings on a novel plan. This plan, which was first adopted by St Bruno and his twelve companions at the original institution at Chartreux, near Grenoble, was maintained in all the Carthusian establishments throughout Europe, even after the ascetic severity of the order had been to some extent relaxed, and the primitive simplicity of their buildings had been exchanged for the magnificence of decoration which characterizes such foundations as the *Certosas* of Pavia and Florence. According to the rule of St Bruno, all the members of a Carthusian brotherhood lived in the most absolute solitude and silence. Each occupied a small detached cottage, standing by itself in a small garden surrounded by high walls and connected by a common corridor or cloister. In these cottages or cells a Carthusian monk passed his time in the strictest asceticism, only leaving his solitary dwelling to attend the services of the Church, except on certain days when the brotherhood assembled in the refectory. The peculiarity of the arrangements of a Carthusian monastery, or *charter-house*, as it was called in England, from a corruption of the French *chartreux*, is exhibited in the plan of that of Clermont, from Viollet-le-Duc.

Clermont.

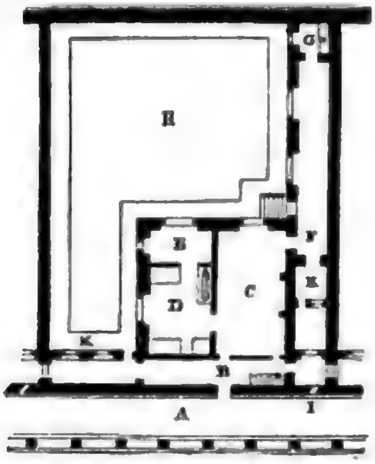
The whole establishment is surrounded by a wall, furnished at intervals with watch towers (R). The enclosure is divided into two courts, of which the eastern court, surrounded by a cloister, from which the cottages of the monks (I) open, is much the larger. The two courts are divided by the main buildings of the monastery, including the church, the sanctuary (A), divided from B, the monks' choir, by a screen with two altars, the smaller cloister to the south (S) surrounded by the chapter-house (E), the refectory (X)—these buildings occupying their normal position—and the chapel of Pontgibaud (K). The kitchen with its offices (V) lies behind the refectory, accessible from the outer court without entering the cloister. To the north of the church, beyond the sacristy (L), and the side chapels (M), we find the cell of the sub-prior (*a*), with its garden. The lodgings of the prior (G) occupy the centre of the outer court, immediately in front of the west door of the church, and face the gateway of the convent (O). A small raised court with a fountain (C) is before it. This outer court also contains the guest-chambers (P), the stables and lodgings of the lay brothers (N), the barns and granaries (Q), the dovecot (H) and the bakehouse (T). At Z is the prison. (In this outer court, in all the earlier foundations, as at Witham, there was a smaller church in addition to the larger church of the monks.) The outer and inner courts are connected by a long passage (F), wide enough to admit a cart laden with wood to supply the cells of the brethren with fuel. The number of cells surrounding the great cloister is 18. They are all arranged on a uniform plan. Each little dwelling contains three rooms: a sitting-room (C), warmed by a stove in winter; a sleeping-room (D), furnished with a bed, a table, a bench, and a bookcase; and a closet (E). Between the cell and the cloister gallery (A) is a passage or corridor (B), cutting off the inmate of the cell from all sound or movement which might interrupt his meditations. The superior had free access to this corridor, and through open niches was able to inspect the garden without being seen. At I is the hatch or turn-table, in which the daily allowance of food was deposited by a brother appointed for that purpose, affording no view either inwards or outwards. H is the garden, cultivated by the occupant of the cell. At K is the wood-house. F is a covered walk, with the necessary at the end.



A.	Church.
B.	Monks' choir.
C.	Prior's garden.
D.	Great cloister.
E.	Chapter-house.
F.	Passage.
G.	Prior's lodgings.
H.	Dovecot.
I.	Cells.
K.	Chapel of Pontgibaud.
L.	Sacristy.
M.	Chapel.
N.	Stables.
O.	Gateway.
P.	Guest-chambers.
Q.	Barns and granaries.
R.	Watch-tower.
S.	Little cloister.
T.	Bakehouse.
V.	Kitchen.
X.	Refectory.
Y.	Cemetery.
Z.	Prison.
a.	Cell of sub-prior.
b.	Garden of do.

FIG. 12.—Carthusian monastery of Clermont.

The above arrangements are found with scarcely any variation in all the charter-houses of western Europe. The Yorkshire Charter-house of Mount Grace, founded by Thomas Holland, the young duke of Surrey, nephew of Richard II. and marshal of England, during the revival of the popularity of the order, about A.D. 1397, is the most perfect and best preserved English example. It is characterized by all the simplicity of the order. The church is a modest building, long, narrow and aisleless. Within the wall of enclosure are two courts. The smaller of the two, the south, presents the usual arrangement of church, refectory, &c., opening out of a cloister. The buildings are plain and solid. The northern court contains the cells, 14 in number. It is surrounded by a double stone wall, the two walls being about 30 ft. or 40 ft. apart. Between these, each in its own garden, stand the cells; low-built two-storied cottages, of two or three rooms on the ground-floor, lighted by a larger and a smaller window to the side, and provided with a doorway to the court, and one at the back, opposite to one in the outer wall, through which the monk may have conveyed the sweepings of his cell and the refuse of his garden to the "eremus" beyond. By the side of the door to the court is a little hatch through which the daily pittance of food was supplied, so contrived by turning at an angle in the wall that no one could either look in or look out. A very perfect example of this hatch—an arrangement belonging to all Carthusian houses—exists at Miraflores, near Burgos, which remains nearly as it was completed in 1480.



A. Cloister gallery.
B. Corridor.
C. Living-room.
D. Sleeping-room.
E. Closets.
F. Covered walk.
G. Necessary.
H. Garden.
I. Hatch.
K. Wood-house.

FIG. 13.—Carthusian cell, Clermont.

There were only nine Carthusian houses in England. The earliest was that at Witham in Somersetshire, founded by Henry II., by whom the order was first brought into England. The wealthiest and most magnificent was that of Sheen or Richmond in Surrey, founded by Henry V. about A.D. 1414. The dimensions of the buildings at Sheen are stated to have been remarkably large. The great court measured 300 ft. by 250 ft.; the cloisters were a square of 500 ft.; the hall was 110 ft. in length by 60 ft. in breadth. The most celebrated historically is the Charter-house of London, founded by Sir Walter Manny A.D. 1371, the name of which is preserved by the famous public school established on the site by Thomas Sutton A.D. 1611, now removed to Godalming.

Mendicant Friars.

An article on monastic arrangements would be incomplete without some account of the convents of the Mendicant or Preaching Friars, including the Black Friars or Dominicans, the Grey or Franciscans, the White or Carmelites, the Eremite or Austin Friars. These orders arose at the beginning of the 13th century, when the Benedictines, together with their various reformed branches, had terminated their active mission, and Christian Europe was ready for a new religious revival. Planting themselves, as a rule, in large towns, and by preference in the poorest and most densely populated districts, the Preaching Friars were obliged to adapt their buildings to the requirements of the site. Regularity of arrangement, therefore, was not possible, even if they had studied it. Their churches, built for the reception of large congregations of hearers rather than worshippers, form a class by themselves, totally unlike those of the elder orders in ground-plan and character. They were usually long parallelograms unbroken by transepts. The nave very usually consisted of two equal bodies, one containing the stalls of the brotherhood, the other left entirely free for the congregation. The constructional choir is often wanting, the whole church forming one uninterrupted structure, with a continuous range of windows. The east end was usually square, but the Friars Church at Winchelsea had a polygonal apse. We not unfrequently find a single transept, sometimes of great size, rivalling or exceeding the nave. This arrangement is frequent in Ireland, where the numerous small friaries afford admirable exemplifications of these peculiarities of ground-plan. The friars' churches were at first destitute of towers; but in the 14th and 15th centuries, tall, slender towers were commonly inserted between the nave and the choir. The Grey Friars at Lynn, where the tower is hexagonal, is a good example. The arrangement of the monastic buildings is equally peculiar and characteristic. We miss entirely the regularity of the buildings of the earlier orders. At the Jacobins at Paris, a cloister lay to the north of the long narrow church of two parallel aisles, while the refectory—a room of immense length, quite detached from the cloister—stretched across the area before the west front of the church. At Toulouse the nave also has two parallel aisles, but the choir is apsidal, with radiating chapel. The refectory stretches northwards at right angles to the cloister, which lies to the north of the church, having the chapter-house and sacristy on the east. As examples of English friaries, the Dominican house at Norwich, and those of the Dominicans and Franciscans at Gloucester, may be mentioned. The church of the Black Friars of Norwich departs from the original type in the nave (now St Andrew's Hall), in having regular aisles. In this it resembles the earlier examples of the Grey Friars at Reading. The choir is long and aisleless; an hexagonal tower between the two, like that existing at Lynn, has perished. The cloister and monastic buildings remain tolerably perfect to the north. The Dominican convent at Gloucester still exhibits the cloister-court, on the north side of which is the desecrated church. The refectory is on the west side and on the south the dormitory of the 13th century. This is a remarkably good example. There were 18 cells or cubicles on each side, divided by partitions, the bases of which remain. On the east side was the prior's house, a building of later date. At the Grey or Franciscan Friars, the church followed the ordinary type in having two equal bodies, each gabled, with a continuous range of windows. There was a slender tower between the nave and the choir. Of the convents of the Carmelite or White Friars we have a good example in the Abbey of Hulne, near Alnwick, the first of the order in England, founded A.D. 1240. The church is a narrow oblong, destitute of aisles, 123 ft. long by only 26 ft. wide. The cloisters are to the south, with the chapter-house, &c., to the east, with the dormitory over. The prior's lodge is placed to the west of the cloister. The guest-houses adjoin the entrance gateway, to which a chapel was annexed on the south side of the conventual area. The nave of the church of the Austin Friars or Eremites in London is still standing. It is of Decorated date, and has wide centre and side aisles, divided by a very light and graceful arcade. Some fragments of the south walk of the cloister of the Grey Friars remained among the buildings of Christ's Hospital (the Blue-Coat School), while they were still standing. Of the Black Friars all has perished but the name. Taken as a whole, the remains of the establishments of the friars afford little warrant for the bitter invective of the Benedictine of St Alban's, Matthew Paris:—"The friars who have been founded hardly 40 years have built residences as the palaces of kings. These are they who, enlarging day by day their sumptuous edifices, encircling them with lofty walls, lay up in them their incalculable treasures, imprudently transgressing the bounds of poverty and violating the very fundamental rules of their profession." Allowance must here be made for jealousy of a rival order just rising in popularity.

Norwich.
Gloucester.

Hulne.

Cells.

Every large monastery had depending upon it one or more smaller establishments known as *cells*. These cells were monastic colonies, sent forth by the parent house, and planted on some outlying estate. As an example, we may refer to the small religious house of St Mary Magdalene's, a cell of the great Benedictine house of St Mary's, York, in the valley of the Witham, to the south-east of the city of Lincoln. This consists of one long narrow range of building, of which the eastern part formed the chapel and the western contained the apartments of the handful of monks of which it was the home. To the east may be traced the site of the abbey mill, with its dam and mill-lead. These cells, when belonging to a Cluniac house, were called *Obedientiae*. The plan given by

Viollet-le-Duc of the Priory of *St Jean des Bons Hommes*, a Cluniac cell, situated between the town of Avallon and the village of Savigny, shows that these diminutive establishments comprised every essential feature of a monastery,—chapel, cloister, chapter-room, refectory, dormitory, all grouped according to the recognized arrangement. These Cluniac *obedientiae* differed from the ordinary Benedictine cells in being also places of punishment, to which monks who had been guilty of any grave infringement of the rules were relegated as to a kind of penitentiary. Here they were placed under the authority of a prior, and were condemned to severe manual labour, fulfilling the duties usually executed by the lay brothers, who acted as farm-servants. The outlying farming establishments belonging to the monastic foundations were known as *villae* or *granges*. They gave employment to a body of *conversi* and labourers under the management of a monk, who bore the title of *Brother Hospitaller*—the granges, like their parent institutions, affording shelter and hospitality to belated travellers.

Authorities.—Dugdale, *Monasticon*; Lenoir, *Architecture monastique* (1852–1856); Viollet-le-Duc, *Dictionnaire raisonnée de l'architecture française*; Springer, *Klosterleben und Klosterkunst* (1886); Kraus, *Geschichte der christlichen Kunst* (1896). (E. V.)

ABBON OF FLEURY, or Abbo Floriacensis (*c.* 945–1004), a learned Frenchman, born near Orleans about 945. He distinguished himself in the schools of Paris and Reims, and was especially proficient in science as known in his time. He spent two years in England, assisting Archbishop Oswald of York in restoring the monastic system, and was abbot of Romsey. After his return to France he was made abbot of Fleury on the Loire (988). He was twice sent to Rome by King Robert the Pious (986, 996), and on each occasion succeeded in warding off a threatened papal interdict. He was killed at La Réole in 1004, in endeavouring to quell a monkish revolt. He wrote an *Epitome de vitis Romanorum pontificum*, besides controversial treatises, letters, &c. (see Migne, *Patrologia Latina*, vol. 139). His life, written by his disciple Aimoin of Fleury, in which much of Abbon's correspondence was reproduced, is of great importance as a source for the reign of Robert II., especially with reference to the papacy (cf. Migne, *op. cit.* vol. 139).

See Ch. Pfister, *Études sur le règne de Robert le Pieux* (1885); Cuissard-Gaucheron, "L'École de Fleury-sur-Loire à la fin du 10e siècle," in *Mémoires de la société archéol. de l'Orléanais*, xiv. (Orleans, 1875); A. Molinier, *Sources de l'histoire de France*.

ABBOT, EZRA (1819–1884), American biblical scholar, was born at Jackson, Waldo county, Maine, on the 28th of April 1819. He graduated at Bowdoin College in 1840; and in 1847, at the request of Prof. Andrews Norton, went to Cambridge, where he was principal of a public school until 1856. He was assistant librarian of Harvard University from 1856 to 1872, and planned and perfected an alphabetical card catalogue, combining many of the advantages of the ordinary dictionary catalogues with the grouping of the minor topics under more general heads, which is characteristic of a systematic catalogue. From 1872 until his death he was Bussey Professor of New Testament Criticism and Interpretation in the Harvard Divinity School. His studies were chiefly in Oriental languages and the textual criticism of the New Testament, though his work as a bibliographer showed such results as the exhaustive list of writings (5300 in all) on the doctrine of the future life, appended to W. R. Alger's *History of the Doctrine of a Future Life, as it has prevailed in all Nations and Ages* (1862), and published separately in 1864. His publications, though always of the most thorough and scholarly character, were to a large extent dispersed in the pages of reviews, dictionaries, concordances, texts edited by others, Unitarian controversial treatises, &c.; but he took a more conspicuous and more personal part in the preparation (with the Baptist scholar, Horatio B. Hackett) of the enlarged American edition of Dr (afterwards Sir) William Smith's *Dictionary of the Bible* (1867–1870), to which he contributed more than 400 articles besides greatly improving the bibliographical completeness of the work; was an efficient member of the American revision committee employed in connexion with the Revised Version (1881–1885) of the King James Bible; and aided in the preparation of Caspar René Gregory's *Prolegomena* to the revised Greek New Testament of Tischendorf. His principal single production, representing his scholarly method and conservative conclusions, was *The Authorship of the Fourth Gospel: External Evidences* (1880; second edition, by J. H. Thayer, with other essays, 1889), originally a lecture, and in spite of the compression due to its form, up to that time probably the ablest defence, based on external evidence, of the Johannine authorship, and certainly the completest treatment of the relation of Justin Martyr to this gospel. Abbot, though a layman, received the degree of S. T. D. from Harvard in 1872, and that of D.D. from Edinburgh in 1884. He died in Cambridge, Massachusetts, on the 21st of March 1884.

See S. J. Barrows, *Ezra Abbot* (Cambridge, Mass., 1884).

ABBOT, GEORGE (1562–1633), English divine, archbishop of Canterbury, was born on the 19th of October 1562, at Guildford in Surrey, where his father was a cloth-worker. He studied, and then taught, at Balliol College, Oxford, was chosen master of University College in 1597, and appointed dean of Winchester in 1600. He was three times vice-chancellor of the university, and took a leading part in preparing the authorized version of the New Testament. In 1608 he went to Scotland with the earl of Dunbar to arrange for a union between the churches of England and Scotland. He so pleased the king (James I.) in this affair that he was made bishop of Lichfield and Coventry in 1609, was translated to the see of London a month afterwards, and in less than a year was raised to that of Canterbury. His puritan instincts frequently led him not only into harsh treatment of Roman Catholics, but also into courageous resistance to the royal will, *e.g.* when he opposed the scandalous divorce suit of the Lady Frances Howard against the earl of Essex, and again in 1618 when, at Croydon, he forbade the reading of the declaration permitting Sunday sports. He was naturally, therefore, a promoter of the match between the elector palatine and the Princess Elizabeth, and a firm opponent of the projected marriage of the prince of Wales with the infanta of Spain. This policy brought upon him the hatred of Laud (with whom he had previously come into collision at Oxford) and the court, though the king himself never forsook him. In 1622, while hunting in Lord Zouch's park at Bramshill, Hampshire, a bolt from his cross-bow aimed at a deer happened to strike one of the keepers, who died within an hour, and Abbot was so greatly distressed by the event that he fell into a state of settled melancholy. His enemies maintained that the fatal issue of this accident disqualified him for his office, and argued that, though the homicide was involuntary, the sport of hunting which had led to it was one in which no clerical person could lawfully indulge. The king had to refer the matter to a commission of ten, though he said that "an angel might have miscarried after this sort." The commission was equally divided, and the king gave a casting vote in the archbishop's favour, though signing also a formal pardon or dispensation. After this the archbishop seldom appeared at the council, chiefly on account of his infirmities. He attended the king constantly, however, in his last illness, and performed the ceremony of the coronation of Charles I. His refusal to license the assize sermon preached by Dr Robert Sibthorp at Northampton on the 22nd of February 1626–1627, in which cheerful obedience was urged to the king's demand for a general loan, and the duty proclaimed of absolute non-resistance even to the most arbitrary royal commands, led Charles to deprive him of his functions as primate, putting them in commission. The need of summoning parliament, however, soon brought about a nominal restoration of the archbishop's powers. His presence being unwelcome at court, he lived from that time in retirement, leaving Laud and his party in undisputed ascendancy. He died at Croydon on the 5th of August 1633, and was buried at Guildford, his native place, where he had endowed a hospital with lands to the value of £300 a year. Abbot was a conscientious prelate, though narrow in view and often harsh towards both separatists and Romanists. He wrote a large number of works, the most interesting being his discursive *Exposition on the Prophet Jonah* (1600), which was reprinted in 1845. His *Geography, or a Brief Description of the Whole World* (1599), passed through numerous editions.

The best account of him is in S. R. Gardiner's *History of England.*

ABBOT, GEORGE (1603–1648), English writer, known as "The Puritan," has been oddly and persistently mistaken for others. He has been described as a clergyman, which he never was, and as son of Sir Morris (or Maurice) Abbot, and his writings accordingly entered in the bibliographical authorities as by the nephew of the archbishop of Canterbury. One of the sons of Sir Morris Abbot was, indeed, named George, and he was a man of mark, but the more famous George Abbot was of a different family altogether. He was son or grandson (it is not clear which) of Sir Thomas Abbot, knight of Easington, East Yorkshire, having been born there in 1603–1604, his mother (or grandmother) being of the ancient house of Pickering. Of his early life and training nothing is known. He married a daughter of Colonel Purefoy of Caldecote, Warwickshire, and as his monument, which may still be seen in the church there, tells, he bravely held the manor house against Princes Rupert and Maurice during the civil war. As a layman, and nevertheless a theologian and scholar of rare ripeness and critical ability, he holds an almost unique place in the literature of the period. The terseness of his *Whole Booke of Job Paraphrased, or made easy for any to understand* (1640, 4to), contrasts favourably with the usual prolixity of the Puritan expositors and commentators. His *Vindiciae Sabbathi* (1641, 8vo) had a profound and lasting influence in the long Sabbatarian controversy. His *Brief Notes upon the Whole Book of Psalms* (1651, 4to), as its date shows, was posthumous. He died on the 2nd of February 1648.

AUTHORITIES.—MS. collections at Abbeyville for history of all of the name of Abbot, by J. T. Abbot, Esq., F.S.A., Darlington; Dugdale's *Antiquities of Warwickshire*, 1730, p. 1099; Wood's *Athenae* (Bliss), ii. 141, 594; Cox's *Literature of the Sabbath.*

ABBOT, ROBERT (1588?–1662?), English Puritan divine. Noted as this worthy was in his own time, and representative in various ways, he has often since been confounded with others, *e.g.* Robert Abbot, bishop of Salisbury. He is also wrongly described as a relative of Archbishop Abbot, from whom he acknowledges very gratefully, in the first of his epistles dedicatory of *A Hand of Fellowship to Helpe Keepe out Sinne and Antichrist* (1623, 4to), that he had "received all" his "worldly maintenance," as well as "best earthly countenance" and "fatherly incouragements." The worldly maintenance was the presentation in 1616 to the vicarage of Cranbrook in Kent. He had received his education at Cambridge, where he proceeded M.A., and was afterwards incorporated at Oxford. In 1639, in the epistle to the reader of his most noticeable book historically, his *Triall of our Church-Forsakers*, he tells us, "I have lived now, by God's gratious dispensation, above fifty years, and in the place of my allotment two and twenty full." The former date carries us back to 1588–1589, or perhaps 1587–1588—the "Armada" year—as his birth-time; the latter to 1616–1617 (*ut supra*). In his *Bee Thankfull London and her Sisters* (1626), he describes himself as formerly "assistant to a reverend divine . . . now with God," and the name on the margin is "Master Haiward of Wool Church (Dorset)." This was doubtless previous to his going to Cranbrook. Very remarkable and effective was Abbot's ministry at Cranbrook, where his parishioners were as his own "sons and daughters" to him. Yet, Puritan though he was, he was extremely and often unfairly antagonistic to Nonconformists. He remained at Cranbrook until 1643, when, Parliament deciding against pluralities of ecclesiastical offices, he chose the very inferior living of Southwick, Hants, as between the one and the other. He afterwards succeeded the "extruded" Udall of St Austin's, London, where according to the *Warning-piece* he was still pastor in 1657. He disappears silently between 1657–1658 and 1662. Robert Abbot's books are conspicuous amongst the productions of his time by their terseness and variety. In addition to those mentioned above he wrote *Milk for Babes, or a Mother's Catechism for her Children* (1646), and *A Christian Family builded by God, or Directions for Governors of Families* (1653).

AUTHORITIES.—Brook's *Puritans*, iii. 182, 3; Walker's *Sufferings*, ii. 183; Wood's *Athenae* (Bliss), i. 323; Palmer's *Nonconf. Mem.* ii. 218, which confuses him most oddly of all with one of the ejected ministers of 1662.

ABBOT, WILLIAM (1798–1843), English actor, was born in Chelsea, and made his first appearance on the stage at Bath in 1806, and his first London appearance in 1808. At Covent Garden in 1813, in light comedy and melodrama, he made his first decided success. He was Pylades to Macready's Orestes in Ambrose Philips's *Distressed Mother* when Macready made his first appearance at that theatre (1816). He created the parts of Appius Claudius in Sheridan Knowles's *Virginius* (1820) and of Modus in his *Hunchback* (1832). In 1827 he organized the company, including Macready and Miss Smithson, which acted Shakespeare in Paris. On his return to London he played Romeo to Fanny Kemble's Juliet (1830). Two of Abbot's melodramas, *The Youthful Days of Frederick the Great* (1817) and *Swedish Patriotism* (1819), were produced at Covent Garden. He died in poverty at Baltimore, Maryland.

ABBOT (from the Hebrew *ab*, a father, through the Syriac *abba*, Lat. *abbas*, gen. *abbatis*, O.E. *abbad*, fr. late Lat. form *abbad-em* changed in 13th century under influence of the Lat. form to *abbat*, used alternatively till the end of the 17th century; Ger. *Abt*; Fr. *abbé*), the head and chief governor of a community of monks, called also in the East hegumenos or archimandrite. The title had its origin in the monasteries of Syria, whence it spread through the East, and soon became accepted generally in all languages as the designation of the head of a monastery. At first it was employed as a respectful title for any monk, as we learn from St Jerome, who denounced the custom on the ground that Christ had said, "Call no man father on earth" (in *Epist. ad Gal.* iv. 6, in Matt. xxiii. 9), but it was soon restricted to the superior. The name "abbot," though general in the West, was never universal. Among the Dominicans, Carmelites, Augustinians, &c., the superior was called *Praepositus*, "provost," and *Prior*; among the Franciscans, *Custos*, "guardian"; and by the monks of Camaldoli, *Major*.

In Egypt, the first home of monasticism, the jurisdiction of the abbot, or archimandrite, was but loosely defined. Sometimes he ruled over only one community, sometimes over several, each of which had its own abbot as well. Cassian speaks of an abbot of the Thebaid who had 500 monks under him, a number exceeded in other cases. By the rule of St Benedict, which, until the reform of Cluny, was the norm in the West, the abbot has jurisdiction over only one community. The rule, as was inevitable, was subject to frequent violations; but it was not until the foundation of the Cluniac Order that the idea of a supreme abbot, exercising jurisdiction over all the houses of an order, was definitely recognized. New styles were devised to express this new relation; thus the abbot of Monte Cassino was called *abbas abbatum*, while the chiefs of other orders had the titles *abbas generalis*, or *magister* or *minister generalis*.

Monks, as a rule, were laymen, nor at the outset was the abbot any exception. All orders of clergy, therefore, even the "doorkeeper," took precedence of him. For the reception of the sacraments, and for other religious offices, the abbot and his monks were commanded to attend the nearest church (*Novellae*, 133, c. ii.). This rule naturally proved inconvenient when a monastery was situated in a desert or at a distance from a city, and necessity compelled the ordination of abbots. This innovation was not introduced without a struggle, ecclesiastical dignity being regarded as inconsistent with the higher spiritual life, but, before the close of the 5th century, at least in the East, abbots seem almost universally to have become deacons, if not presbyters. The change spread more slowly in the West, where the office of abbot was commonly filled by laymen till the end of the 7th century, and partially so up to the 11th. Ecclesiastical councils were, however, attended by abbots. Thus at that held at Constantinople, A.D. 448, for the condemnation of Eutyches, 23 archimandrites or abbots sign, with 30 bishops, and, *c.* A.D. 690, Archbishop Theodore promulgated a canon, inhibiting bishops from compelling abbots to attend councils. Examples are not uncommon in Spain and in England in Saxon times. Abbots were permitted by the second council of Nicaea, A.D. 787, to ordain their monks to the inferior orders. This rule was adopted in the West, and the strong prejudice against clerical monks having gradually broken down, eventually monks, almost without exception, took holy orders.

Abbots were originally subject to episcopal jurisdiction, and continued generally so, in fact, in the West till the 11th century. The Code of Justinian (lib. i. tit. iii. de Ep. leg. xl.) expressly subordinates the abbot to episcopal oversight. The first case recorded of the partial exemption of an abbot from episcopal control is that of Faustus, abbot of Lerins, at the council of Arles, A.D. 456; but the exorbitant claims and exactions of bishops, to which this repugnance to episcopal control is to be traced, far more than to the arrogance of abbots, rendered it increasingly frequent, and, in the 6th century, the practice of exempting religious houses partly or altogether from episcopal control, and making them responsible to the pope alone, received an impulse from Gregory the Great. These exceptions, introduced with a good object, had grown into a widespread evil by the 12th century, virtually creating an *imperium in imperio*, and depriving the bishop of all authority over the chief centres of influence in his diocese. In the 12th century the abbots of Fulda claimed precedence of the archbishop of Cologne. Abbots more and more assumed almost episcopal state, and in defiance of the prohibition of early councils and the protests of St Bernard and others, adopted the episcopal insignia of mitre, ring, gloves and sandals. It has been maintained that the right to wear mitres was sometimes granted by the popes to abbots before the 11th century, but the documents on which this claim is based are not genuine (J. Braun, *Liturgische Gewandung*, p. 453). The first undoubted instance is the bull by which Alexander II. in 1063 granted the use of the mitre to Egelsinus, abbot of the monastery of St Augustine at Canterbury (see MITRE). The mitred abbots in England were those of Abingdon, St Alban's, Bardney, Battle, Bury St Edmund's, St Augustine's Canterbury, Colchester, Croyland, Evesham, Glastonbury, Gloucester, St Benet's Hulme, Hyde, Malmesbury, Peterborough, Ramsey, Reading, Selby, Shrewsbury, Tavistock, Thorney, Westminster, Winchcombe, St Mary's York. Of these the precedence was originally yielded to the abbot of Glastonbury, until in A.D. 1154 Adrian IV. (Nicholas Breakspear) granted it to the abbot of St Alban's, in which monastery he had been brought up. Next after the abbot of St Alban's ranked the abbot of Westminster. To distinguish abbots from bishops, it was ordained that their mitre should be made of less costly materials, and should not be ornamented with gold, a rule which was soon entirely disregarded, and that the crook of their pastoral staff should turn inwards instead of outwards, indicating that their jurisdiction was limited to their own house.

The adoption of episcopal insignia by abbots was followed by an encroachment on episcopal functions, which had to be specially but ineffectually guarded against by the Lateran council, A.D. 1123. In the East, abbots, if in priests' orders, with the consent of the bishop, were, as we have seen, permitted by the second Nicene council, A.D. 787, to confer the tonsure and admit to the order of reader; but gradually abbots, in the West also, advanced higher claims, until we find them in A.D. 1489 permitted by Innocent IV. to confer both the subdiaconate and diaconate. Of course, they always and everywhere had the power of admitting their own monks and vesting them with the religious habit.

When a vacancy occurred, the bishop of the diocese chose the abbot out of the monks of the convent, but the right of election was transferred by jurisdiction to the monks themselves, reserving to the bishop the confirmation of the election and the benediction of the new abbot. In abbeys exempt from episcopal jurisdiction, the confirmation and benediction had to be conferred by the pope in person, the house being taxed with the expenses of the new abbot's journey to Rome. By the rule of St Benedict, the consent of the laity was in some undefined way required; but this seems never to have been practically enforced. It was necessary that an abbot should be at least 25 years of age, of legitimate birth, a monk of the house, unless it furnished no suitable candidate, when a liberty was allowed of electing from another convent, well instructed himself, and able to instruct others, one also who had learned how to command by having practised obedience. In some exceptional cases an abbot was allowed to name his own successor. Cassian speaks of an abbot in Egypt doing this; and in later times we have another example in the case of St Bruno. Popes and sovereigns gradually encroached on the rights of the monks, until in Italy the pope had usurped the nomination of all abbots, and the king in France, with the exception of Cluny, Prémontré and other houses, chiefs of their order. The election was for life, unless the abbot was canonically deprived by the chiefs of his order, or when he was directly subject to them, by the pope or the bishop.

The ceremony of the formal admission of a Benedictine abbot in medieval times is thus prescribed by the consuetudinary of Abingdon. The newly elected abbot was to put off his shoes at the door of the church, and proceed barefoot to meet the members of the house advancing in a procession. After proceeding up the nave, he was to kneel and pray at the topmost step of the entrance of the choir, into which he was to be introduced by the bishop or his commissary, and placed in his stall. The monks, then kneeling, gave him the kiss of peace on the hand, and rising, on the mouth, the abbot holding his staff of office. He then put on his shoes in the vestry, and a chapter was held, and the bishop or his commissary preached a suitable sermon.

The power of the abbot was paternal but absolute, limited, however, by the canons of the church, and, until the general establishment of exemptions, by episcopal control. As a rule, however, implicit obedience was enforced; to act without his orders was culpable; while it was a sacred duty to execute his orders, however unreasonable, until they were withdrawn. Examples among the Egyptian monks of this blind submission to the commands of the superiors, exalted into a virtue by those who regarded the entire crushing of the individual will as the highest excellence, are detailed by Cassian and others,—*e.g.* a monk watering a dry stick, day after day, for months, or endeavouring to remove a huge rock immensely exceeding his powers. St Jerome, indeed, lays down, as the principle of the compact between the abbot and his monks, that they should obey their superiors in all things, and perform whatever they commanded (Ep. 2, *ad Eustoch. de custod. virgin.*). So despotic did the tyranny become in the West, that in the time of Charlemagne it was necessary to restrain abbots by legal enactments from mutilating their monks and putting out their eyes; while the rule of St Columban ordained 100 lashes as the punishment for very slight offences. An abbot also had the power of excommunicating refractory nuns, which he might use if desired by their abbess.

The abbot was treated with the utmost submission and reverence by the brethren of his house. When he appeared either in church or chapter all present rose and bowed. His letters were received kneeling, like those of the pope and the king. If he gave a command, the monk receiving it was also to kneel. No monk might sit in his presence, or leave it without his permission. The highest place was naturally assigned to him, both in church and at table. In the East he was commanded to eat with the other monks. In the West the rule of St Benedict appointed him a separate table, at which he might entertain guests and strangers. This permission opening the door to luxurious living, the council of Aix, A.D. 817, decreed that the abbot should dine in the refectory, and be content with the ordinary fare of the monks, unless he had to entertain a guest. These ordinances proved, however, generally ineffectual to secure strictness of diet, and contemporaneous literature abounds with satirical remarks and complaints concerning the inordinate extravagance of the tables of the abbots. When the abbot condescended to dine in the refectory, his chaplains waited upon him with the dishes, a servant, if necessary, assisting them. At St Alban's the abbot took the lord's seat, in the centre of the high table, and was served on silver plate, and sumptuously entertained noblemen, ambassadors and strangers of quality. When abbots dined in their own private hall, the rule of St Benedict charged them to invite their monks to their table, provided there was room, on which occasions the guests were to abstain from quarrels, slanderous talk and idle gossiping.

The ordinary attire of the abbot was according to rule to be the same as that of the monks. But by the 10th century the rule was commonly set aside, and we find frequent complaints of abbots dressing in silk, and adopting sumptuous attire. They sometimes even laid aside the monastic habit altogether, and assumed a secular dress.[1] This was a necessary consequence of their following the chase, which was quite usual, and indeed at that time only natural. With the increase of wealth and power, abbots had lost much of their special religious character, and become great lords, chiefly distinguished from lay lords by celibacy. Thus we hear of abbots going out to sport, with their men carrying bows and arrows; keeping horses, dogs and huntsmen; and special mention is made of an abbot of Leicester, *c.* 1360, who was the most skilled of all the nobility in hare-hunting. In magnificence of equipage and retinue the abbots vied with the first nobles of the realm. They rode on mules with gilded bridles, rich saddles and housings, carrying hawks on their wrist, followed by an immense train of attendants. The bells of the churches were rung as they passed. They associated on equal terms with laymen of the highest distinction, and shared all their pleasures and pursuits. This rank and power was, however, often used most beneficially. For instance, we read of Whiting, the last abbot of Glastonbury, judicially murdered by Henry VIII., that his house was a kind of well-ordered court, where as many as 300 sons of noblemen and gentlemen, who had been sent to him for virtuous education, had been brought up, besides others of a meaner rank, whom he fitted for the universities. His table, attendance and officers were an honour to the nation. He would entertain as many as 500 persons of rank at one time, besides relieving the poor of the vicinity twice a week. He had his country houses and fisheries, and when he travelled to attend parliament his retinue amounted to upwards of 100 persons. The abbots of Cluny and Vendôme were, by virtue of their office, cardinals of the Roman church.

In process of time the title abbot was improperly transferred to clerics who had no connexion with the monastic system, as to the principal of a body of parochial clergy; and under the Carolingians to the chief chaplain of the king, *Abbas Curiae*, or military chaplain of the emperor, *Abbas Castrensis*. It even came to be adopted by purely secular officials. Thus the chief magistrate of the republic at Genoa was called *Abbas Populi*. Du Cange, in his glossary, also gives us *Abbas Campanilis*, *Clocherii*, *Palatii*, *Scholaris*, &c.

Lay abbots (M. Lat. *defensores*, *abbacomites*, *abbates laici*, *abbates milites*, *abbates saeculares* or *irreligiosi*, *abbatiarii*, or sometimes simply *abbates*) were the outcome of the growth of the feudal system from the 8th century onwards. The practice of *commendation*, by which—to meet a contemporary emergency—the revenues of the community were handed over to a lay lord, in return for his protection, early suggested to the emperors and kings the expedient of rewarding their warriors with rich abbeys held *in commendam*. During the Carolingian epoch the custom grew up of granting these as regular heritable fiefs or benefices, and by the 10th century, before the great Cluniac reform, the system was firmly established. Even the abbey of St Denis was held *in commendam* by Hugh Capet. The example of the kings was followed by the feudal nobles, sometimes by making a temporary concession permanent, sometimes without any form of commendation whatever. In England the abuse was rife in the 8th century, as may be gathered from the acts of the council of Cloveshoe. These lay abbacies were not merely a question of overlordship, but implied the concentration in lay hands of all the rights, immunities and jurisdiction of the foundations, *i.e.* the more or less complete secularization of spiritual institutions. The lay abbot took his recognized rank in the feudal hierarchy, and was free to dispose of his fief as in the case of any other. The enfeoffment of abbeys differed in form and degree. Sometimes the monks were directly subject to the lay abbot; sometimes he appointed a substitute to perform the spiritual functions, known usually as dean (*decanus*), but also as abbot (*abbas legitimus*, *monasticus*, *regularis*). When the great reform of the 11th century had put an end to the direct jurisdiction of the lay abbots, the honorary title of abbot continued to be held by certain of the great feudal families, as late as the 13th century and later, the actual head of the community retaining that of dean. The connexion of the lesser lay abbots with the abbeys, especially in the south of France, lasted longer; and certain feudal families retained the title of *abbés chevaliers* (abbates milites) for centuries, together with certain rights over the abbey lands or revenues. The abuse was not confined to the West. John, patriarch of Antioch, at the beginning of the 12th century, informs us that in his time most monasteries had been handed over to laymen, *beneficiarii*, for life, or for part of their lives, by the emperors.

In conventual cathedrals, where the bishop occupied the place of the abbot, the functions usually devolving on the superior of the monastery were performed by a prior.

The title *abbé* (Ital. *abbate*), as commonly used in the Catholic church on the European continent, is the equivalent of the English "Father," being loosely applied to all who have received the tonsure. This use of the title is said to have originated in the right conceded to the king of France, by the concordat between Pope Leo X. and Francis I. (1516), to appoint *abbés commendataires* to most of the abbeys in France. The expectation of obtaining these sinecures drew young men towards the church in considerable numbers, and the class of abbés so formed—*abbés de cour* they were sometimes called, and sometimes (ironically) *abbés de sainte espérance*, abbés of St Hope—came to hold a recognized position. The connexion many of them had with the church was of the slenderest kind, consisting mainly in adopting the name of *abbé*, after a remarkably moderate course of theological study, practising celibacy and wearing a distinctive dress—a short dark-violet coat with narrow collar. Being men of presumed learning and undoubted leisure, many of the class found admission to the houses of the French nobility as tutors or advisers. Nearly every great family had its abbé. The class did not survive the Revolution; but the courtesy title of abbé, having long lost all connexion in people's minds with any special ecclesiastical function, remained as a convenient general term applicable to any clergyman.

In the German Evangelical church the title of abbot (*Abt*) is sometimes bestowed, like *abbé*, as an honorary distinction, and sometimes survives to designate the heads of monasteries converted at the Reformation into collegiate foundations. Of these the most noteworthy is the abbey of Lokkum in Hanover, founded as a Cistercian house in 1163 by Count Wilbrand of Hallermund, and reformed in 1593. The abbot of Lokkum, who still carries a pastoral staff, takes precedence of all the clergy of Hanover, and is *ex officio* a member of the consistory of the kingdom. The governing body of the abbey consists of abbot, prior and the "convent" of canons (*Stiftsherren*).

See Joseph Bingham, *Origines ecclesiasticae* (1840); Du Cange, *Glossarium med. et inf. Lat.* (ed. 1883); J. Craigie Robertson, *Hist. of the Christian Church* (1858–1873); Edmond Martène, *De antiquis ecclesiae ritibus* (Venice, 1783); C. F. R. de Montalembert, *Les moines d'occident depuis S. Benoît jusqu'à S. Bernard* (1860–1877); Achille Luchaire, *Manuel des institutions françaises* (Par. 1892).

(E. V.; W. A. P.)

ABBOTSFORD, formerly the residence of Sir Walter Scott, situated on the S. bank of the Tweed, about 3 m. W. of Melrose, Roxburghshire, Scotland, and nearly 1 m. from Abbotsford Ferry station on the North British railway, connecting Selkirk and Galashiels. The nucleus of the estate was a small farm of 100 acres, called Cartleyhole, nicknamed Clarty (*i.e.* muddy) Hole, and bought by Scott on the lapse of his lease (1811) of the neighbouring house of Ashestiel. It was added to from time to time, the last and principal acquisition being that of Toftfield

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[1] Walworth, the fourth abbot of St Alban's, *c.* 930, is charged by Matthew Paris with adopting the attire of a sportsman.

(afterwards named Huntlyburn), purchased in 1817. The new house was then begun and completed in 1824. The general ground-plan is a parallelogram, with irregular outlines, one side overlooking the Tweed; and the style is mainly the Scottish Baronial. Into various parts of the fabric were built relics and curiosities from historical structures, such as the doorway of the old Tolbooth in Edinburgh. Scott had only enjoyed his residence one year when (1825) he met with that reverse of fortune which involved the estate in debt. In 1830 the library and museum were presented to him as a free gift by the creditors. The property was wholly disencumbered in 1847 by Robert Cadell, the publisher, who cancelled the bond upon it in exchange for the family's share in the copyright of Sir Walter's works. Scott's only son Walter did not live to enjoy the property, having died on his way from India in 1847. Among subsequent possessors were Scott's son-in-law, J. G. Lockhart, J. R. Hope Scott, Q.C., and his daughter (Scott's great-granddaughter), the Hon. Mrs Maxwell Scott. Abbotsford gave its name to the "Abbotsford Club," a successor of the Bannatyne and Maitland clubs, founded by W. B. D. D. Turnbull in 1834 in Scott's honour, for printing and publishing historical works connected with his writings. Its publications extended from 1835 to 1864.

See Lockhart, *Life of Scott*; Washington Irving, *Abbotsford and Newstead Abbey*; W. S. Crockett, *The Scott Country*.

ABBOTT, EDWIN ABBOTT (1838–), English schoolmaster and theologian, was born on the 20th of December 1838. He was educated at the City of London school and at St John's College, Cambridge, where he took the highest honours in the classical, mathematical and theological triposes, and became fellow of his college. In 1862 he took orders. After holding masterships at King Edward's School, Birmingham, and at Clifton College, he succeeded G. F. Mortimer as headmaster of the City of London school in 1865 at the early age of twenty-six. He was Hulsean lecturer in 1876. He retired in 1889, and devoted himself to literary and theological pursuits. Dr Abbott's liberal inclinations in theology were prominent both in his educational views and in his books. His *Shakespearian Grammar* (1870) is a permanent contribution to English philology. In 1885 he published a life of Francis Bacon. His theological writings include three anonymously published religious romances—*Philochristus* (1878), *Onesimus* (1882), *Silanus* (1906). More weighty contributions are the anonymous theological discussion *The Kernel and the Husk* (1886), *Philomythus* (1891), his book on *Cardinal Newman as an Anglican* (1892), and his article "The Gospels" in the ninth edition of the *Encyclopaedia Britannica*, embodying a critical view which caused considerable stir in the English theological world; he also wrote *St Thomas of Canterbury, his Death and Miracles* (1898), *Johannine Vocabulary* (1905), *Johannine Grammar* (1906).

His brother, Evelyn Abbott (1843–1901), was a well-known tutor of Balliol, Oxford, and author of a scholarly *History of Greece*.

ABBOTT, EMMA (1849–1891), American singer, was born at Chicago and studied in Milan and Paris. She had a fine soprano voice, and appeared first in opera in London under Colonel Mapleson's direction at Covent Garden, also singing at important concerts. She organized an opera company known by her name, and toured extensively in the United States, where she had a great reputation. In 1873 she married E. J. Wetherell. She died at Salt Lake City on the 5th of January 1891.

ABBOTT, JACOB (1803–1879), American writer of books for the young, was born at Hallowell, Maine, on the 14th of November 1803. He graduated at Bowdoin College in 1820; studied at Andover Theological Seminary in 1821, 1822, and 1824; was tutor in 1824–1825, and from 1825 to 1829 was professor of mathematics and natural philosophy in Amherst College; was licensed to preach by the Hampshire Association in 1826; founded the Mount Vernon School for young ladies in Boston in 1829, and was principal of it in 1829–1833; was pastor of Eliot Congregational Church (which he founded), at Roxbury, Mass., in 1834–1835; and was, with his brothers, a founder, and in 1843–1851 a principal of Abbott's Institute, and in 1845–1848 of the Mount Vernon School for boys, in New York City. He was a prolific author, writing juvenile stories, brief histories and biographies, and religious books for the general reader, and a few works in popular science. He died on the 31st of October 1879 at Farmington, Maine, where he had spent part of his time since 1839, and where his brother Samuel Phillips Abbott founded in 1844 the Abbott School, popularly called "Little Blue." Jacob Abbott's "Rollo Books"—*Rollo at Work*, *Rollo at Play*, *Rollo in Europe*, &c. (28 vols.)—are the best known of his writings, having as their chief characters a representative boy and his associates. In them Abbott did for one or two generations of young American readers a service not unlike that performed earlier, in England and America, by the authors of *Evenings at Home*, *Sandford and Merton*, and the *Parent's Assistant*. Of his other writings (he produced more than two hundred volumes in all), the best are the *Franconia Stories* (10 vols.), twenty-two volumes of biographical histories in a series of thirty-two volumes (with his brother John S. C. Abbott), and the *Young Christian*,—all of which had enormous circulations.

His sons, Benjamin Vaughan Abbott (1830–1890), Austin Abbott (1831–1896), both eminent lawyers, Lyman Abbott (*q.v.*), and Edward Abbott (1841–1908), a clergyman, were also well-known authors.

See his *Young Christian, Memorial Edition, with a Sketch of the Author by one of his sons, i.e.* Edward Abbott (New York, 1882), with a bibliography of his works.

ABBOTT, JOHN STEVENS CABOT (1805–1877), American writer, was born in Brunswick, Maine, on the 18th of September 1805. He was a brother of Jacob Abbott, and was associated with him in the management of Abbott's Institute, New York City, and in the preparation of his series of brief historical biographies. He is best known, however, as the author of a partisan and unscholarly, but widely popular and very readable *History of Napoleon Bonaparte* (1855), in which the various elements and episodes in Napoleon's career are treated with some skill in arrangement, but with unfailing adulation. Dr Abbott graduated at Bowdoin College in 1825, prepared for the ministry at Andover Theological Seminary, and between 1830 and 1844, when he retired from the ministry, preached successively at Worcester, Roxbury and Nantucket, Massachusetts. He died at Fair Haven, Connecticut, on the 17th of June 1877. He was a voluminous writer of books on Christian ethics, and of histories, which now seem unscholarly and untrustworthy, but were valuable in their time in cultivating a popular interest in history. In general, except that he did not write juvenile fiction, his work in subject and style closely resembles that of his brother, Jacob Abbott.

ABBOTT, LYMAN (1835–), American divine and author, was born at Roxbury, Massachusetts, on the 18th of December 1835, the son of Jacob Abbott. He graduated at the University of New York in 1853, studied law, and was admitted to the bar in 1856; but soon abandoned the legal profession, and, after studying theology with his uncle, J. S. C. Abbott, was ordained a minister of the Congregational Church in 1860. He was pastor of a church in Terre Haute, Indiana, in 1860–1865, and of the New England Church in New York City in 1865–1869. From 1865 to 1868 he was secretary of the American Union (Freedman's) Commission. In 1869 he resigned his pastorate to devote himself to literature. He was an associate editor of *Harper's Magazine*, was editor of the *Illustrated Christian Weekly*, and was co-editor (1876–1881) of *The Christian Union* with Henry Ward Beecher, whom he succeeded in 1888 as pastor of Plymouth Church, Brooklyn. From this pastorate he resigned ten years later. From 1881 he was editor-in-chief of *The Christian Union*, renamed *The Outlook* in 1893; this periodical reflected his efforts toward social reform, and, in theology, a liberality, humanitarian and nearly unitarian. The latter characteristics marked his published works also.

His works include *Jesus of Nazareth* (1869); *Illustrated Commentary on the New Testament* (4 vols., 1875); *A Study in Human Nature* (1885); *Life of Christ* (1894); *Evolution of Christianity* (Lowell Lectures, 1896); *The Theology of an Evolutionist* (1897); *Christianity and Social Problems* (1897); *Life and Letters of Paul* (1898);

The Life that Really is (1899); *Problems of Life* (1900); *The Rights of Man* (1901); *Henry Ward Beecher* (1903); *The Christian Ministry* (1905); *The Personality of God* (1905); *Industrial Problems* (1905); and *Christ's Secret of Happiness* (1907). He edited *Sermons of Henry Ward Beecher* (2 vols., 1868).

ABBOTTABAD, a town of British India, 4120 ft. above sea-level, 63 m. from Rawalpindi, the headquarters of the Hazara district in the N.W. Frontier Province, called after its founder, Sir James Abbott, who settled this wild district after the annexation of the Punjab. It is an important military cantonment and sanatorium, being the headquarters of a brigade in the second division of the northern army corps. In 1901 the population of the town and cantonment was 7764.

ABBREVIATION (Lat. *brevis*, short), strictly a shortening; more particularly, an "abbreviation" is a letter or group of letters, taken from a word or words, and employed to represent them for the sake of brevity. Abbreviations, both of single words and of phrases, having a meaning more or less fixed and recognized, are common in ancient writings and inscriptions (see PALAEOGRAPHY and DIPLOMATIC), and very many are in use at the present time. A distinction is to be observed between abbreviations and the contractions that are frequently to be met with in old manuscripts, and even in early printed books, whereby letters are dropped out here and there, or particular collocations of letters represented by somewhat arbitrary symbols. The commonest form of abbreviation is the substitution for a word of its initial letter; but, with a view to prevent ambiguity, one or more of the other letters are frequently added. Letters are often doubled to indicate a plural or a superlative.

I. CLASSICAL ABBREVIATIONS.—The following list contains a selection from the abbreviations that occur in the writings and inscriptions of the Romans:—

A.

A.	Absolvo, Aedilis, Aes, Ager, Ago, Aio, Amicus, Annus, Antiquo, Auctor, Auditor, Augustus, Aulus, Aurum, Aut.
A.A.	Aes alienum, Ante audita, Apud agrum, Aurum argentum.
AA.	Augusti. AAA. Augusti tres.
A.A.A.F.F.	Auro argento aere flando feriundo.[1]
A.A.V.	Alter ambove.
A.C.	Acta causa, Alius civis.
A.D.	Ante diem; *e.g.* A.D.V. Ante diem quintum.
A.D.A.	Ad dandos agros.
AED.	Aedes, Aedilis, Aedilitas.
AEM. *and* AIM.	Aemilius, Aemilia.
AER.	Aerarium. AER.P. Aere publico.
A.F.	Actum fide, Auli filius.
AG.	Ager, Ago, Agrippa.
A.G.	Animo grato, Aulus Gellius.
A.L.AE. *and* A.L.E.	Arbitrium litis aestimandae.
A.M. *and* A.MILL.	Ad milliarium.
AN.	Aniensis, Annus, Ante.
ANN.	Annales, Anni, Annona.
ANT.	Ante, Antonius.
A.O.	Alii omnes, Amico optimo.
AP.	Appius, Apud.
A.P.	Ad pedes, Aedilitia potestate.
A.P.F.	Auro (*or* argento) publico feriundo.
A.P.M.	Amico posuit monumentum, Annorum plus minus.
A.P.R.C.	Anno post Romam conditam.
ARG.	Argentum.
AR.V.V.D.D.	Aram votam volens dedicavit, Arma votiva dono dedit.
A T.	A tergo. *Also* A TE. *and* A TER.
A.T.M.D.O.	Aio te mihi dare oportere.
AV.	Augur, Augustus, Aurelius.
A.V.	Annos vixit.
A.V.C.	Ab urbe condita.
AVG.	Augur, Augustus.
AVGG.	Augusti (*generally of two*). AVGGG. Augusti tres.
AVT.PR.R.	Auctoritas provinciae Romanorum.

B.

B.	Balbius, Balbus, Beatus, Bene, Beneficiarius, Beneficium, Bonus, Brutus, Bustum.
B. *for* V.	Berna Bivus, Bixit.
B.A.	Bixit anos, Bonis auguriis, Bonus amabilis.
BB. *or* B.B.	Bene bene, *i.e.* optime, Optimus.
B.D.	Bonae deae, Bonum datum.
B.DD.	Bonis deabus.
B.D.S.M.	Bene de se merenti.
B.F.	Bona femina, Bona fides, Bona fortuna, Bonum factum.
ꓭ.Ⅎ.	Bona femina, Bona filia.
B.H.	Bona hereditaria, Bonorum heres.
B.I.	Bonum judicium. B.I.I. Boni judicis judicium.
B.M.	Beatae memoriae, Bene merenti.
B.N.	Bona nostra, Bonum nomen.
BN.H.I.	Bona hic invenies.
B.P.	Bona paterna, Bonorum potestas, Bonum publicum.
B.Q.	Bene quiescat, Bona quaesita.
B.RP.N.	Bono reipublicae natus.
BRT.	Britannicus.
B.T.	Bonorum tutor, Brevi tempore.
B.V.	Bene vale, Bene vixit, Bonus vir.
B.V.V.	Balnea vina Venus.
BX.	Bixit, *for* vixit.

C.

C.	Caesar, Caius, Caput, Causa, Censor, Civis, Cohors, Colonia, Comitialis (dies), Condemno, Consul, Cum, Curo, Custos.
Ↄ.	Caia, Centuria, Cum, *the prefix* Con.
C.B.	Civis bonus, Commune bonum, Conjugi benemerenti, Cui bono.
C.C.	Calumniae causa, Causa cognita, Conjugi carissimae, Consilium cepit, Curiae consulto.
C.C.C.	Calumniae cavendae causa.
C.C.F.	Caesar (*or* Caius) curavit faciendum, Caius Caii filius.
CC.VV.	Clarissimi viri.
C.D.	Caesaris decreto, Caius Decius, Comitialibus diebus.
CES.	Censor, Censores. CESS. Censores.
C.F.	Causa fiduciae, Conjugi fecit, Curavit faciendum.
C.H.	Custos heredum, Custos hortorum.
C.I.	Caius Julius, Consul jussit, Curavit judex.
CL.	Clarissimus, Claudius, Clodius, Colonia.
CL.V.	Clarissimus vir, Clypeum vovit.
C.M.	Caius Marius, Causa mortis.
CN.	Cnaeus.
COH.	Coheres, Cohors.
COL.	Collega, Collegium, Colonia, Columna.
COLL.	Collega, Coloni, Coloniae.
COM.	Comes, Comitium, Comparatum.
CON.	Conjux, Consensus, Consiliarius, Consul, Consularis.
COR.	Cornelia (tribus), Cornelius, Corona, Corpus.
COS.	Consiliarius, Consul, Consulares. COSS. Consules.
C.P.	Carissimus *or* Clarissimus puer, Civis publicus, Curavit ponendum.
C.R.	Caius Rufus, Civis Romanus, Curavit reficiendum.
CS.	Caesar, Communis, Consul.
C.V.	Clarissimus *or* Consularis vir.
CVR.	Cura, Curator, Curavit, Curia.

D.

D.	Dat, Dedit, &c., De, Decimus, Decius, Decretum, Decurio, Deus, Dicit, &c., Dies, Divus, Dominus, Domus, Donum.
D.C.	Decurio coloniae, Diebus comitialibus, Divus Caesar.
D.D.	Dea Dia, Decurionum decreto, Dedicavit, Deo dedit, Dono dedit.
D.D.D.	Datum decreto decurionum, Dono dedit dedicavit.
D.E.R.	De ea re.
DES.	Designatus.
D.I.	Dedit imperator, Diis Immortalibus, Diis inferis.
D.I.M.	Deo invicto Mithrae, Diis inferis Manibus.
D.M.	Deo Magno, Dignus memoria, Diis Manibus, Dolo malo.
D.O.M.	Deo Optimo Maximo.
D.P.S.	Dedit proprio sumptu, Deo perpetuo sacrum, De pecunia sua.

E.

E.	Ejus, Eques, Erexit, Ergo, Est, Et, Etiam, Ex.
EG.	Aeger, Egit, Egregius.
E.M.	Egregiae memoriae, Ejusmodi, Erexit monumentum.
EQ.M.	Equitum magister.
E.R.A.	Ea res agitur.

F.

F.	Fabius, Facere, Fecit, &c., Familia, Fastus (dies), Felix, Femina, Fides, Filius, Flamen, Fortuna, Frater, Fuit, Functus.
F.C.	Faciendum curavit, Fidei commissum, Fiduciae causa.
F.D.	Fidem dedit, Flamen Dialis, Fraude donavit.
F.F.F.	Ferro flamma fame, Fortior fortuna fato.
FL.	Filius, Flamen, Flaminius, Flavius.
F.L.	Favete linguis, Fecit libens, Felix liber.
FR.	Forum, Fronte, Frumentarius.
F.R.	Forum Romanum.

G.

G.	Gaius (=Caius), Gallia, Gaudium, Gellius, Gemina, Gens, Gesta, Gratia.
G.F.	Gemina fidelis (*applied to a legion*). *So* G.P.F. Gemina pia fidelis.

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[1] Describing the function of the *triumviri monetales*.

GL.	Gloria.
GN.	Genius, Gens, Genus, Gnaeus (=Cnaeus).
G.P.R.	Genio populi Romani.

H.

H.	Habet, Heres, Hic, Homo, Honor, Hora.
HER.	Heres, Herennius. HER. *and* HERC. Hercules.
H.L.	Hac lege, Hoc loco, Honesto loco.
H.M.	Hoc monumentum, Honesta mulier, Hora mala.
H.S.E.	Hic sepultus est, Hic situs est.
H.V.	Haec urbs, Hic vivit, Honeste vixit, Honestus vir.

I.

I.	Immortalis, Imperator, In, Infra, Inter, Invictus, Ipse, Isis, Judex, Julius, Junius, Jupiter, Justus.
IA.	Jam, Intra.
I.C.	Julius Caesar, Juris Consultum, Jus civile.
ID.	Idem, Idus, Interdum.
I.D.	Inferis diis, Jovi dedicatum, Jus dicendum, Jussu Dei.
I.D.M.	Jovi deo magno.
I.F.	In foro, In fronte.
I.H.	Jacet hic, In honestatem, Justus homo.
IM.	Imago, Immortalis, Immunis, Impensa.
IMP.	Imperator, Imperium.
I.O.M.	Jovi optimo maximo.
I.P.	In publico, Intra provinciam, Justa persona.
I.S.V.P.	Impensa sua vivus posuit.

K.

K.	Kaeso, Caia, Calumnia, Caput, Carus, Castra.
K., KAL. *and* KL.	Kalendae.

L.

L.	Laelius, Legio, Lex, Libens, Liber, Libra, Locus, Lollius, Lucius, Ludus.
LB.	Libens, Liberi, Libertus.
L.D.D.D.	Locus datus decreto decurionum.
LEG.	Legatus, Legio.
LIB.	Liber, Liberalitas, Libertas, Libertus, Librarius.
LL.	Leges, Libentissime, Liberti.
L.M.	Libens merito, Locus monumenti.
L.S.	Laribus sacrum, Libens solvit, Locus sacer.
LVD.	Ludus.
LV.P.F.	Ludos publicos fecit.

M.

M.	Magister, Magistratus, Magnus, Manes, Marcus, Marius, Marti, Mater, Memoria, Mensis, Miles, Monumentum, Mortuus, Mucius, Mulier.
M'.	Manius.
M.D.	Magno Deo, Manibus diis, Matri deum, Merenti dedit.
MES.	Mensis. MESS. Menses.
M.F.	Mala fides, Marci filius, Monumentum fecit.
M.I.	Matri Idaeae, Matri Isidi, Maximo Jovi.
MNT. *and* MON.	Moneta.
M.P.	Male positus, Monumentum posuit.
M.S.	Manibus sacrum, Memoriae sacrum, Manu scriptum.
MVN.	Municeps, *or* municipium; *so also* MN., MV. *and* MVNIC.
M.V.S.	Marti ultori sacrum, Merito votum solvit.

N.

N.	Natio, Natus, Nefastus (dies), Nepos, Neptunus, Nero, Nomen, Non, Nonae, Noster, Novus, Numen, Numerius, Numerus, Nummus.
NEP.	Nepos, Neptunus.
N.F.C.	Nostrae fidei commissum.
N.L.	Non licet, Non liquet, Non longe.
N.M.V.	Nobilis memoriae vir.
NN.	Nostri. NN., NNO. *and* NNR. Nostrorum.
NOB.	Nobilis. NOB., NOBR. *and* NOV. Novembris.
N.P.	Nefastus primo (*i.e.* priore parte diei), Non potest.

O.

O.	Ob, Officium, Omnis, Oportet, Optimus, Opus, Ossa.
OB.	Obiit, Obiter, Orbis.
O.C.S.	Ob cives servatos.
O.H.F.	Omnibus honoribus functus.
O.H.S.S.	Ossa hic sita sunt.
OR.	Hora, Ordo, Ornamentum.
O.T.B.Q.	Ossa tua bene quiescant.

P.

P.	Pars, Passus, Pater, Patronus, Pax, Perpetuus, Pes, Pius, Plebs, Pondo, Populus, Post, Posuit, Praeses, Praetor, Primus, Pro, Provincia, Publicus, Publius, Puer.
P.C.	Pactum conventum, Patres conscripti, Pecunia constituta, Ponendum curavit, Post consulatum, Potestate censoria.
P.F.	Pia fidelis, Pius felix, Promissa fides, Publii filius.
P.M.	Piae memoriae, Plus minus, Pontifex maximus.
P.P.	Pater patratus, Pater patriae, Pecunia publica, Praepositus, Primipilus, Propraetor.
PR.	Praeses, Praetor, Pridie, Princeps.
P.R.	Permissu reipublicae, Populus Romanus.
P.R.C.	Post Romam conditam.
PR.PR.	Praefectus praetorii, Propraetor.
P.S.	Pecunia sua, Plebiscitum, Proprio sumptu, Publicae saluti.
P.V.	Pia victrix, Praefectus urbi, Praestantissimus vir.

Q.

Q.	Quaestor, Quando, Quantus, Que, Qui, Quinquennalis, Quintus, Quirites.
Q.D.R.	Qua de re.
Q.I.S.S.	Quae infra scripta sunt; *so* Q.S.S.S. Quae supra, &c.
QQ.	Quaecunque, Quinquennalis, Quoque.
Q.R.	Quaestor reipublicae.

R.

R.	Recte, Res, Respublica, Retro, Rex, Ripa, Roma, Romanus, Rufus, Rursus.
R.C.	Romana civitas, Romanus civis.
RESP. *and* RP.	Respublica.
RET.P. *and* RP.	Retro pedes.

S.

S.	Sacrum, Scriptus, Semis, Senatus, Sepultus, Servius, Servus, Sextus, Sibi, Sine, Situs, Solus, Solvit, Sub, Suus.
SAC.	Sacerdos, Sacrificium, Sacrum.
S.C.	Senatus consultum.
S.D.	Sacrum diis, Salutem dicit, Senatus decreto, Sententiam dedit.
S.D.M.	Sacrum diis Manibus, Sine dolo malo.
SER.	Servius, Servus.
S.E.T.L.	Sit ei terra levis.
SN.	Senatus, Sententia, Sine.
S.P.	Sacerdos perpetua, Sine pecunia, Sua pecunia.
S.P.Q.R.	Senatus populusque Romanus.
S.S.	Sanctissimus senatus, Supra scriptum.
S.V.B.E.E.Q.V.	Si vales bene est, ego quidem valeo.

T.

T.	Terminus, Testamentum, Titus, Tribunus, Tu, Turma, Tutor.
TB., TI. *and* TIB.	Tiberius.
TB., TR. *and* TRB.	Tribunus.
T.F.	Testamentum fecit, Titi filius, Titulum fecit, Titus Flavius.
TM.	Terminus, Testamentum, Thermae.
T.P.	Terminum posuit, Tribunicia potestate, Tribunus plebis.
TVL.	Tullius, Tullus.

V.

V.	Urbs, Usus, Uxor, Vale, Verba, Vestalis, Vester, Vir, Vivus, Vixit, Volo, Votum.
V.A.	Veterano assignatus, Vixit annos.
V.C.	Vale conjux, Vir clarissimus, Vir consularis.
V.E.	Verum etiam, Vir egregius, Visum est.
V.F.	Usus fructus, Verba fecit, Vivus fecit.
V.P.	Urbis praefectus, Vir perfectissimus, Vivus posuit.
V.R.	Urbs Roma, Uti rogas, Votum reddidit.

II. MEDIEVAL ABBREVIATIONS.—Of the different kinds of abbreviations in use in the middle ages, the following are examples:—

A.M.	Ave Maria.
B.P.	Beatus Paulus, Beatus Petrus.
CC.	Carissimus (*also plur.* Carissimi), Clarissimus, Circum.
D.	Deus, Dominicus, Dux.
D.N.PP.	Dominus noster Papa.
FF.	Felicissimus, Fratres, Pandectae (*prob. for Gr.* Π).
I.C. *or* I.X.	Jesus Christus.
I.D.N.	In Dei nomine.
KK.	Karissimus (*or* -mi).
MM.	Magistri, Martyres, Matrimonium, Meritissimus.
O.S.B.	Ordinis Sancti Benedicti.
PP.	Papa, Patres, Piissimus.
R.F.	Rex Francorum.
R.P.D.	Reverendissimus Pater Dominus.
S.C.M.	Sacra Caesarea Majestas.
S.M.E.	Sancta Mater Ecclesia.
S.M.M.	Sancta Mater Maria.
S.R.I.	Sanctum Romanum Imperium.
S.V.	Sanctitas Vestra, Sancta Virgo.
V.	Venerabilis, Venerandus.
V.R.P.	Vestra Reverendissima Paternitas.

III. ABBREVIATIONS NOW IN USE.—The import of these will often be readily understood from the connexion in which they occur. There is no occasion to explain here the common abbreviations used for Christian names, books of Scripture, months of the year, points of the compass, grammatical and mathematical terms, or familiar titles, like "Mr," &c.

The ordinary abbreviations, now or recently in use, may be conveniently classified under the following headings:—

1. Abbreviated Titles and Designations.

A.A.	Associate of Arts.
A.B.	Able-bodied seaman; (in America) Bachelor of Arts.
A.D.C.	Aide-de-Camp.
A.M.	(*Artium Magister*), Master of Arts.
A.R.A.	Associate of the Royal Academy.
A.R.I.B.A.	Associate of the Royal Institution of British Architects.
A.R.S.A.	Associate of the Royal Scottish Academy.
B.A.	Bachelor of Arts.
Bart.	Baronet.
B.C.L.	Bachelor of Civil Law.
B.D.	Bachelor of Divinity.
B.LL.	Bachelor of Laws.
B.Sc.	Bachelor of Science.
C.	Chairman.
C.A.	Chartered Accountant.
C.B.	Companion of the Bath.
C.E.	Civil Engineer.
C.I.E.	Companion of the Order of the Indian Empire.
C.M.	(*Chirurgiae Magister*), Master in Surgery.
C.M.G.	Companion of St Michael and St George.
C.S.I.	Companion of the Star of India.
D.C.L.	Doctor of Civil Law.
D.D.	Doctor of Divinity.
D.Lit. *or* Litt. D.	Doctor of Literature.
D.M.	Doctor of Medicine (Oxford).
D.Sc.	Doctor of Science.
D.S.O.	Distinguished Service Order.
Ebor.	(*Eboracensis*) of York.[1]
F.C.S.	Fellow of the Chemical Society.
F.D.	(*Fidei Defensor*), Defender of the Faith.
F.F.P.S.	Fellow of the Faculty of Physicians and Surgeons (Glasgow).
F.G.S.	Fellow of the Geological Society.
F.K.Q.C.P.I.	Fellow of King and Queen's College of Physicians in Ireland.
F.L.S.	Fellow of the Linnaean Society.
F.M.	Field Marshal.
F.P.S.	Fellow of the Philological Society.
F.R.A.S.	Fellow of the Royal Astronomical Society.
F.R.C.P.	Fellow of the Royal College of Physicians.
F.R.C.P.E.	Fellow of the Royal College of Physicians of Edinburgh.
F.R.C.S.	Fellow of the Royal College of Surgeons.
F.R.G.S.	Fellow of the Royal Geographical Society.
F.R.H.S.	Fellow of the Royal Horticultural Society.
F.R.Hist.Soc.	Fellow of the Royal Historical Society.
F.R.I.B.A.	Fellow of the Royal Institution of British Architects.
F.R.S.	Fellow of the Royal Society.
F.R.S.E.	Fellow of the Royal Society of Edinburgh.
F.R.S.L.	Fellow of the Royal Society of Literature.
F.S.A.	Fellow of the Society of Antiquaries.
F.S.S.	Fellow of the Statistical Society.
F.Z.S.	Fellow of the Zoological Society.
G.C.B.	Knight Grand Cross of the Bath.
G.C.H.	Knight Grand Cross of Hanover.
G.C.I.E.	Knight Grand Commander of the Order of the Indian Empire.
G.C.M.G.	Knight Grand Cross of St Michael and St George.
G.C.S.I.	Knight Grand Commander of the Star of India.
G.C.V.O.	Knight Grand Commander of the Victorian Order.
H.H.	His or Her Highness.
H.I.H.	His or Her Imperial Highness.
H.I.M.	His or Her Imperial Majesty.
H.M.	His or Her Majesty.
H.R.H.	His or Her Royal Highness.
H.S.H.	His or Her Serene Highness.
J.	Judge.
J.C.D.	(*Juris Canonici Doctor*, or *Juris Civilis Doctor*), Doctor of Canon or Civil Law.
J.U.D.	(*Juris utriusque Doctor*), Doctor of Civil and Canon Law.
J.P.	Justice of the Peace.
K.C.	King's Counsel.
K.C.B.	Knight Commander of the Bath.
K.C.I.E.	Knight Commander of the Order of the Indian Empire.
K.C.M.G.	Knight Commander of St Michael and St George.
K.C.S.I.	Knight Commander of the Star of India.
K.C.V.O.	Knight Commander of the Victorian Order.
K.G.	Knight of the Garter.
K.P.	Knight of St Patrick.
K.T.	Knight of the Thistle.
L.A.H.	Licentiate of the Apothecaries' Hall.
L.C.C.	London County Council, or Councillor.
L.C.J.	Lord Chief Justice
L.J.	Lord Justice.
L.L.A.	Lady Literate in Arts.
LL.B.	(*Legum Baccalaureus*), Bachelor of Laws.
LL.D.	(*Legum Doctor*), Doctor of Laws.
LL.M.	(*Legum Magister*), Master of Laws.
L.R.C.P.	Licentiate of the Royal College of Physicians.
L.R.C.S.	Licentiate of the Royal College of Surgeons.
L.S.A.	Licentiate of the Apothecaries' Society.
M.A.	Master of Arts.
M.B.	(*Medicinae Baccalaureus*), Bachelor of Medicine.
M.C.	Member of Congress.
M.D.	(*Medicinae Doctor*), Doctor of Medicine.
M.Inst.C.E.	Member of the Institute of Civil Engineers.
M.P.	Member of Parliament.
M.R.	Master of the Rolls.
M.R.C.P.	Member of the Royal College of Physicians.
M.R.C.S.	Member of the Royal College of Surgeons.
M.R.I.A.	Member of the Royal Irish Academy.
Mus.B.	Bachelor of Music.
Mus.D.	Doctor of Music.
M.V.O.	Member of the Victorian Order.
N.P.	Notary Public.
O.M.	Order of Merit.
P.C.	Privy Councillor.
Ph.D.	(*Philosophiae Doctor*), Doctor of Philosophy.
P.P.	Parish Priest.
P.R.A.	President of the Royal Academy.
R.	(*Rex, Regina*), King, Queen.
R. & I.	*Rex et Imperator.*
R.A.	Royal Academician, Royal Artillery.
R.A.M.	Royal Academy of Music.
R.E.	Royal Engineers.
Reg. Prof.	Regius Professor.
R.M.	Royal Marines, Resident Magistrate.
R.N.	Royal Navy.
S. *or* St.	Saint.
S.S.C.	Solicitor before the Supreme Courts [of Scotland].
S.T.P.	(*Sacrosanctae Theologiae Professor*), Professor of Sacred Theology.
V.C.	Vice-Chancellor, Victoria Cross.
V.G.	Vicar-General.
V.S.	Veterinary Surgeon.
W.S.	Writer to the Signet [in Scotland]. *Equivalent to Attorney.*

2. Abbreviations Denoting Monies, Weights, and Measures.[2]

ac.	acre.
bar.	barrel.
bus.	bushel.
c.	cent.
c. (*or* cub.) ft. &c.	cubic foot, &c.
cwt.	hundredweight.
d.	(*denarius*), penny.
deg.	degree.
dr.	drachm *or* dram.
dwt.	pennyweight.
f.	franc.
fl.	florin.
ft.	foot.
fur.	furlong.
gal.	gallon.
gr.	grain.
h. *or* hr.	hour.
hhd.	hogshead.
in.	inch.
kilo.	kilometre.
L.,[3]	£,[3] or *l.* (*libra*), pound (money).
lb. *or* ℔.	(*libra*), pound (weight).
m. *or* mi.	mile, minute.
♏.	minim.
mo.	month.
na.	nail.
oz.	ounce.
pk.	peck.
po.	pole.
pt.	pint.
q.	(*quadrans*), farthing.
qr.	quarter.
qt.	quart.
ro.	rood.
Rs.[3]	rupees.
s. *or* /	(*solidus*), shilling.
s. *or* sec.	second.
sc. *or* scr.	scruple.
sq. ft. &c.	square foot, &c.
st.	stone.
yd.	yard.

3. Miscellaneous Abbreviations.

A.	Accepted.
A.C.	(*Ante Christum*), Before Christ.
acc., a/c. *or* acct.	Account.
A.D.	(*Anno Domini*), In the year of our Lord.
A.E.I.O.U.	Austriae est imperare orbi universo,[4] *or* Alles Erdreich Ist Oesterreich Unterthan.
Aet. *or* Aetat.	(*Aetatis*, [*anno*]), In the year of his age.
A.H.	(*Anno Hegirae*), In the year of the Hegira (the Mohammedan era).

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[1] An archbishop or bishop, in writing his signature, substitutes for his surname the name of his see; thus the prelates of Canterbury, York, Oxford, London, &c., subscribe themselves with their initials (Christian names only), followed by Cantuar., Ebor., Oxon., Londin. (sometimes London.), &c.

[2] Characters, not properly abbreviations, are used in the same way; *e.g.* ° ′ ″ for "degrees, minutes, seconds" (circular measure); ℥, ʒ, ℈ for "ounces, drachms, scruples." ℥ is probably to be traced to the written form of the *z* in "*oz.*"

[3] These forms (as well as $, the symbol for the American dollar) are placed before their amounts.

[4] *It is given to Austria to rule the whole earth.* The device of Austria, first adopted by Frederick III.

could only increase their pride and leaning to rebellion. His confession that he had known only twenty happy days in his long reign is perhaps a moral tale, to be classed with the "*omnia fui, et nil expedit*" of Septimius Severus.

In the agony of the Omayyad dynasty in Spain, two princes of the house were proclaimed caliphs for a very short time, Abd-ar-rahman IV. Mortaḍa (1017), and Abd-ar-rahman V. Mostadir (1023–1024). Both were the mere puppets of factions, who deserted them at once. Abd-ar-rahman IV. was murdered in the year in which he was proclaimed, at Guadiz, when fleeing from a battle in which he had been deserted by his supporters. Abd-ar-rahman V. was proclaimed caliph in December 1023 at Cordova, and murdered in January 1024 by a mob of unemployed workmen, headed by one of his own cousins.

The history of the Omayyads in Spain is the subject of the *Histoire des Musulmans d'Espagne*, by R. Dozy (Leiden, 1861). (D. H.)

ABD-EL-AZIZ IV. (1880–   ), sultan of Morocco, son of Sultan Mulai el Hasan III. by a Circassian wife. He was fourteen years of age on his father's death in 1894. By the wise action of Si Ahmad bin Musa, the chamberlain of El Hasan, Abd-el-Aziz's accession to the sultanate was ensured with but little fighting. Si Ahmad became regent and for six years showed himself a capable ruler. On his death in 1900 the regency ended, and Abd-el-Aziz took the reins of government into his own hands, with an Arab from the south, El Menebhi, for his chief adviser. Urged by his Circassian mother, the sultan sought advice and counsel from Europe and endeavoured to act up to it. But disinterested advice was difficult to obtain, and in spite of the unquestionable desire of the young ruler to do the best for the country, wild extravagance both in action and expenditure resulted, leaving the sultan with depleted exchequer and the confidence of his people impaired. His intimacy with foreigners and his imitation of their ways were sufficient to rouse fanaticism and create dissatisfaction. His attempt to reorganize the finances by the systematic levy of taxes was hailed with delight, but the government was not strong enough to carry the measures through, and the money which should have been used to pay the taxes was employed to purchase firearms. Thus the benign intentions of Mulai Abd-el-Aziz were interpreted as weakness, and Europeans were accused of having spoiled the sultan and of being desirous of spoiling the country. When British engineers were employed to survey the route for a railway between Mequinez and Fez, this was reported as indicating an absolute sale of the country. The fanaticism of the people was aroused, and a revolt broke out near the Algerian frontier. Such was the condition of things when the news of the Anglo-French Agreement of 1904 came as a blow to Abd-el-Aziz, who had relied on England for support and protection against the inroads of France. On the advice of Germany he proposed the assembly of an international conference at Algeciras in 1906 to consult upon methods of reform, the sultan's desire being to ensure a condition of affairs which would leave foreigners with no excuse for interference in the control of the country, and would promote its welfare, which Abd-el-Aziz had earnestly desired from his accession to power. The sultan gave his adherence to the Act of the Algeciras Conference, but the state of anarachy into which Morocco fell during the latter half of 1906 and the beginning of 1907 showed that the young ruler lacked strength sufficient to make his will respected by his turbulent subjects. In May 1907 the southern tribes invited Mulai Hafid, an elder brother of Abd-el-Aziz, and viceroy at Marrakesh, to become sultan, and in the following August Hafid was proclaimed sovereign there with all the usual formalities. In the meantime the murder of Europeans at Casablanca had led to the occupation of that port by France. In September Abd-el-Aziz arrived at Rabat from Fez and endeavoured to secure the support of the European powers against his brother. From France he accepted the grand cordon of the Legion of Honour, and was later enabled to negotiate a loan. His leaning to Christians aroused further opposition to his rule, and in January 1908 he was declared deposed by the ulema of Fez, who offered the throne to Hafid. After months of inactivity Abd-el-Aziz made an effort to restore his authority, and quitting Rabat in July he marched on Marrakesh. His force, largely owing to treachery, was completely overthrown (August 19th) when near that city, and Abd-el-Aziz fled to Settat within the French lines round Casablanca. In November he came to terms with his brother, and thereafter took up his residence in Tangier as a pensioner of the new sultan. He declared himself more than reconciled to the loss of the throne, and as looking forward to a quiet, peaceful life. (See MOROCCO, *History*.)

ABD-EL-KADER (*c.* 1807–1883), amir of Mascara, the great opponent of the conquest of Algeria by France, was born near Mascara in 1807 or 1808. His family were *sherifs* or descendants of Mahomet, and his father, Mahi-ed-Din, was celebrated throughout North Africa for his piety and charity. Abd-el-Kader received the best education attainable by a Mussulman of princely rank, especially in theology and philosophy, in horsemanship and in other manly exercises. While still a youth he was taken by his father on the pilgrimage to Mecca and Medina and to the tomb of Sidi Abd-el-Kader El Jalili at Bagdad—events which stimulated his natural tendency to religious enthusiasm. While in Egypt in 1827, Abd-el-Kader is stated to have been impressed, by the reforms then being carried out by Mehemet Ali, with the value of European civilization, and the knowledge he then gained affected his career. Mahi-ed-Din and his son returned to Mascara shortly before the French occupation of Algiers (July 1830) destroyed the government of the Dey. Coming forward as the champion of Islam against the infidels, Abd-el-Kader was proclaimed amir at Mascara in 1832. He prosecuted the war against France vigorously and in a short time had rallied to his standard all the tribes of western Algeria. The story of his fifteen years' struggle against the French is given under ALGERIA. To the beginning of 1842 the contest went in favour of the amir; thereafter he found in Marshal Bugeaud an opponent who proved, in the end, his master. Throughout this period Abd-el-Kader showed himself a born leader of men, a great soldier, a capable administrator, a persuasive orator, a chivalrous opponent. His fervent faith in the doctrines of Islam was unquestioned, and his ultimate failure was due in considerable measure to the refusal of the Kabyles, Berber mountain tribes whose Mahommedanism is somewhat loosely held, to make common cause with the Arabs against the French. On the 21st of December 1847, the amir gave himself up to General Lamoricière at Sidi Brahim. On the 23rd, his submission was formally made to the duc d'Aumale, then governor of Algeria. In violation of the promise that he would be allowed to go to Alexandria or St Jean d'Acre, on the faith of which he surrendered, Abd-el-Kader and his family were detained in France, first at Toulon, then at Pau, being in November 1848 transferred to the château of Amboise. There Abd-el-Kader remained until October 1852, when he was released by Napoleon III. on taking an oath never again to disturb Algeria. The amir then took up his residence in Brusa, removing in 1855 to Damascus. In July 1860, when the Moslems of that city, taking advantage of disturbances among the Druses of Lebanon, attacked the Christian quarter and killed over 3000 persons, Abd-el-Kader helped to repress the outbreak and saved large numbers of Christians. For this action the French government, which granted the amir a pension of £4000, bestowed on him the grand cross of the Legion of Honour. In 1865, he visited Paris and London, and was again in Paris at the exposition of 1867. In 1871, when the Algerians again rose in revolt, Abd-el-Kader wrote to them counselling submission to France. After his surrender in 1847 he devoted himself anew to theology and philosophy, and composed a philosophical treatise, of which a French translation was published in 1858 under the title of *Rappel à l'intelligent. Avis à l'indifférent.* He also wrote a book on the Arab horse. He died at Damascus on the 26th of May 1883.

See Commdt. J. Pichon, *Abd el Kader*, 1807–1883 (Paris [1899]); Alex. Bellemare, *Abd-el-Kader: sa vie politique et militaire* (Paris, 1863); Col. C. H. Churchill, *The Life of Abdel Kader* (London, 1867).

ABDERA, an ancient seaport town on the south coast of Spain, between Malaca and New Carthage, in the district inhabited by the Bastuli. It was founded by the Carthaginians as a trading station, and after a period of decline became under the Romans one of the more important towns in the province of Hispania Baetica. It was situated on a hill above the modern Adra (*q.v.*). Of its coins the most ancient bear the Phoenician inscription *abdrt* with the head of Heracles (Melkarth) and a tunny-fish; those of Tiberius (who seems to have made the place a colony) show the chief temple of the town with two tunny-fish erect in the form of columns. For inscriptions relating to the Roman municipality see *C.I.L.* ii. 267.

ABDERA, a town on the coast of Thrace near the mouth of the Nestos, and almost opposite Thasos. Its mythical foundation was attributed to Heracles, its historical to a colony from Clazomenae in the 7th century B.C. But its prosperity dates from 544 B.C., when the majority of the people of Teos migrated to Abdera after the Ionian revolt to escape the Persian yoke (Herod. i. 168); the chief coin type, a gryphon, is identical with that of Teos; the coinage is noted for the beauty and variety of its reverse types. The town seems to have declined in importance after the middle of the 4th century. The air of Abdera was proverbial as causing stupidity; but among its citizens was the philosopher Democritus. The ruins of the town may still be seen on Cape Balastra; they cover seven small hills, and extend from an eastern to a western harbour; on the S.W. hills are the remains of the medieval settlement of Polystylon.

Mittheil. d. deutsch. Inst. Athens, xii. (1887), p. 161 (Regel); *Mém. de l'Acad. des Inscriptions*, xxxix. 211; K. F. Hermann, *Ges. Abh.* 90-111, 370 ff.

ABDICATION (Lat. *abdicatio*, disowning, renouncing, from *ab*, from, and *dicare*, to declare, to proclaim as not belonging to one), the act whereby a person in office renounces and gives up the same before the expiry of the time for which it is held. In Roman law, the term is especially applied to the disowning of a member of a family, as the disinheriting of a son, but the word is seldom used except in the sense of surrendering the supreme power in a state. Despotic sovereigns are at liberty to divest themselves of their powers at any time, but it is otherwise with a limited monarchy. The throne of Great Britain cannot be lawfully abdicated unless with the consent of the two Houses of Parliament. When James II., after throwing the great seal into the Thames, fled to France in 1688, he did not formally resign the crown, and the question was discussed in parliament whether he had forfeited the throne or had abdicated. The latter designation was agreed on, for in a full assembly of the Lords and Commons, met in convention, it was resolved, in spite of James's protest, "that King James II. having endeavoured to subvert the constitution of the kingdom, by breaking the original contract between king and people, and, by the advice of Jesuits and other wicked persons, having violated the fundamental laws, and having withdrawn himself out of this kingdom, has abdicated the government, and that the throne is thereby vacant." The Scottish parliament pronounced a decree of forfeiture and deposition. Among the most memorable abdications of antiquity may be mentioned that of Sulla the dictator, 79 B.C., and that of the Emperor Diocletian, A.D. 305. The following is a list of the more important abdications of later times:—

	A.D.
Benedict IX., pope	1048
Stephen II. of Hungary	1131
Albert (the Bear) of Brandenburg	1169
Ladislaus III. of Poland	1206
Celestine V., pope	Dec. 13, 1294
John Baliol of Scotland	1296
John Cantacuzene, emperor of the East	1355
Richard II. of England	Sept. 29, 1399
John XXIII., pope	1415
Eric VII. of Denmark and XIII. of Sweden	1439
Murad II., Ottoman Sultan	1444 and 1445
Charles V., emperor	1556
Christina of Sweden	1654
John Casimir of Poland	1668
James II. of England	1688
Frederick Augustus of Poland	1704
Philip V. of Spain	1724
Victor Amadeus II. of Sardinia	1730
Ahmed III., Sultan of Turkey	1730
Charles of Naples (on accession to throne of Spain)	1759
Stanislaus II. of Poland	1795
Charles Emanuel IV. of Sardinia	June 4, 1802
Charles IV. of Spain	Mar. 19, 1808
Joseph Bonaparte of Naples	June 6, 1808
Gustavus IV. of Sweden	Mar. 29, 1809
Louis Bonaparte of Holland	July 2, 1810
Napoleon I., French Emperor	April 4, 1814, and June 22, 1815
Victor Emanuel of Sardinia	Mar. 13, 1821
Charles X. of France	Aug. 2, 1830
Pedro of Brazil[1]	April 7, 1831
Miguel of Portgual	May 26, 1834
William I. of Holland	Oct. 7, 1840
Louis Philippe, king of the French	Feb. 24, 1848
Louis Charles of Bavaria	Mar. 21, 1848
Ferdinand of Austria	Dec. 2, 1848
Charles Albert of Sardinia	Mar. 23, 1849
Leopold II. of Tuscany	July 21, 1859
Isabella II. of Spain	June 25, 1870
Amadeus I. of Spain	Feb. 11, 1873
Alexander of Bulgaria	Sept. 7, 1886
Milan of Servia	Mar. 6, 1889

ABDOMEN (a Latin word, either from *abdere*, to hide, or from a form *adipomen*, from *adeps*, fat), the belly, the region of the body containing most of the digestive organs. (See for anatomical details the articles ALIMENTARY CANAL, and ANATOMY, *Superficial and Artistic*.)

ABDOMINAL SURGERY.—The diseases affecting this region are dealt with generally in the article DIGESTIVE ORGANS, and under their own names (*e.g.* APPENDICITIS). The term "abdominal surgery" covers generally the operations which involve opening the abdominal cavity, and in modern times this field of work has been greatly extended. In this Encyclopaedia the surgery of each abdominal organ is dealt with, for the most part, in connexion with the anatomical description of that organ (see STOMACH, KIDNEY, LIVER, &c.); but here the general principles of abdominal surgery may be discussed.

Exploratory Laparotomy.—In many cases of serious intra-abdominal disease it is impossible for the surgeon to say exactly what is wrong without making an incision and introducing his finger, or, if need be, his hand among the intestines. With due care this is not a perilous or serious procedure, and the great advantage appertaining to it is daily being more fully recognized. It was Dr Oliver Wendell Holmes, the American physiologist and poet, who remarked that one cannot say of what wood a table is made without lifting up the cloth; so also it is often impossible to say what is wrong inside the abdomen without making an opening into it. When an opening is made in such circumstances—provided only it is done soon enough—the successful treatment of the case often becomes a simple matter. An exploratory operation, therefore, should be promptly resorted to as a means of diagnosis, and not left as a last resource till the outlook is well-nigh hopeless.

It is probable that if the question were put to any experienced hospital surgeon if he had often had cause to regret having advised recourse to an exploratory operation on the abdomen, his answer would be in the negative, but that, on the other hand, he had not infrequently had cause to regret that he had not resorted to it, *post-mortem* examination having shown that if only he had insisted on an exploration being made, some band, some adhesion, some tumour, some abscess might have been satisfactorily dealt with, which, left unsuspected in the dark cavity, was accountable for the death. A physician by himself is helpless in these cases.

Much of the rapid advance which has of late been made in the results of abdominal surgery is due to the improved relationship which exists between the public and the surgical profession. In former days it was not infrequently said, "If a surgeon is called in he is sure to operate." Not only have the uncle Sultan Abd-ul-Aziz on his visit to England and France in 1867. At his accession spectators were struck by the fearless manner in which he rode, practically unattended, on his way to be girt with the sword of Eyub. He was supposed to be of liberal principles, and the more conservative of his subjects were for some years after his accession inclined to regard him with suspicion as a too ardent reformer. But the circumstances of the country at his accession were ill adapted for liberal developments. Default in the public funds and an empty treasury, the insurrection in Bosnia and the Herzegovina, the war with Servia and Montenegro, the feeling aroused throughout Europe by the methods adopted in stamping out the Bulgarian rebellion, all combined to prove to the new sultan that he could expect little aid from the Powers. But, still clinging to the groundless belief, for which British statesmen had, of late at least, afforded Turkey no justification, that Great Britain at all events would support him, he obstinately refused to give ear to the pressing requests of the Powers that the necessary reforms should be instituted. The international Conference which met at Constantinople towards the end of 1876 was, indeed, startled by the salvo of guns heralding the promulgation of a constitution, but the demands of the Conference were rejected, in spite of the solemn warnings addressed to the sultan by the Powers; Midhat Pasha, the author of the constitution, was exiled; and soon afterwards his work was suspended, though figuring to this day on the Statute-Book. Early in 1877 the disastrous war with Russia followed. The hard terms, embodied in the treaty of San Stefano, to which Abd-ul-Hamid was forced to consent, were to some extent amended at Berlin, thanks in the main to British diplomacy (see EUROPE, *History*); but by this time the sultan had lost all confidence in England, and thought that he discerned in Germany, whose supremacy was evidenced in his eyes by her capital being selected as the meeting-place of the Congress, the future friend of Turkey. He hastened to employ Germans for the reorganization of his finances and his army, and set to work in the determination to maintain his empire in spite of the difficulties surrounding him, to resist the encroachments of foreigners, and to take gradually the reins of absolute power into his own hands, being animated by a profound distrust, not unmerited, of his ministers. Financial embarrassments forced him to consent to a foreign control over the Debt, and the decree of December 1881, whereby many of the revenues of the empire were handed over to the Public Debt Administration for the benefit of the bondholders, was a sacrifice of principle to which he could only have consented with the greatest reluctance. Trouble in Egypt, where a discredited khedive had to be deposed, trouble on the Greek frontier and in Montenegro, where the Powers were determined that the decisions of the Berlin Congress should be carried into effect, were more or less satisfactorily got over. In his attitude towards Arabi, the would-be saviour of Egypt, Abd-ul-Hamid showed less than his usual astuteness, and the resulting consolidation of England's hold over the country contributed still further to his estrangement from Turkey's old ally. The union in 1885 of Bulgaria with Eastern Rumelia, the severance of which had been the great triumph of the Berlin Congress, was another blow. Few people south of the Balkans dreamed that Bulgaria could be anything but a Russian province, and apprehension was entertained of the results of the union until it was seen that Russia really and entirely disapproved of it. Then the best was made of it, and for some years the sultan preserved towards Bulgaria an attitude skilfully calculated so as to avoid running counter either to Russian or to German wishes. Germany's friendship was not entirely disinterested, and had to be fostered with a railway or loan concession from time to time, until in 1899 the great object aimed at, the Bagdad railway, was conceded. Meanwhile, aided by docile instruments, the sultan had succeeded in reducing his ministers to the position of secretaries, and in concentrating the whole administration of the country into his own hands at Yildiz. But internal dissension was not thereby lessened. Crete was constantly in turmoil, the Greeks were dissatisfied, and from about 1890 the Armenians began a violent agitation with a view to obtaining the reforms promised them at Berlin. Minor troubles had occurred in 1892 and 1893 at Marsovan and Tokat. In 1894 a more serious rebellion in the mountainous region of Sassun was ruthlessly stamped out; the Powers insistently demanded reforms, the eventual grant of which in the autumn of 1895 was the signal for a series of massacres, brought on in part by the injudicious and threatening acts of the victims, and extending over many months and throughout Asia Minor, as well as in the capital itself. The reforms became more or less a dead letter. Crete indeed profited by the grant of extended privileges, but these did not satisfy its turbulent population, and early in 1897 a Greek expedition sailed to unite the island to Greece. War followed, in which Turkey was easily successful and gained a small rectification of frontier; then a few months later Crete was taken over "*en depôt*" by the Four Powers—Germany and Austria not participating,—and Prince George of Greece was appointed their mandatory. In the next year the sultan received the visit of the German emperor and empress.

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[1] Pedro had succeeded to the throne of Portugal in 1826, but abdicated it at once in favour of his daughter.

Abd-ul-Hamid had always resisted the pressure of the European Powers to the last moment, in order to seem to yield only to overwhelming force, while posing as the champion of Islam against aggressive Christendom. The Panislamic propaganda was encouraged; the privileges of foreigners in the Ottoman Empire—often an obstacle to government—were curtailed; the new railway to the Holy Places was pressed on, and emissaries were sent to distant countries preaching Islam and the caliph's supremacy. This appeal to Moslem sentiment was, however, powerless against the disaffection due to perennial misgovernment. In Mesopotamia and Yemen disturbance was endemic; nearer home, a semblance of loyalty was maintained in the army and among the Mussulman population by a system of delation and espionage, and by wholesale arrests; while, obsessed by terror of assassination, the sultan withdrew himself into fortified seclusion in the palace of Yildiz.

The national humiliation of the situation in Macedonia (*q.v.*), together with the resentment in the army against the palace spies and informers, at last brought matters to a crisis. The remarkable revolution associated with the names of Niazi Bey and Enver Bey, the young Turk leaders, and the Committee of Union and Progress is described elsewhere (see TURKEY: *History*); here it must suffice to say that Abd-ul-Hamid, on learning of the threat of the Salonica troops to march on Constantinople (July 23), at once capitulated. On the 24th an *iradé* announced the restoration of the suspended constitution of 1875; next day, further *iradés* abolished espionage and the censorship, and ordered the release of political prisoners. On the 10th of December the sultan opened the Turkish parliament with a speech from the throne in which he said that the first parliament had been "temporarily dissolved until the education of the people had been brought to a sufficiently high level by the extension of instruction throughout the empire."

The correct attitude of the sultan did not save him from the suspicion of intriguing with the powerful reactionary elements in the state, a suspicion confirmed by his attitude towards the counter-revolution of the 13th of April, when an insurrection of the soldiers and the Moslem populace of the capital overthrew the committee and the ministry. The committee, restored by the Salonica troops, now decided on Abd-ul-Hamid's deposition, and on the 27th of April his brother Reshid Effendi was proclaimed sultan as Mahommed V. The ex-sultan was conveyed into dignified captivity at Salonica.

ABD-UL-MEJID (1823–1861), sultan of Turkey, was born on the 23rd of April 1823, and succeeded his father Mahmud II. on the 2nd of July 1839. Mahmud appears to have been unable to effect the reforms he desired in the mode of educating his children, so that his son received no better education than that given, according to use and wont, to Turkish princes in the harem. When Abd-ul-Mejid succeeded to the throne, the affairs of Turkey were in an extremely critical state. At the very time his father died, the news was on its way to Constantinople that the Turkish army had been signally defeated at Nezib by that of the rebel Egyptian viceroy, Mehemet Ali;

and the Turkish fleet was at the same time on its way to Alexandria, where it was handed over by its commander, Ahmed Pasha, to the same enemy, on the pretext that the young sultan's advisers were sold to Russia. But through the intervention of the European Powers Mehemet Ali was obliged to come to terms, and the Ottoman empire was saved. (See Mehemet Ali.) In compliance with his father's express instructions, Abd-ul-Mejid set at once about carrying out the reforms to which Mahmud had devoted himself. In November 1839 was proclaimed an edict, known as the Hatt-i-sherif of Gulhané, consolidating and enforcing these reforms, which was supplemented at the close of the Crimean war by a similar statute issued in February 1856. By these enactments it was provided that all classes of the sultan's subjects should have security for their lives and property; that taxes should be fairly imposed and justice impartially administered; and that all should have full religious liberty and equal civil rights. The scheme met with keen opposition from the Mussulman governing classes and the *ulema*, or privileged religious teachers, and was but partially put in force, especially in the remoter parts of the empire; and more than one conspiracy was formed against the sultan's life on account of it. Of the other measures of reform promoted by Abd-ul-Mejid the more important were—the reorganization of the army (1843–1844), the institution of a council of public instruction (1846), the abolition of an odious and unfairly imposed capitation tax, the repression of slave trading, and various provisions for the better administration of the public service and for the advancement of commerce. For the public history of his times—the disturbances and insurrections in different parts of his dominions throughout his reign, and the great war successfully carried on against Russia by Turkey, and by England, France and Sardinia, in the interest of Turkey (1853–1856)—see Turkey, and Crimean War. When Kossuth and others sought refuge in Turkey, after the failure of the Hungarian rising in 1849, the sultan was called on by Austria and Russia to surrender them, but boldly and determinedly refused. It is to his credit, too, that he would not allow the conspirators against his own life to be put to death. He bore the character of being a kind and honourable man, if somewhat weak and easily led. Against this, however, must be set down his excessive extravagance, especially towards the end of his life. He died on the 25th of June 1861, and was succeeded by his brother, Abd-ul-Aziz, as the oldest survivor of the family of Osman. He left several sons, of whom two, Murad V. and Abd-ul-Hamid II., eventually succeeded to the throne. In his reign was begun the reckless system of foreign loans, carried to excess in the ensuing reign, and culminating in default, which led to the alienation of European sympathy from Turkey and, indirectly, to the dethronement and death of Abd-ul-Aziz.

ABDUR RAHMAN KHAN, amir of Afghanistan (*c.* 1844–1901), was the son of Afzul Khan, who was the eldest son of Dost Mahomed Khan, the famous amir, by whose success in war the Barakzai family established their dynasty in the rulership of Afghanistan. Before his death at Herat, 9th June 1863, Dost Mahomed had nominated as his successor Shere Ali, his third son, passing over the two elder brothers, Afzul Khan and Azim Khan; and at first the new amir was quietly recognized. But after a few months Afzul Khan raised an insurrection in the northern province, between the Hindu Kush mountains and the Oxus, where he had been governing when his father died; and then began a fierce contest for power among the sons of Dost Mahomed, which lasted for nearly five years. In this war, which resembles in character, and in its striking vicissitudes, the English War of the Roses at the end of the 15th century, Abdur Rahman soon became distinguished for ability and daring energy. Although his father, Afzul Khan, who had none of these qualities, came to terms with the Amir Shere Ali, the son's behaviour in the northern province soon excited the amir's suspicion, and Abdur Rahman, when he was summoned to Kabul, fled across the Oxus into Bokhara. Shere Ali threw Afzul Khan into prison, and a serious revolt followed in south Afghanistan; but the amir had scarcely suppressed it by winning a desperate battle, when Abdur Rahman's reappearance in the north was a signal for a mutiny of the troops stationed in those parts and a gathering of armed bands to his standard. After some delay and desultory fighting, he and his uncle, Azim Khan, occupied Kabul (March 1866). The amir Shere Ali marched up against them from Kandahar; but in the battle that ensued at Sheikhabad on 10th May he was deserted by a large body of his troops, and after his signal defeat Abdur Rahman released his father, Afzul Khan, from prison in Ghazni, and installed him upon the throne as amir of Afghanistan. Notwithstanding the new amir's incapacity, and some jealousy between the real leaders, Abdur Rahman and his uncle, they again routed Shere Ali's forces, and occupied Kandahar in 1867; and when at the end of that year Afzul Khan died, Azim Khan succeeded to the rulership, with Abdur Rahman as his governor in the northern province. But towards the end of 1868 Shere Ali's return, and a general rising in his favour, resulting in their defeat at Tinah Khan on the 3rd of January 1869, forced them both to seek refuge in Persia, whence Abdur Rahman proceeded afterwards to place himself under Russian protection at Samarkand. Azim died in Persia in October 1869.

This brief account of the conspicuous part taken by Abdur Rahman in an eventful war, at the beginning of which he was not more than twenty years old, has been given to show the rough school that brought out his qualities of resource and fortitude, and the political capacity needed for rulership in Afghanistan. He lived in exile for eleven years, until on the death, in 1879, of Shere Ali, who had retired from Kabul when the British armies entered Afghanistan, the Russian governor-general at Tashkent sent for Abdur Rahman, and pressed him to try his fortunes once more across the Oxus. In March 1880 a report reached India that he was in northern Afghanistan; and the governor-general, Lord Lytton, opened communications with him to the effect that the British government were prepared to withdraw their troops, and to recognize Abdur Rahman as amir of Afghanistan, with the exception of Kandahar and some districts adjacent. After some negotiations, an interview took place between him and Mr (afterwards Sir) Lepel Griffin, the diplomatic representative at Kabul of the Indian government, who described Abdur Rahman as a man of middle height, with an exceedingly intelligent face and frank and courteous manners, shrewd and able in conversation on the business in hand. At the durbar on the 22nd of July 1880, Abdur Rahman was officially recognized as amir, granted assistance in arms and money, and promised, in case of unprovoked foreign aggression, such further aid as might be necessary to repel it, provided that he followed British advice in regard to his external relations. The evacuation of Afghanistan was settled on the terms proposed, and in 1881 the British troops also made over Kandahar to the new amir; but Ayub Khan, one of Shere Ali's sons, marched upon that city from Herat, defeated Abdur Rahman's troops, and occupied the place in July. This serious reverse roused the amir, who had not at first displayed much activity. He led a force from Kabul, met Ayub's army close to Kandahar, and the complete victory which he there won forced Ayub Khan to fly into Persia. From that time Abdur Rahman was fairly seated on the throne at Kabul, and in the course of the next few years he consolidated his dominion over all Afghanistan, suppressing insurrections by a sharp and relentless use of his despotic authority. Against the severity of his measures the powerful Ghilzai tribe revolted, and were crushed by the end of 1887. In that year Ayub Khan made a fruitless inroad from Persia; and in 1888 the amir's cousin, Ishak Khan, rebelled against him in the north; but these two enterprises came to nothing.

In 1885, at the moment when (see Afghanistan) the amir was in conference with the British viceroy, Lord Dufferin, in India, the news came of a collision between Russian and Afghan troops at Panjdeh, over a disputed point in the demarcation of the north-western frontier of Afghanistan. Abdur Rahman's attitude at this critical juncture is a good example of his political sagacity. To one who had been a man of war from his youth up, who had won and lost many fights, the rout of a detachment and the forcible seizure of some debateable frontier lands was an untoward incident; but it was no sufficent reason for calling upon the British, although they had guaranteed his territory's integrity, to vindicate his rights by hostilities which would certainly bring upon him a Russian invasion from the north, and would compel his British allies to throw an army into Afghanistan from the south-east. His interest lay in keeping powerful neighbours, whether friends or foes, outside his kingdom. He knew this to be the only policy that would be supported by the Afghan nation; and although for some time a rupture with Russia seemed imminent, while the Indian government made ready for that contingency, the amir's reserved and circumspect tone in the consultations with him helped to turn the balance between peace and war, and substantially conduced towards a pacific solution. Abdur Rahman left on those who met him in India the impression of a clear-headed man of action, with great self-reliance and hardihood, not without indications of the implacable severity that too often marked his administration. His investment with the insignia of the highest grade of the Order of the Star of India appeared to give him much pleasure.

From the end of 1888 the amir passed eighteen months in his northern provinces bordering upon the Oxus, where he was engaged in pacifying the country that had been disturbed by revolts, and in punishing with a heavy hand all who were known or suspected to have taken any part in rebellion. Shortly afterwards (1892) he succeeded in finally beating down the resistance of the Hazara tribe, who vainly attempted to defend their immemorial independence, within their highlands, of the central authority at Kabul.

In 1893 Sir Henry Durand was deputed to Kabul by the government of India for the purpose of settling an exchange of territory required by the demarcation of the boundary between north-eastern Afghanistan and the Russian possessions, and in order to discuss with the amir other pending questions. The amir showed his usual ability in diplomatic argument, his tenacity where his own views or claims were in debate, with a sure underlying insight into the real situation. The territorial exchanges were amicably agreed upon; the relations between the Indian and Afghan governments, as previously arranged, were confirmed; and an understanding was reached upon the important and difficult subject of the border line of Afghanistan on the east, towards India. In 1895 the amir found himself unable, by reason of ill-health, to accept an invitation from Queen Victoria to visit England; but his second son Nasrullah Khan went in his stead.

Abdur Rahman died on the 1st of October 1901, being succeeded by his son Habibullah. He had defeated all enterprises by rivals against his throne; he had broken down the power of local chiefs, and tamed the refractory tribes; so that his orders were irresistible throughout the whole dominion. His government was a military despotism resting upon a well-appointed army; it was administered through officials absolutely subservient to an inflexible will and controlled by a widespread system of espionage; while the exercise of his personal authority was too often stained by acts of unnecessary cruelty. He held open courts for the receipt of petitioners and the dispensation of justice; and in the disposal of business he was indefatigable. He succeeded in imposing an organized government upon the fiercest and most unruly population in Asia; he availed himself of European inventions for strengthening his armament, while he sternly set his face against all innovations which, like railways and telegraphs, might give Europeans a foothold within his country. His adventurous life, his forcible character, the position of his state as a barrier between the Indian and the Russian empires, and the skill with which he held the balance in dealing with them, combined to make him a prominent figure in contemporary Asiatic politics and will mark his reign as an epoch in the history of Afghanistan.

The amir received an annual subsidy from the British government of 18½ lakhs of rupees. He was allowed to import munitions of war. In 1896 he adopted the title of Zia-ul-Millat-ud-Din (Light of the nation and religion); and his zeal for the cause of Islam induced him to publish treatises on Jehad. His eldest son Habibullah Khan, with his brother Nasrullah Khan, was born at Samarkand. His youngest son, Mahomed Omar Jan, was born in 1889 of an Afghan mother, connected by descent with the Barakzai family.

See also S. Wheeler, F.R.G.S., *The Amir Abdur Rahman* (London, 1895); *The Life of Abdur Rahman, Amir of Afghanistan, G.C.B., G.C.S.I.*, edited by Mir Munshi, Sultan Mahommed Khan (2 vols., London, 1900); *At the Court of the Amir*, by J. A. Grey (1895).

(A. C. L.)

ABECEDARIANS, a nickname given to certain extreme Anabaptists (*q.v.*), who regarded the teaching of the Holy Spirit as all that was necessary, and so despised all human learning and even the power of reading the written word.

À BECKETT, GILBERT ABBOTT (1811–1856), English writer, was born in north London on the 9th of January 1811. He belonged to a family claiming descent from the father of St Thomas Becket. His elder brother, Sir William à Beckett (1806–1869), became chief justice of Victoria (Australia). Gilbert Abbott à Beckett was educated at Westminster school, and was called to the bar at Gray's Inn in 1841. He edited *Figaro in London*, and was one of the original staff of *Punch* and a contributor all his life. He was an active journalist on *The Times* and *The Morning Herald*, contributed a series of light articles to *The Illustrated London News*, conducted in 1846 *The Almanack of the Month* and found time to produce some fifty or sixty plays, among them dramatized versions of Dickens's shorter stories in collaboration with Mark Lemon. As poor-law commissioner he presented a valuable report to the home secretary regarding scandals in connexion with the Andover Union, and in 1849 he became a metropolitan police magistrate. He died at Boulogne on the 30th of August 1856 of typhus fever.

His eldest son GILBERT ARTHUR À BECKETT (1837–1891) was born at Hammersmith on the 7th of April 1837. He went up to Christ Church, Oxford, as a Westminster scholar in 1855, graduating in 1860. He was entered at Lincoln's Inn, but gave his attention chiefly to the drama, producing *Diamonds and Hearts* at the Haymarket in 1867, which was followed by other light comedies. His pieces include numerous burlesques and pantomimes, the libretti of *Savonarola* (Hamburg, 1884) and of *The Canterbury Pilgrims* (Drury Lane, 1884) for the music of Dr (afterwards Sir) C. V. Stanford. *The Happy Land* (Court Theatre, 1873), a political burlesque of W. S. Gilbert's *Wicked World*, was written in collaboration with F. L. Tomline. For the last ten years of his life he was on the regular staff of *Punch*. His health was seriously affected in 1889 by the death of his only son, and he died on the 15th of October 1891.

A younger son, ARTHUR WILLIAM À BECKETT (1844–1909), a well-known journalist and man of letters, was also on the staff of *Punch* from 1874 to 1902, and gave an account of his father and his own reminiscences in *The À Becketts of Punch* (1903). He died in London on the 14th of January 1909.

See also M. H. Spielmann, *The History of Punch* (1895).

ABEDNEGO, the name given in Babylon to Azariah, one of the companions of Daniel (Dan. i. 7, &c.). It is probably a corruption, perhaps deliberate, of Abednebo, "servant of Nebo," though G. Hoffmann thinks that the original form was Abednergo, for Abednergal, "servant of the god Nergal." C. H. Toy compares Barnebo, "son of Nebo," of which he regards Barnabas as a slightly disguised form (*Jewish Encyclopaedia*).

ABEKEN, HEINRICH (1809–1872), German theologian and Prussian official, was born at Berlin on the 8th of August 1809. He studied theology at Berlin and in 1834 became chaplain to the Prussian embassy in Rome. In 1841 he visited England, being commissioned by King Frederick William IV. to make arrangements for the establishment of the Protestant bishopric of Jerusalem. In 1848 he received an appointment in the Prussian ministry for foreign affairs, and in 1853 was promoted to be privy councillor of legation (Geheimer Legationsrath). He was much employed by Bismarck in the writing of official despatches, and stood high in the favour of King William, whom he often accompanied on his journeys as representative of the foreign office. He was present with the king during the campaigns of 1866 and 1870–71. In 1851 he published anonymously *Babylon und Jerusalem*, a slashing criticism of the views of the Countess von Hahn-Hahn (*q.v.*).

See *Heinrich Abeken, ein schlichtes Leben in bewegter Zeit* (Berlin, 1898), by his widow. This is valuable by reason of the letters written from the Prussian headquarters.

ABEL (Hebrew for *breath*), the second son of Adam, slain by Cain, his elder brother (Gen. iv. 1-16). The narrative in Genesis which tells us that "the Lord had respect unto Abel and to his offering, but unto Cain and to his offering he had not respect," is supplemented by the statement of the New Testament, that "by faith Abel offered unto God a more excellent sacrifice than Cain" (Heb. xi. 4), and that Cain slew Abel "because his own works were evil and his brother's righteous" (1 John iii. 12). See further under CAIN. The name has been identified with the Assyrian *ablu*, "son," but this is far from certain. It more probably means "herdsman" (cf. the name Jabal), and a distinction is drawn between the pastoral Abel and the agriculturist Cain. If Cain is the eponym of the Kenites it is quite possible that Abel was originally a South Judaean demigod or hero; on this, see Winckler, *Gesch. Israels*, ii. p. 189; E. Meyer, *Israeliten*, p. 395. A sect of *Abelitae*, who seem to have lived in North Africa, is mentioned by Augustine (*De Haeresibus*, lxxxvi.).

ABEL, SIR FREDERICK AUGUSTUS, BART. (1827–1902), English chemist, was born in London on the 17th of July 1827. After studying chemistry for six years under A. W. von Hofmann at the Royal College of Chemistry (established in London in 1845), he became professor of chemistry at the Royal Military Academy in 1851, and three years later was appointed chemist to the War Department and chemical referee to the government. During his tenure of this office, which lasted until 1888, he carried out a large amount of work in connexion with the chemistry of explosives. One of the most important of his investigations had to do with the manufacture of gun-cotton, and he developed a process, consisting essentially of reducing the nitrated cotton to fine pulp, which enabled it to be prepared with practically no danger and at the same time yielded the product in a form that increased its usefulness. This work to an important extent prepared the way for the "smokeless powders" which came into general use towards the end of the 19th century; cordite, the particular form adopted by the British government in 1891, was invented jointly by him and Professor James Dewar. Our knowledge of the explosion of ordinary black powder was also greatly added to by him, and in conjunction with Sir Andrew Noble he carried out one of the most complete inquiries on record into its behaviour when fired. The invention of the apparatus, legalized in 1879, for the determination of the flash-point of petroleum, was another piece of work which fell to him by virtue of his official position. His first instrument, the open-test apparatus, was prescribed by the act of 1868, but, being found to possess certain defects, it was superseded in 1879 by the Abel close-test instrument (see PETROLEUM). In electricity Abel studied the construction of electrical fuses and other applications of electricity to warlike purposes, and his work on problems of steel manufacture won him in 1897 the Bessemer medal of the Iron and Steel Institute, of which from 1891 to 1893 he was president. He was president of the Institution of Electrical Engineers (then the Society of Telegraph Engineers) in 1877. He became a member of the Royal Society in 1860, and received a royal medal in 1887. He took an important part in the work of the Inventions Exhibition (London) in 1885, and in 1887 became organizing secretary and first director of the Imperial Institute, a position he held till his death, which occurred in London on the 6th of September 1902. He was knighted in 1891, and created a baronet in 1893.

Among his books were—*Handbook of Chemistry* (with C. L. Bloxam), *Modern History of Gunpowder* (1866), *Gun-cotton* (1866), *On Explosive Agents* (1872), *Researches in Explosives* (1875), and *Electricity applied to Explosive Purposes* (1884). He also wrote several important articles in the ninth edition of the *Encyclopaedia Britannica*.

ABEL, KARL FRIEDRICH (1725–1787), German musician, was born in Köthen in 1725, and died on the 20th of June 1787 in London. He was a great player on the viola da gamba, and composed much music of importance in its day for that instrument. He studied under Johann Sebastian Bach at the Leipzig Thomasschule; played for ten years (1748–1758) under A. Hasse in the band formed at Dresden by the elector of Saxony; and then, going to England, became (in 1759) chamber-musician to Queen Charlotte. He gave a concert of his own compositions in London, performing on various instruments, one of which, the pentachord, was newly invented. In 1762 Johann Christian Bach, the eleventh son of Sebastian, came to London, and the friendship between him and Abel led, in 1764 or 1765, to the establishment of the famous concerts subsequently known as the Bach and Abel concerts. For ten years these were organized by Mrs Cornelys, whose enterprises were then the height of fashion. In 1775 the concerts became independent of her, and were continued by Abel unsuccessfully for a year after Bach's death in 1782. At them the works of Haydn were first produced in England. After the failure of his concert undertakings Abel still remained in great request as a player on various instruments new and old, but he took to drink and thereby hastened his death. He was a man of striking presence, of whom several fine portraits, including two by Gainsborough, exist.

ABEL, NIELS HENRIK (1802–1829), Norwegian mathematician, was born at Findöe on the 25th of August 1802. In 1815 he entered the cathedral school at Christiania, and three years later he gave proof of his mathematical genius by his brilliant solutions of the original problems proposed by B. Holmboë. About this time, his father, a poor Protestant minister, died, and the family was left in straitened circumstances; but a small pension from the state allowed Abel to enter Christiania University in 1821. His first notable work was a proof of the impossibility of solving the quintic equation by radicals. This investigation was first published in 1824 and in abstruse and difficult form, and afterwards (1826) more elaborately in the first volume of *Crelle's Journal*. Further state aid enabled him to visit Germany and France in 1825, and having visited the astronomer Heinrich Schumacher (1780–1850) at Hamburg, he spent six months in Berlin, where he became intimate with August Leopold Crelle, who was then about to publish his mathematical journal. This project was warmly encouraged by Abel, who contributed much to the success of the venture. From Berlin he passed to Freiberg, and here he made his brilliant researches in the theory of functions, elliptic, hyperelliptic and a new class known as Abelians being particularly studied. In 1826 he moved to Paris, and during a ten months' stay he met the leading mathematicians of France; but he was little appreciated, for his work was scarcely known, and his modesty restrained him from proclaiming his researches. Pecuniary embarrassments, from which he had never been free, finally compelled him to abandon his tour, and on his return to Norway he taught for some time at Christiania. In 1829 Crelle obtained a post for him at Berlin, but the offer did not reach Norway until after his death near Arendal on the 6th of April.

The early death of this talented mathematician, of whom Legendre said "*quelle tête celle du jeune Norvegien!*", cut short a career of extraordinary brilliance and promise. Under Abel's guidance, the prevailing obscurities of analysis began to be cleared, new fields were entered upon and the study of functions so advanced as to provide mathematicians with numerous ramifications along which progress could be made. His works, the greater part of which originally appeared in *Crelle's Journal*, were edited by Holmboë and published in 1839 by the Swedish government, and a more complete edition by L. Sylow and S. Lie was published in 1881.

For further details of his mathematical investigations see the articles Groups, Theory of, and Functions of Complex Variables.

See C. A. Bjerknes, *Niels Henrik Abel: Tableau de sa vie et son action scientifique* (Paris, 1885); Lucas de Pesloüan, *Niels Henrik Abel* (Paris, 1906).

ABEL (better Abell), **THOMAS** (d. 1540), an English priest who was martyred during the reign of Henry VIII. The place and date of his birth are unknown. He was educated at Oxford and entered the service of Queen Catherine some time before 1528, when he was sent by her to the emperor Charles V. on a mission relating to the proposed divorce. On his return he was presented by Catherine to the living of Bradwell, in Essex, and remained to the last a staunch supporter of the unfortunate queen. In 1533, he published his *Invicta Veritas* (with the fictitious pressmark of Luneberge, to avoid suspicion), which contained an answer to the numerous tracts supporting Henry's ecclesiastical claims. After an imprisonment of more than six years, Abel was sentenced to death for denying the royal supremacy in the church, and was executed at Smithfield on the 30th of July 1540. There is still to be seen on the wall of his prison in the Tower the symbol of a bell with an A upon it and the name Thomas above, which he carved during his confinement. He was beatified by Pope Leo XIII.

See J. Gillow's *Bibl. Dictionary of Eng. Catholics*, vol. i.; *Calendar of State Papers of Henry VIII.*, vols. iv.-vii. *passim.*

ABELARD, PETER (1079–1142), scholastic philosopher, was born at Pallet (Palais), not far from Nantes, in 1079. He was the eldest son of a noble Breton house. The name *Abaelardus* (also written *Abailardus*, *Abaielardus*, and in many other ways) is said to be a corruption of *Habelardus*, substituted by himself for a nickname *Bajolardus* given to him when a student. As a boy, he showed an extraordinary quickness of apprehension, and, choosing a learned life instead of the knightly career natural to a youth of his birth, early became an adept in the art of dialectic, under which name philosophy, meaning at that time chiefly the logic of Aristotle transmitted through Latin channels, was the great subject of liberal study in the episcopal schools. Roscellinus, the famous canon of Compiègne, is mentioned by himself as his teacher; but whether he heard this champion of extreme Nominalism in early youth, when he wandered about from school to school for instruction and exercise, or some years later, after he had already begun to teach for himself, remains uncertain. His wanderings finally brought him to Paris, still under the age of twenty. There, in the great cathedral school of Notre-Dame, he sat for a while under the teaching of William of Champeaux, the disciple of St Anselm and most advanced of Realists, but, presently stepping forward, he overcame the master in discussion, and thus began a long duel that issued in the downfall of the philosophic theory of Realism, till then dominant in the early Middle Age. First, in the teeth of opposition from the metropolitan teacher, while yet only twenty-two, he proceeded to set up a school of his own at Melun, whence, for more direct competition, he removed to Corbeil, nearer Paris. The success of his teaching was signal, though for a time he had to quit the field, the strain proving too great for his physical strength. On his return, after 1108, he found William lecturing no longer at Notre-Dame, but in a monastic retreat outside the city, and there battle was again joined between them. Forcing upon the Realist a material change of doctrine, he was once more victorious, and thenceforth he stood supreme. His discomfited rival still had power to keep him from lecturing in Paris, but soon failed in this last effort also. From Melun, where he had resumed teaching, Abelard passed to the capital, and set up his school on the heights of St Geneviève, looking over Notre-Dame. From his success in dialectic, he next turned to theology and attended the lectures of Anselm at Laon. His triumph over the theologian was complete; the pupil was able to give lectures, without previous training or special study, which were acknowledged superior to those of the master. Abelard was now at the height of his fame. He stepped into the chair at Notre-Dame, being also nominated canon, about the year 1115.

Few teachers ever held such sway as Abelard now did for a time. Distinguished in figure and manners, he was seen surrounded by crowds—it is said thousands—of students, drawn from all countries by the fame of his teaching, in which acuteness of thought was relieved by simplicity and grace of exposition. Enriched by the offerings of his pupils, and feasted with universal admiration, he came, as he says, to think himself the only philosopher standing in the world. But a change in his fortunes was at hand. In his devotion to science, he had hitherto lived a very regular life, varied only by the excitement of conflict: now, at the height of his fame, other passions began to stir within him. There lived at that time, within the precincts of Notre-Dame, under the care of her uncle, the canon Fulbert, a young girl named Heloise, of noble extraction, and born about 1101. Fair, but still more remarkable for her knowledge, which extended beyond Latin, it is said, to Greek and Hebrew, she awoke a feeling of love in the breast of Abelard; and with intent to win her, he sought and gained a footing in Fulbert's house as a regular inmate. Becoming also tutor to the maiden, he used the unlimited power which he thus obtained over her for the purpose of seduction, though not without cherishing a real affection which she returned in unparalleled devotion. Their relation interfering with his public work, and being, moreover, ostentatiously sung by himself, soon became known to all the world except the too-confiding Fulbert; and, when at last it could not escape even his vision, they were separated only to meet in secret. Thereupon Heloise found herself pregnant, and was carried off by her lover to Brittany, where she gave birth to a son. To appease her furious uncle, Abelard now proposed a marriage, under the condition that it should be kept secret, in order not to mar his prospects of advancement in the church; but of marriage, whether public or secret, Heloise would hear nothing. She appealed to him not to sacrifice for her the independence of his life, nor did she finally yield to the arrangement without the darkest forebodings, only too soon to be realized. The secret of the marriage was not kept by Fulbert; and when Heloise, true to her singular purpose, boldly denied it, life was made so unsupportable to her that she sought refuge in the convent of Argenteuil. Immediately Fulbert, believing that her husband, who aided in the flight, designed to be rid of her, conceived a dire revenge. He and some others broke into Abelard's chamber by night, and perpetrated on him the most brutal mutilation. Thus cast down from his pinnacle of greatness into an abyss of shame and misery, there was left to the brilliant master only the life of a monk. The priesthood and ecclesiastical office were canonically closed to him. Heloise, not yet twenty, consummated her work of self-sacrifice at the call of his jealous love, and took the veil.

It was in the abbey of St Denis that Abelard, now aged forty, sought to bury himself with his woes out of sight. Finding, however, in the cloister neither calm nor solitude, and having gradually turned again to study, he yielded after a year to urgent entreaties from without and within, and went forth to reopen his school at the priory of Maisoncelle (1120). His lectures, now framed in a devotional spirit, were heard again by crowds of students, and all his old influence seemed to have returned; but old enmities were revived also, against which he was no longer able as before to make head. No sooner had he put in writing his theological lectures (apparently the *Introductio ad Theologiam* that has come down to us), than his adversaries fell foul of his rationalistic interpretation of the Trinitarian dogma. Charging him with the heresy of Sabellius in a provincial synod held at Soissons in 1121, they procured by irregular practices a condemnation of his teaching, whereby he was made to throw his book into the flames and then was shut up in the convent of St Médard at Soissons. After the other, it was the bitterest possible experience that could befall him, nor, in the state of mental desolation into which it plunged him, could he find any comfort from being soon again set free. The life in his own monastery proved no more congenial than formerly. For this Abelard himself was partly responsible. He took a sort of malicious pleasure in irritating the monks. *Quasi jocando*, he cited Bede to prove that Dionysius the Areopagite had been bishop of Corinth, while they relied upon the statement of the abbot Hilduin that he had been bishop of Athens. When this historical heresy led to the inevitable persecution, Abelard wrote a letter to the abbot Adam in which he preferred to the authority of Bede that of Eusebius' *Historia Ecclesiastica* and St Jerome, according to whom Dionysius, bishop of Corinth, was distinct from Dionysius the Areopagite, bishop of Athens and founder of the abbey, though, in deference to Bede, he suggested that the Areopagite might also have been bishop of Corinth. Life in the monastery was intolerable for such a troublesome spirit, and Abelard, who had once attempted to escape the persecution he had called forth by flight to a monastery at Provins, was finally allowed to withdraw. In a desert place near Nogent-sur-Seine, he built himself a cabin of stubble and reeds, and turned hermit. But there fortune came back to him with a new surprise. His retreat becoming known, students flocked from Paris, and covered the wilderness around him with their tents and huts. When he began to teach again he found consolation, and in gratitude he consecrated the new oratory they built for him by the name of the Paraclete.

Upon the return of new dangers, or at least of fears, Abelard left the Paraclete to make trial of another refuge, accepting an invitation to preside over the abbey of St Gildas-de-Rhuys, on the far-off shore of Lower Brittany. It proved a wretched exchange. The region was inhospitable, the domain a prey to lawless exaction, the house itself savage and disorderly. Yet for nearly ten years he continued to struggle with fate before he fled from his charge, yielding in the end only under peril of violent death. The misery of those years was not, however, unrelieved; for he had been able, on the breaking up of Heloise's convent at Argenteuil, to establish her as head of a new religious house at the deserted Paraclete, and in the capacity of spiritual director he often was called to revisit the spot thus made doubly dear to him. All this time Heloise had lived amid universal esteem for her knowledge and character, uttering no word under the doom that had fallen upon her youth; but now, at last, the occasion came for expressing all the pent-up emotions of her soul. Living on for some time apart (we do not know exactly where), after his flight from St Gildas, Abelard wrote, among other things, his famous *Historia Calamitatum*, and thus moved her to pen her first *Letter*, which remains an unsurpassed utterance of human passion and womanly devotion; the first being followed by the two other *Letters*, in which she finally accepted the part of resignation which, now as a brother to a sister, Abelard commended to her. He not long after was seen once more upon the field of his early triumphs lecturing on Mount St Geneviève in 1136 (when he was heard by John of Salisbury), but it was only for a brief space: no new triumph, but a last great trial, awaited him in the few years to come of his chequered life. As far back as the Paraclete days, he had counted as chief among his foes Bernard of Clairvaux, in whom was incarnated the principle of fervent and unhesitating faith, from which rational inquiry like his was sheer revolt, and now this uncompromising spirit was moving, at the instance of others, to crush the growing evil in the person of the boldest offender. After preliminary negotiations, in which Bernard was roused by Abelard's steadfastness to put forth all his strength, a council met at Sens (1141), before which Abelard, formally arraigned upon a number of heretical charges, was prepared to plead his cause. When, however, Bernard, not without foregone terror in the prospect of meeting the redoubtable dialectician, had opened the case, suddenly Abelard appealed to Rome. The stroke availed him nothing; for Bernard, who had power, notwithstanding, to get a condemnation passed at the council, did not rest a moment till a second condemnation was procured at Rome in the following year. Meanwhile, on his way thither to urge his plea in person, Abelard had broken down at the abbey of Cluny, and there, an utterly fallen man, with spirit of the humblest, and only not bereft of his intellectual force, he lingered but a few months before the approach of death. Removed by friendly hands, for the relief of his sufferings, to the priory of St Marcel, near Chalon-sur-Saone, he died on the 21st of April 1142. First buried at St Marcel, his remains soon after were carried off in secrecy to the Paraclete, and given over to the loving care of Heloise, who in time came herself to rest beside them (1164). The bones of the pair were shifted more than once afterwards, but they were marvellously preserved even through the vicissitudes of the French Revolution, and now they lie united in the well-known tomb in the cemetery of Père-la-Chaise at Paris.

Great as was the influence exerted by Abelard on the minds of his contemporaries and the course of medieval thought, he has been little known in modern times but for his connexion with Heloise. Indeed, it was not till the 19th century, when Cousin in 1836 issued the collection entitled *Ouvrages inédits d'Abélard*, that his philosophical performance could be judged at first hand; of his strictly philosophical works only one, the ethical treatise *Scito te ipsum*, having been published earlier, namely, in 1721. Cousin's collection, besides giving extracts from the theological work *Sic et Non* (an assemblage of opposite opinions on doctrinal points, culled from the Fathers as a basis for discussion, the main interest in which lies in the fact that there is no attempt to reconcile the different opinions), includes the *Dialectica*, commentaries on logical works of Aristotle, Porphyry and Boëthius, and a fragment, *De Generibus et Speciebus*. The last-named work, and also the psychological treatise *De Intellectibus*, published apart by Cousin (in *Fragmens Philosophiques*, vol. ii.), are now considered upon internal evidence not to be by Abelard himself, but only to have sprung out of his school. A genuine work, the *Glossulae super Porphyrium*, from which Charles de Rémusat, in his classical monograph *Abélard* (1845), has given extracts, remains in manuscript.

The general importance of Abelard lies in his having fixed more decisively than any one before him the scholastic manner of philosophizing, with its object of giving a formally rational expression to the received ecclesiastical doctrine. However his own particular interpretations may have been condemned, they were conceived in essentially the same spirit as the general scheme of thought afterwards elaborated in the 13th century with approval from the heads of the church. Through him was prepared in the Middle Age the ascendancy of the philosophical authority of Aristotle, which became firmly established in the half-century after his death, when first the completed *Organon*, and gradually all the other works of the Greek thinker, came to be known in the schools: before his time it was rather upon the authority of Plato that the prevailing Realism sought to lean. As regards his so-called Conceptualism and his attitude to the question of Universals, see SCHOLASTICISM. Outside of his dialectic, it was in ethics that Abelard showed greatest activity of philosophical thought; laying very particular stress upon the subjective intention as determining, if not the moral character, at least the moral value, of human action. His thought in this direction, wherein he anticipated something of modern speculation, is the more remarkable because his scholastic successors accomplished least in the field of morals, hardly venturing to bring the principles and rules of conduct under pure philosophical discussion, even after the great ethical inquiries of Aristotle became fully known to them.

BIBLIOGRAPHY.—Abelard's own works remain the best sources for his life, especially his *Historia Calamitatum*, an autobiography, and the correspondence with Heloise. The literature on Abelard is extensive, but consists principally of monographs on different aspects of his philosophy. Charles de Rémusat's *Abélard* (2 vols., 1845) remains an authority; it must be distinguished from his drama *Abélard* (1877), which is an attempt to give a picture of medieval life. McCabe's life of Abelard is written closely from the sources. See also the valuable analysis by Nitsch in the article "Abälard" in Hauck's *Realencyklopädie f. prot. Theol. u. Kirche*, 3rd ed., 1896. There is a comprehensive bibliography in U. Chevalier, *Répertoire des sources hist. du moyen âge*, s. "Abailard." (G. C. R.; J. T. S.*)

ABELIN, JOHANN PHILIPP, an early 16th-century German chronicler, was born, probably, at Strasburg, and died there between the years 1634 and 1637. He wrote numerous histories over the pseudonyms of Philipp Arlanibäus, Abeleus and Johann Ludwig Gottfried or Gotofredus, his earliest works of importance being his history of the German wars of Gustavus Adolphus, entitled *Arma Suecica* (pub. 1631–1634, in 12 parts), and the *Inventarium Sueciae* (1632)—both compilations from existing records. His best known work is the *Theatrum Europaeum*, a series of chronicles of the chief events in the history of the world down to 1619. He was himself responsible for the first two volumes. It was continued by various writers and grew to twenty-one volumes (Frankf. 1633–1738). The chief interest of the work is, however, its illustration by the beautiful copper-plate engravings of Matthäus Merian (1593–1650). Abelin also wrote a history of the antipodes, *Historia Antipodum* (posthumously pub. Frankf. 1655), and a history of India.

See G. Droysen, *Arlanibaeus, Godofredus, Abelinus* (Berlin, 1864); and notice in *Allgemeine Deutsche Biographie*.

ABENCERRAGES, a family or faction that is said to have held a prominent position in the Moorish kingdom of Granada in the 15th century. The name appears to have been derived from the Yussuf ben-Serragh, the head of the tribe in the time of Mahommed VII., who did that sovereign good service in his struggles to retain the crown of which he was three times deprived. Nothing is known of the family with certainty; but the name is familiar from the interesting romance of Gines Perez de Hita, *Guerras civiles de Granada*, which celebrates the feuds of the Abencerrages and the rival family of the Zegris, and the cruel treatment to which the former were subjected. J. P. de Florian's *Gonsalve de Cordoue* and Chateaubriand's *Le dernier des Abencerrages* are imitations of Perez de Hita's work. The hall of the Abencerrages in the Alhambra takes its name from being the reputed scene of the massacre of the family.

ABENDANA, the name of two Jewish theologians. (1) Jacob (1630–1695), rabbi (Hakham) of the Spanish Jews in London from 1680. Like his brother Isaac, Jacob Abendana had a circle of Christian friends, and his reputation led to the appreciation of Jewish scholarship by modern Christian theologians. (2) Isaac (*c.* 1650–1710), his brother, taught Hebrew at Cambridge and afterwards at Oxford. He compiled a Jewish Calendar and wrote *Discourses on the Ecclesiastical and Civil Polity of the Jews* (1706).

ABENEZRA (Ibn Ezra), or, to give him his full name, Abraham ben Meir Ibn Ezra (1092 or 1093–1167), one of the most distinguished Jewish men of letters and writers of the Middle Ages. He was born at Toledo, left his native land of Spain before 1140 and led until his death a life of restless wandering, which took him to North Africa, Egypt, Italy (Rome, Lucca, Mantua, Verona), Southern France (Narbonne, Beziers), Northern France (Dreux), England (London), and back again to the South of France. At several of the above-named places he remained for some time and developed a rich literary activity. In his native land he had already gained the reputation of a distinguished poet and thinker; but, apart from his poems, his works, which were all in the Hebrew language, were written in the second period of his life. With these works, which cover in the first instance the field of Hebrew philology and Biblical exegesis, he fulfilled the great mission of making accessible to the Jews of Christian Europe the treasures of knowledge enshrined in the works written in Arabic which he had brought with him from Spain. His grammatical writings, among which *Moznayim* ("the Scales," written in 1140) and *Zahot* ("Correctness," written in 1141) are the most valuable, were the first expositions of Hebrew grammar in the Hebrew language, in which the system of Hayyūj and his school prevailed. He also translated into Hebrew the two writings of Hayyūj in which the foundations of the system were laid down Of greater original value than the grammatical works of Ibn Ezra are his commentaries on most of the books of the Bible, of which, however, a part has been lost. His reputation as an intelligent and acute expounder of the Bible was founded on his commentary on the Pentateuch, of which the great popularity is evidenced by the numerous commentaries which were written upon it. In the editions of this commentary (ed. princ. Naples 1488) the commentary on the book of Exodus is replaced by a second, more complete commentary of Ibn Ezra, while the first and shorter commentary on Exodus was not printed until 1840. The great editions of the Hebrew Bible with rabbinical commentaries contained also commentaries of Ibn Ezra's on the following books of the Bible: Isaiah, Minor Prophets, Psalms, Job, Pentateuch, Daniel; the commentaries on Proverbs, Ezra and Nehemiah which bear his name are really those of Moses Kimhi. Ibn Ezra wrote a second commentary on Genesis as he had done on Exodus, but this was never finished. There are second commentaries also by him on the Song of Songs, Esther and Daniel. The importance of the exegesis of Ibn Ezra consists in the fact that it aims at arriving at the simple sense of the text, the so-called "Pesohat," on solid grammatical principles. It is in this that, although he takes a great part of his exegetical material from his predecessors, the originality of his mind is everywhere apparent, an originality which displays itself also in the witty and lively language of his commentaries. To judge by certain signs, of which Spinoza in his *Tractatus Theologico Politicus* makes use, Ibn Ezra belongs to the earliest pioneers of the criticism of the Pentateuch. His commentaries, and especially some of the longer excursuses, contain numerous contributions to the philosophy of religion. One writing in particular, which belongs to this province (Yōsōd Mēra), on the division and the reasons for the Biblical commandments, he wrote in 1158 for a London friend, Joseph b. Jacob. In his philosophical thought neo-platonic ideas prevail; and astrology also had a place in his view of the world. He also wrote various works on mathematical and astronomical subjects. Ibn Ezra died on the 28th of January 1167, the place of his death being unknown.

Among the literature on Ibn Ezra may be especially mentioned: M. Friedländer, *Essays on the Writings of Ibn Ezra* (London, 1877); W. Bacher, *Abraham Ibn Ezra als Grammatiker* (Strasburg, 1882); M. Steinschneider, *Abraham Ibn Ezra*, in the *Zeitschrift für Mathematik und Physik*, Band xxv., Supplement; D. Rosin, *Die Religionsphilosophie Abraham Ibn Ezra's* in vols. xlii. and xliii. of the *Monatschrift für Geschichte und Wissenschaft des Judenthums;* his *Diwan* was edited by T. Egers (Berlin, 1886); a collection of his poems, *Reime und Gedichte*, with translation and commentary, were published by D. Rosin in several annual reports of the Jewish theological Seminary at Breslau (1885–1894). (W. Ba.)

ABENSBERG, a town of Germany, in the kingdom of Bavaria, on the Abens, a tributary of the Danube, 18 m. S.W. of Regensburg, with which it is connected by rail. Pop. 2202. It has a small spa, and its sulphur baths are resorted to for the cure of rheumatism and gout. The town is the Castra Abusina of the Romans, and Roman remains exist in the neighbourhood. Here, on the 20th of April 1809, Napoleon gained a signal victory over the Austrians under the Archduke Louis and General Hiller.

ABEOKUTA, a town of British West Africa in the Egba division of the Yoruba country, S. Nigeria Protectorate. It is situated in 7° 8′ N., 3° 25′ E., on the Ogun river, 64 m. N. of Lagos by railway, or 81 m. by water. Population, approximately 60,000. Abeokuta lies in a beautiful and fertile country, the surface of which is broken by masses of grey granite. It is spread over an extensive area, being surrounded by mud walls 18 miles in extent. Abeokuta, under the reforming zeal of its native rulers, was largely transformed during the early years of the 20th century. Law courts, government offices, prisons and a substantial bridge were built, good roads made, and a large staff of sanitary inspectors appointed. The streets are generally narrow and the houses built of mud. There are numerous markets in which a considerable trade is done in native products and articles of European manufacture. Palm-oil, timber, rubber, yams and shea-butter are the chief articles of trade. An official newspaper is published in the Yoruba and English languages. Abeokuta is the headquarters of the Yoruba branch of the Church Missionary Society, and British and American missionaries have met with some success in their civilizing work. In their schools about 2000 children are educated. The completion in 1899 of a railway from Lagos helped not only to develop trade but to strengthen generally the influence of the white man.

Abeokuta (a word meaning "under the rocks"), dating from 1825, owes its origin to the incessant inroads of the slave-hunters from Dahomey and Ibadan, which compelled the village populations scattered over the open country to take refuge in this rocky stronghold against the common enemy. Here they constituted themselves a free confederacy of many distinct tribal groups, each preserving the traditional customs, religious rites and even the very names of their original villages. Yet this apparently incoherent aggregate held its ground successfully against the powerful armies often sent against the place both by the king of Dahomey from the west, and by the people of Ibadan from the north-east.

The district of Egba, of which Abeokuta is the capital, has an estimated area of 3000 sq. m. and a population of some 350,000. It is officially known as the Abeokuta province of the Southern Nigeria protectorate. It contains luxuriant forests of palm-trees, which constitute the chief wealth of the people. Cotton is indigenous and is grown for export. The Egbas are enthusiastic farmers and have largely adopted European methods of cultivation. They are very tenacious of their independence, but accepted without opposition the establishment of a British protectorate, which, while putting a stop to inter-tribal warfare, slave-raiding and human sacrifices, and exercising control over the working of the laws, left to the people executive and fiscal autonomy. The administration is in the hands of a council of chiefs which exercises legislative, executive and, to some extent, judicial functions. The president of this council, or ruling chief—chosen from among the members of the two recognized reigning families—is called the *alake*, a word meaning "Lord of Ake," Ake being the name of the principal quarter of Abeokuta, after the ancient capital of the Egbas. The alake exercises little authority apart from his council, the form of government being largely democratic. Revenue is chiefly derived from tolls or import duties. A visit of the alake to England in 1904 evoked considerable public interest. The chief was a man of great intelligence, eager to study western civilization, and an ardent agriculturist.

See the publications of the Church Missionary Society dealing with the Yoruba Mission; Col. A. B. Ellis's *The Yoruba-speaking Peoples* (London, 1894); and an article on Abeokuta by Sir Wm. Macgregor, sometime governor of Lagos, in the African Society's *Journal*, No. xii. (London, July 1904).

ABERAVON, a contributory parliamentary and municipal borough of Glamorganshire, Wales, on the right bank of the Avon, near its mouth in Swansea Bay, 11 m. E.S.E. of Swansea and 170 m. from London by rail. Pop. (1901) 7553. It has a station on the Rhondda and Swansea Bay railway and is also on the main South Wales line of the Great Western, whose station, however, is at Port Talbot, half a mile distant, on the eastern side of the Avon. The valley of the Avon, which is only some three miles long, has been from about 1840 a place of much metallurgical activity. There are tinplate and engineering works within the borough. At Cwmavon, 1½ m. to the north-east, are large copper-smelting works established in 1838, acquired two years later by the governor and Company of the Copper Miners of England, but now worked by the Rio Tinto Copper Company. There are also iron, steel and tinplate works both at Cwmavon and at Port Talbot, which, when it consisted only of docks, was appropriately known as Aberavon Port.

The town derives its name from the river Avon (corrupted from Avan), which also gave its name to a medieval lordship. On the Norman conquest at Glamorgan, Caradoc, the eldest son of the defeated prince, Lestyn ab Gwrgan, continued to hold this lordship, and for the defence of the passage of the river built here a castle whose foundations are still traceable in a field near the churchyard. His descendants (who from the 13th century onwards styled themselves De Avan or D'Avene) established, under the protection of the castle, a chartered town, which in 1372 received a further charter from Edward Le Despenser, into whose family the lordship had come on an exchange of lands. In modern times these charters were not acted upon, the town being deemed a borough by prescription, but in 1861 it was incorporated under the Municipal Corporations Act. Since 1832 it has belonged to the Swansea parliamentary district of boroughs, uniting with Kenfig, Loughor, Neath and Swansea to return one member; but in 1885 the older portion of Swansea was given a separate member.

ABERCARN, an urban district in the southern parliamentary division of Monmouthshire, England, 10 m. N.W. of Newport by the Great Western railway. Pop. (1901) 12,607. There are collieries, ironworks and tinplate works in the district; the town, which lies in the middle portion of the Ebbw valley, being situated on the south-eastern flank of the great mining region of Glamorganshire and Monmouthshire.

ABERCORN, JAMES HAMILTON, 1ST EARL OF (*c.* 1575–1618), was the eldest son of Claud Hamilton, Lord Paisley (4th son of James, 2nd earl of Arran, and duke of Chatelherault), and of Margaret, daughter of George, 6th Lord Seton. He was made sheriff of Linlithgow in 1600, received large grants of lands in Scotland and Ireland, was created in 1603 baron of Abercorn, and on the 10th of July 1606 was rewarded for his services in the matter of the union by being made earl of Abercorn, and Baron Hamilton, Mount Castle and Kilpatrick. He married Marion, daughter of Thomas, 5th Lord Boyd, and left five sons, of whom the eldest, baron of Strabane, succeeded him as 2nd earl of Abercorn. He died on the 23rd of March 1618. The title of Abercorn, held by the head of the Hamilton family, became a marquessate in 1790, and a dukedom in 1868, the 2nd duke of Abercorn (b. 1838) being a prominent Unionist politician and chairman of the British South Africa Company.

ABERCROMBIE, JOHN (1780–1844), Scottish physician, was the son of the Rev. George Abercrombie of Aberdeen, where he was born on the 10th of October 1780. He was educated at the university of Edinburgh, and after graduating as M.D. in 1803 he settled down to practise in that city, where he soon attained a leading position. From 1816 he published various papers in the *Edinburgh Medical and Surgical Journal*, which formed the basis of his *Pathological and Practical Researches on Diseases of the Brain and Spinal Cord*, and of his *Researches on the Diseases of the Intestinal Canal, Liver and other Viscera of the Abdomen*, both published in 1828. He also found time for philosophical speculations, and in 1830 he published his *Inquiries concerning the Intellectual Powers of Man and the Investigation of Truth*, which was followed in 1833 by a sequel, *The Philosophy of the Moral Feelings*. Both works, though showing little originality of thought, achieved wide popularity. He died at Edinburgh on the 14th of November 1844.

ABERCROMBY, DAVID, a 17th-century Scottish physician who was sufficiently noteworthy a generation after the probable date of his death to have his *Nova Medicinae Praxis* reprinted at Paris in 1740. During his lifetime his *Tuta ac efficax luis venereae saepe absque mercurio ac semper absque salivatione mercuriali curando methodus* (1684) was translated into French, Dutch and German. Two other works by him were *De Pulsus Variatione* (London, 1685), and *Ars explorandi medicas facultates plantarum ex solo sapore* (London, 1685–1688). His *Opuscula* were collected in 1687. These professional writings gave him a place and memorial in A. von Haller's *Bibliotheca Medicinae Pract.* (4 vols. 8vo, 1779, tom. iii. p. 619); but he claims notice rather by his remarkable controversial books in theology and philosophy than by his medical writings. Bred up at Douai as a Jesuit, he abjured popery, and published *Protestancy proved Safer than Popery* (London, 1686). But the most noticeable of his productions is *A Discourse of Wit* (London, 1685), which contains some of the most characteristic and most definitely-put metaphysical opinions of the Scottish philosophy of common sense. It was followed by *Academia Scientiarum* (1687), and by *A Moral Treatise of the Power of Interest* (1690), dedicated to Robert Boyle. *A Short Account of Scots Divines*, by him, was printed at Edinburgh in 1833, edited by James Maidment. The exact date of his death is unknown, but according to Haller he was alive early in the 18th century.

ABERCROMBY, PATRICK (1656–*c.* 1716), Scottish physician and antiquarian, was the third son of Alexander Abercromby of Fetterneir in Aberdeenshire, and brother of Francis Abercromby, who was created Lord Glasford by James II. He was born at Forfar in 1656 apparently of a Roman Catholic family. Intending to become a doctor of medicine he entered the university of St Andrews, where he took his degree of M.D. in 1685, but apparently he spent most of his youthful years abroad. It has been stated that he attended the university of Paris. The *Discourse of Wit* (1685), sometimes assigned to him, belongs to Dr David Abercromby (*q.v.*). On his return to Scotland, he is found practising as a physician in Edinburgh, where, besides his professional duties, he gave himself with characteristic zeal to the study of antiquities. He was appointed physician to James II. in 1685, but the revolution deprived him of the post. Living during the agitations for the union of England and Scotland, he took part in the war of pamphlets inaugurated and sustained by prominent men on both sides of the Border, and he crossed swords with no less redoubtable a foe than Daniel Defoe in his *Advantages of the Act of Security compared with those of the intended Union* (Edinburgh, 1707), and *A Vindication of the Same against Mr De Foe* (*ibid.*). A minor literary work of Abercromby's was a translation of Jean de Beaugué's *Histoire de la guerre d'Écosse* (1556) which appeared in 1707. But the work with which his name is permanently associated is his *Martial Atchievements of the Scots Nation*, issued in two large folios, vol. i. 1711, vol. ii. 1716. In the title-page and preface to vol. i. he disclaims the ambition of being an historian, but in vol. ii., in title-page and preface alike, he is no longer a simple biographer, but an historian. Even though, read in the light of later researches, much of the first volume must necessarily be relegated to the region of the mythical, none the less was the historian a laborious and accomplished reader and investigator of all available authorities, as well manuscript as printed; while the roll of names of those who aided him includes every man of note in Scotland at the time, from Sir Thomas Craig and Sir George Mackenzie to Alexander Nisbet and Thomas Ruddiman. The date of Abercromby's death is uncertain. It has been variously assigned to 1715, 1716, 1720, and 1726, and it is usually added that he left a widow in great poverty. The *Memoirs of the Abercrombys*, commonly attributed to him, do not appear to have been published.

See Robert Chambers, *Eminent Scotsmen*, *s.v.*; William Anderson, *Scottish Nation*, *s.v.*; Alexander Chalmers, *Biog. Dict.*, *s.v.*; George Chalmers, *Life of Ruddiman*; William Lee, *Defoe*.

ABERCROMBY, SIR RALPH (1734–1801), British lieutenant-general, was the eldest son of George Abercromby of Tullibody, Clackmannanshire, and was born in October 1734. Educated at Rugby and Edinburgh University, in 1754 he was sent to Leipzig to study civil law, with a view to his proceeding to the Scotch bar. On returning from the continent he expressed a strong preference for the military profession, and a cornet's commission was accordingly obtained for him (March 1756) in the 3rd Dragoon Guards. He served with his regiment in the Seven Years' war, and the opportunity thus afforded him of studying the methods of the great Frederick moulded his military character and formed his tactical ideas. He rose through the intermediate grades to the rank of lieutenant-colonel of the regiment (1773) and brevet colonel in 1780, and in 1781 he became colonel of the King's Irish infantry. When that regiment was disbanded in 1783 he retired upon half-pay. That up to this time he had scarcely been engaged in active service was owing mainly to his disapproval of the policy of the government, and especially to his sympathies with the American colonists in their struggles for independence; and his retirement is no doubt to be ascribed to similar feelings. On leaving the army he for a time took up political life as member of Parliament for Clackmannanshire. This, however, proved uncongenial, and, retiring in favour of his brother, he settled at Edinburgh and devoted himself to the education of his children. But on France declaring war against England in 1793, he hastened to resume his professional duties; and, being esteemed one of the ablest and most intrepid officers in the whole British forces, he was appointed to the command of a brigade under the duke of York, for service in Holland. He commanded the advanced guard in the action at Le Cateau, and was wounded at Nijmwegen. The duty fell to him of protecting the British army in its disastrous retreat out of Holland, in the winter of 1794–1795. In 1795 he received the honour of a knighthood of the Bath, in acknowledgment of his services. The same year he was appointed to succeed Sir Charles Grey, as commander-in-chief of the British forces in the West Indies. In 1796 Grenada was suddenly attacked and taken by a detachment of the army under his orders. He afterwards obtained possession of the settlements of Demerara and Essequibo, in South America, and of the islands of St Lucia, St Vincent and Trinidad. He returned in 1797 to Europe, and, in reward for his important services, was appointed colonel of the regiment of Scots Greys, entrusted with the governments of the Isle of Wight, Fort-George and Fort-Augustus, and raised to the rank of lieutenant-general. He held, in 1797–1798, the chief command of the forces in Ireland. There he laboured to maintain the discipline of the army, to suppress the rising rebellion, and to protect the people from military oppression, with a care worthy alike of a great general and an enlightened and beneficent statesman. When he was appointed to the command in Ireland, an invasion of that country by the French was confidently anticipated by the English government. He used his utmost efforts to restore the discipline of an army that was utterly disorganized; and, as a first step, he anxiously endeavoured to protect the people by re-establishing the supremacy of the civil power, and not allowing the military to be called out, except when it was indispensably necessary for the enforcement of the law and the maintenance of order. Finding that he received no adequate support from the head of the Irish government, and that all his efforts were opposed and thwarted by those who presided in the councils of Ireland, he resigned the command. His departure from Ireland was deeply lamented by the reflecting portion of the people, and was speedily followed by those disastrous results which he had anticipated, and which he so ardently desired and had so wisely endeavoured to prevent. After holding for a short period the office of commander-in-chief in Scotland, Sir Ralph, when the enterprise against Holland was resolved upon in 1799, was again called to command under the duke of York. The campaign of 1799 ended in disaster, but friend and foe alike confessed that the most decisive victory could not have more conspicuously proved the talents of this distinguished officer. His country applauded the choice when, in 1801, he was sent with an army to dispossess the French of Egypt. His experience in Holland and the West Indies particularly fitted him for this new command, as was proved by his carrying his army in health, in spirits and with the requisite supplies, in spite of very great difficulties, to the destined scene of action. The debarkation of the troops at Aboukir, in the face of strenuous opposition, is justly ranked among the most daring and brilliant exploits of the English army. A battle in the neighbourhood of Alexandria (March 21, 1801) was the sequel of this successful landing, and it was Abercromby's fate to fall in the moment of victory. He was struck by a spent ball, which could not be extracted, and died seven days after the battle. His old friend and commander the duke of York paid a just tribute to the great soldier's memory in general orders: "His steady observance of discipline, his ever-watchful attention to the health and wants of his troops, the persevering and unconquerable spirit which marked his military career, the splendour of his actions in the field and the heroism of his death, are worthy the imitation of all who desire, like him, a life of heroism and a death of glory." By a vote of the House of Commons, a monument was erected in his honour in St Paul's cathedral. His widow was created Baroness Abercromby of Tullibody and Aboukir Bay, and a pension of £2000 a year was settled on her and her two successors in the title.

A memoir of the later years of his life (1793–1801) by his third son, James (who was Speaker of the House of Commons, 1835–1839, and became Lord Dunfermline), was published in 1861. For a shorter account of Sir Ralph Abercromby see Wilkinson, *Twelve British Soldiers* (London, 1899).

ABERDARE, HENRY AUSTIN BRUCE, 1st Baron (1815–

1895), English statesman, was born at Duffryn, Aberdare, Glamorganshire, on the 16th of April 1815, the son of John Bruce, a Glamorganshire landowner. John Bruce's original family name was Knight, but on coming of age in 1805 he assumed the name of Bruce, his mother, through whom he inherited the Duffryn estate, having been the daughter of William Bruce, high sheriff of Glamorganshire. Henry Austin Bruce was educated at Swansea grammar school, and in 1837 was called to the bar. Shortly after he had begun to practise, the discovery of coal beneath the Duffryn and other Aberdare Valley estates brought the family great wealth. From 1847 to 1852 he was stipendiary magistrate for Merthyr Tydvil and Aberdare, resigning the position in the latter year, when he entered parliament as Liberal member for Merthyr Tydvil. In 1862 he became under-secretary for the home department, and in 1869, after losing his seat at Merthyr Tydvil, but being re-elected for Renfrewshire, he was made home secretary by W. E. Gladstone. His tenure of this office was conspicuous for a reform of the licensing laws, and he was responsible for the Licensing Act of 1872, which constituted the magistrates the licensing authority, increased the penalties for misconduct in public-houses and shortened the number of hours for the sale of drink. In 1873 he relinquished the home secretaryship, at Gladstone's request, to become lord president of the council, and was almost simultaneously raised to the peerage as Baron Aberdare. The defeat of the Liberal government in the following year terminated Lord Aberdare's official political life, and he subsequently devoted himself to social, educational and economic questions. In 1876 he was elected F.R.S.; from 1878 to 1892 he was president of the Royal Historical Society; and in 1881 he became president of the Royal Geographical Society. In 1882 he began a connexion with West Africa which lasted the rest of his life, by accepting the chairmanship of the National African Company, formed by Sir George Taubman Goldie, which in 1886 received a charter under the title of the Royal Niger Company and in 1899 was taken over by the British government, its territories being constituted the protectorate of Nigeria. West African affairs, however, by no means exhausted Lord Aberdare's energies, and it was principally through his efforts that a charter was in 1894 obtained for the university of Wales at Cardiff. Lord Aberdare, who in 1885 was made a G.C.B., presided over several Royal Commissions at different times. He died in London on the 25th of February 1895. His second wife was the daughter of Sir William Napier, the historian of the Peninsular war, whose *Life* he edited.

ABERDARE, a market town of Glamorganshire, Wales, situated (as the name implies) at the confluence of the Dâr and Cynon, the latter being a tributary of the Taff. Pop. of urban district (1901), 43,365. It is 4 m. S.W. of Merthyr Tydvil, 24 from Cardiff and 160 from London by rail. It has a station on the Pontypool and Swansea section of the Great Western railway, and is also served by the Llwydcoed and Abernant stations which are on a branch line to Merthyr. The Taff Vale line (opened 1846) has a terminus in the town. The Glamorgan canal has also a branch (made in 1811) running from Abercynon to Aberdare. From being, at the beginning of the 19th century, a mere village in an agricultural district, the place grew rapidly in population owing to the abundance of its coal and iron ore, and the population of the whole parish (which was only 1486 in 1801) increased tenfold during the first half of the century. Ironworks were established at Llwydcoed and Abernant in 1799 and 1800 respectively, followed by others at Gadlys and Aberaman in 1827 and 1847. These have not been worked since about 1875, and the only metal industries remaining in the town are an iron foundry or two and a small tinplate works at Gadlys (established in 1868). Previous to 1836, most of the coal worked in the parish was consumed locally, chiefly in the ironworks, but in that year the working of steam coal for export was begun, pits were sunk in rapid succession, and the coal trade, which at least since 1875 has been the chief support of the town, soon reached huge dimensions. There are also several brickworks and breweries. During the latter half of the 19th century, considerable public improvements were effected in the town, making it, despite its neighbouring collieries, an agreeable place of residence. Its institutions included a post-graduate theological college (opened in connexion with the Church of England in 1892, until 1907, when it was removed to Llandaff). There is a public park of fifty acres with two small lakes. Aberdare, with the ecclesiastical parishes of St Fagan's (Trecynon) and Aberaman carved out of the ancient parish, has some twelve Anglican churches, one Roman Catholic church (built in 1866 in Monk Street near the site of a cell attached to Penrhys Abbey) and over fifty Nonconformist chapels. The services in the majority of the chapels are in Welsh. The whole parish falls within the parliamentary borough of Merthyr Tydvil. The urban district includes what were once the separate villages of Aberaman, Abernant, Cwmbach, Cwmaman, Cwmdare, Llwydcoed and Trecynon. There are several cairns and the remains of a circular British encampment on the mountain between Aberdare and Merthyr. Hirwaun moor, 4 m. to the N.W. of Aberdare, was according to tradition the scene of a battle at which Rhys ap Jewdwr, prince of Dyfed, was defeated by the allied forces of the Norman Robert Fitzhamon and Iestyn ab Gwrgan, the last prince of Glamorgan.

ABERDEEN, GEORGE GORDON, 1st Earl of (1637–1720), lord chancellor of Scotland, son of Sir John Gordon, 1st baronet of Haddo, Aberdeenshire, executed by the Presbyterians in 1644, was born on the 3rd of October 1637. He graduated M.A., and was chosen professor at King's College, Aberdeen, in 1658. Subsequently he travelled and studied civil law abroad. At the Restoration the sequestration of his father's lands was annulled, and in 1665 he succeeded by the death of his elder brother to the baronetcy and estates. He returned home in 1667, was admitted advocate in 1668 and gained a high legal reputation. He represented Aberdeenshire in the Scottish parliament of 1669 and in the following assemblies, during his first session strongly opposing the projected union of the two legislatures. In November 1678 he was made a privy councillor for Scotland, and in 1680 was raised to the bench as Lord Haddo. He was a leading member of the duke of York's administration, was created a lord of session in June and in November 1681 president of the court. The same year he is reported as moving in the council for the torture of witnesses.[1] In 1682 he was made lord chancellor of Scotland, and was created, on the 13th of November, earl of Aberdeen, Viscount Formartine, and Lord Haddo, Methlick, Tarves and Kellie, in the Scottish peerage, being appointed also sheriff principal of Aberdeenshire and Midlothian. Burnet reflects unfavourably upon him, calls him "a proud and covetous man," and declares "the new chancellor exceeded all that had gone before him."[2] He executed the laws enforcing religious conformity with severity, and filled the parish churches, but resisted the excessive measures of tyranny prescribed by the English government; and in consequence of an intrigue of the duke of Queensberry and Lord Perth, who gained the duchess of Portsmouth with a present of £27,000, he was dismissed in 1684. After his fall he was subjected to various petty prosecutions by his victorious rivals with the view of discovering some act of maladministration on which to found a charge against him, but the investigations only served to strengthen his credit. He took an active part in parliament in 1685 and 1686, but remained a non-juror during the whole of William's reign, being frequently fined for his non-attendance, and took the oaths for the first time after Anne's accession, on the 11th of May 1703. In the great affair of the Union in 1707, while protesting against the completion of the treaty till the act declaring the Scots aliens should be repealed, he refused to support the opposition to the measure itself and refrained from attending parliament when the treaty was settled. He died on the 20th of April 1720, after having amassed a large fortune. He is described by John Mackay as "very knowing in the laws and constitution of his country and is believed to be the solidest statesman in Scotland, a fine orator, speaks slow but sure."

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[1] Sir J. Lauder's *Hist. Notices* (Bannatyne Club, 1848), p. 297.

[2] *Hist. of his own Times*, i. 523.

The Art Gallery and Museum at Schoolhill, built in the Italian Renaissance style of red and brown granite, contains an excellent collection of pictures, the Macdonald Hall of portraits of contemporary artists by themselves being of altogether exceptional interest and unique of its kind in Great Britain. The public library, magnificently housed, contains more than 60,000 volumes. The theatre in Guild Street is the chief seat of dramatic, as the Palace Theatre in Bridge Place is of variety entertainment. The new buildings of Marischal College fronting Broad Street, opened by King Edward VII. in 1906, form one of the most splendid examples of modern architecture in Great Britain; the architect, Alexander Marshall Mackenzie, a native of Aberdeen, having adapted his material, white granite, to the design of a noble building with the originality of genius.

Churches.—Like most Scottish towns, Aberdeen is well equipped with churches, most of them of good design, but few of special interest. The East and West churches of St Nicholas, their kirkyard separated from Union Street by an Ionic façade, 147½ ft. long, built in 1830, form one continuous building, 220 ft. in length, including the Drum Aisle (the ancient burial-place of the Irvines of Drum) and the Collison Aisle, which divide them and which formed the transept of the 12th-century church of St Nicholas. The West Church was built in 1775, in the Italian style, the East originally in 1834 in the Gothic. In 1874 a fire destroyed the East Church and the old central tower with its fine peal of nine bells, one of which, Laurence or "Lowrie," was 4 ft. in diameter at the mouth, 3½ ft. high and very thick. The church was rebuilt and a massive granite tower erected over the intervening aisles at the cost of the municipality, a new peal of 36 bells, cast in Holland, being installed to commemorate the Victorian jubilee of 1887. The Roman Catholic Cathedral in Huntly Street, a Gothic building, was erected in 1859. The see of Aberdeen was first founded at Mortlach in Banffshire by Malcolm II. in 1004 to celebrate his victory there over the Danes, but in 1137 David I. transferred the bishopric to Old Aberdeen, and twenty years later the cathedral of St Machar, situated a few hundred yards from the Don, was begun. Save during the episcopate of William Elphinstone (1484–1511), the building progressed slowly. Gavin Dunbar, who followed him in 1518, was enabled to complete the structure by adding the two western spires and the southern transept. The church suffered severely at the Reformation, but is still used as the parish church. It now consists of the nave and side aisles. It is chiefly built of outlayer granite, and, though the plainest cathedral in Scotland, its stately simplicity and severe symmetry lend it unique distinction. On the flat panelled ceiling of the nave are the heraldic shields of the princes, noblemen and bishops who shared in its erection, and the great west window contains modern painted glass of excellent colour and design. The cemeteries are St Peter's in Old Aberdeen, Trinity near the links, Nellfield at the junction of Great Western and Holburn Roads, and Allenvale, very tastefully laid out, adjoining Duthie Park.

Education.—Aberdeen University consists of King's College in Old Aberdeen, founded by Bishop Elphinstone in 1494, and Marischal College, in Broad Street, founded in 1593 by George Keith, 5th earl Marischal, which were incorporated in 1860. Arts and divinity are taught at King's, law, medicine and science at Marischal. The number of students exceeds 800 yearly. The buildings of both colleges are the glories of Aberdeen. King's forms a quadrangle with interior court, two sides of which have been rebuilt, and a library wing has been added. The Crown Tower and the Chapel, the oldest parts, date from 1500. The former is surmounted by a structure about 40 ft. high, consisting of a six-sided lantern and royal crown, both sculptured, and resting on the intersections of two arched ornamental slips rising from the four corners of the top of the tower. The choir of the chapel still contains the original oak canopied stalls, miserere seats and lofty open screens in the French flamboyant style, and of unique beauty of design and execution. Their preservation was due to the enlightened energy of the principal at the time of the Reformation, who armed his folk to save the building from the barons of the Mearns after they had robbed St Machar's of its bells and lead. Marischal College is a stately modern building, having been rebuilt in 1836–1841, and greatly extended several years later at a cost of £100,000. The additions to the buildings opened by King Edward VII. in 1906 have been already mentioned. The beautiful Mitchell Tower is so named from the benefactor (Dr Charles Mitchell) who provided the splendid graduation hall. The opening of this tower in 1895 signalized the commemoration of the four hundredth anniversary of the foundation of the university. The University Library comprises nearly 100,000 books. A Botanic Garden was presented to the university in 1899. Aberdeen and Glasgow Universities combine to return one member to Parliament. The United Free Church Divinity Hall in Alford Place, in the Tudor Gothic style, dates from 1850. The Grammar School, founded in 1263, was removed in 1861–1863 from its old quarters in Schoolhill to a large new building, in the Scots Baronial style, off Skene Street. Robert Gordon's College in Schoolhill was founded in 1729 by Robert Gordon of Straloch and further endowed in 1816 by Alexander Simpson of Collyhill. Originally devoted (as Gordon's Hospital) to the instruction and maintenance of the sons of poor burgesses of guild and trade in the city, it was reorganized in 1881 as a day and night school for secondary and technical education, and has since been unusually successful. Besides a High School for Girls and numerous board schools, there are many private higher-class schools. Under the Endowments Act 1882 an educational trust was constituted which possesses a capital of £155,000. At Blairs, in Kincardineshire, five miles S.W. of Aberdeen, is St Mary's Roman Catholic College for the training of young men intended for the priesthood.

Charities.—The Royal Infirmary, in Woolmanhill, established in 1740, rebuilt in the Grecian style in 1833–1840, and largely extended after 1887 as a memorial of Queen Victoria's jubilee; the Royal Asylum, opened in 1800; the Female Orphan Asylum, in Albyn Place, founded in 1840; the Blind Asylum, in Huntly Street, established in 1843; the Royal Hospital for Sick Children; the Maternity Hospital, founded in 1823; the City Hospital for Infectious Diseases; the Deaf and Dumb Institution; Mitchell's Hospital in Old Aberdeen; the East and West Poorhouses, with lunatic wards; and hospitals devoted to specialized diseases, are amongst the most notable of the charitable institutions. There are, besides, industrial schools for boys and girls and for Roman Catholic children, a Female School of Industry, the Seabank Rescue Home, Nazareth House and Orphanage, St Martha's Home for Girls, St Margaret's Convalescent Home and Sisterhood, House of Bethany, the Convent of the Sacred Heart and the Educational Trust School.

Parks and Open Spaces.—Duthie Park, of 50 acres, the gift of Miss Elizabeth Crombie Duthie of Ruthrieston, occupies an excellent site on the north bank of the Dee. Victoria Park (13 acres) and its extension Westburn Park (13 acres) are situated in the north-western area; farther north lies Stewart Park (11 acres), called after Sir D. Stewart, lord provost in 1893. The capacious links bordering the sea between the mouths of the two rivers are largely resorted to for open-air recreation; there is here a rifle range where a "wapinschaw," or shooting tournament, is held annually. Part is laid out as an 18-hole golf course; a section is reserved for cricket and football; a portion has been railed off for a race-course, and a bathing-station has been erected. Union Terrace Gardens are a popular rendezvous in the heart of the city.

Statues.—In Union Terrace Gardens stands a colossal statue in bronze of Sir William Wallace, by W. G. Stevenson, R.S.A. (1888). In the same gardens are a bronze statue of Burns and Baron Marochetti's seated figure of Prince Albert. In front of Gordon's College is the bronze statue, by T. S. Burnett, A.R.S.A., of General Gordon (1888). At the east end of Union Street is the bronze statue of Queen Victoria, erected in 1893 by the royal tradesmen of the city. Near the Cross stands the granite statue of the 5th duke of Gordon (d. 1836). Here may also be mentioned the obelisk of Peterhead granite, 70 ft. high, erected in the square of Marischal College to the memory of Sir James

M'Grigor (1778–1851), the military surgeon and director-general of the Army Medical Department, who was thrice elected lord rector of the College.

Bridges.—The Dee is crossed by four bridges,—the old bridge, the Wellington suspension bridge, the railway bridge, and Victoria Bridge, opposite Market Street. The first, till 1832 the only access to the city from the south, consists of seven semicircular ribbed arches, is about 30 ft. high, and was built early in the 16th century by Bishops Elphinstone and Dunbar. It was nearly all rebuilt in 1718–1723, and in 1842 was widened from 14½ to 26 ft. The bridge of Don has five granite arches, each 75 ft. in span, and was built in 1827–1832. A little to the west is the Auld Brig o' Balgownie, a picturesque single arch spanning the deep black stream, said to have been built by King Robert I., and celebrated by Byron in the tenth canto of *Don Juan.*

Harbour.—A defective harbour, with a shallow sand and gravel bar at its entrance, long retarded the trade of Aberdeen, but under various acts since 1773 it was greatly deepened. The north pier, built partly by Smeaton in 1775–1781, and partly by Telford in 1810–1815, extends nearly 3000 ft. into the North Sea. It increases the depth of water on the bar from a few feet to 22 or 24 ft. at spring tides and to 17 or 18 ft. at neap. A wet dock, of 29 acres, and with 6000 ft. of quay, was completed in 1848 and called Victoria Dock in honour of the queen's visit to the city in that year. Adjoining it is the Upper Dock. By the Harbour Act of 1868, the Dee near the harbour was diverted from the south at a cost of £80,000, and 90 acres of new ground (in addition to 25 acres formerly made up) were provided on the north side of the river for the Albert Basin (with a graving dock), quays and warehouses. A breakwater of concrete, 1050 ft. long, was constructed on the south side of the stream as a protection against south-easterly gales. On Girdleness, the southern point of the bay, a lighthouse was built in 1833. Near the harbour mouth are three batteries mounting nineteen guns.

Industry.—Owing to the variety and importance of its chief industries Aberdeen is one of the most prosperous cities in Scotland. Very durable grey granite has been quarried near Aberdeen for more than 300 years, and blocked and dressed paving "setts," kerb and building stones, and monumental and other ornamental work of granite have long been exported from the district to all parts of the world. This, though once the predominant industry, has been surpassed by the deep-sea fisheries, which derived a great impetus from beam-trawling, introduced in 1882, and steam line fishing in 1889, and threaten to rival if not to eclipse those of Grimsby. Fish trains are despatched to London daily. Most of the leading industries date from the 18th century, amongst them woollens (1703), linen (1749) and cotton (1779). These give employment to several thousands of operatives. The paper-making industry is one of the most famous and oldest in the city, paper having been first made in Aberdeen in 1694. Flax-spinning and jute and comb-making factories are also very flourishing, and there are successful foundries and engineering works. There are large distilleries and breweries, and chemical works employing many hands. In the days of wooden ships ship-building was a flourishing industry, the town being noted for its fast clippers, many of which established records in the "tea races." The introduction of trawling revived this to some extent, and despite the distance of the city from the iron fields there is a fair yearly output of iron vessels. Of later origin are the jam, pickle and potted meat factories, hundreds of acres having been laid down in strawberries and other fruits within a few miles of the city.

History.—Aberdeen was an important place as far back as the 12th century. William the Lion had a residence in the city, to which he gave a charter in 1179 confirming the corporate rights granted by David I. The city received other royal charters later. It was burned by the English king, Edward III., in 1336, but it was soon rebuilt and extended, and called New Aberdeen. The burgh records are the oldest in Scotland. They begin in 1398 and with one brief break are complete to the present day. For many centuries the city was subject to attacks by the neighbouring barons, and was strongly fortified, but the gates were all removed by 1770. In 1497 a blockhouse was built at the harbour mouth as a protection against the English. During the struggles between the Royalists and Covenanters the city was impartially plundered by both sides. In 1715 the Earl Marischal proclaimed the Old Pretender at Aberdeen, and in 1745 the duke of Cumberland resided for a short time in the city before attacking the Young Pretender. The motto on the city arms is "Bon Accord," which formed the watchword of the Aberdonians while aiding Robert Bruce in his battles with the English.

Population.—In 1396 the population was about 3000. By 1801 it had become 26,992; in 1841 it was 63,262; (1891) 121,623; (1901) 153,503.

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ABERDEEN, a city and the county-seat of Brown county, South Dakota, U.S.A., about 125 m. N.E. of Pierre. Pop. (1890) 3182; (1900) 4087, of whom 880 were foreign born; (1005) 5841; (1910) 10,753. Aberdeen is served by the Chicago, Milwaukee and St Paul, the Great Northern, the Minneapolis and St Louis, and the Chicago and North Western railways. It is the financial and trade centre for the northern part of the state, a fine agricultural region, and in 1908 had five banks and a number of wholesale houses. The city is the seat of the Northern Normal and Industrial School, a state institution, and has a Carnegie library; the principal buildings are the court house and the government buildings. Artesian wells furnish good water-power, and artesian-well supplies, grain pitchers, brooms, chemicals and flour are manufactured. The municipality owns and operates the water-works. Aberdeen was settled in 1880, and was chartered as a city in 1883.

ABERDEENSHIRE, a north-eastern county of Scotland, bounded N. and E. by the North Sea, S. by Kincardine, Forfar and Perth, and W. by Inverness and Banff. It has a coast-line of 65 m., and is the sixth Scottish county in area, occupying 1,261,887 acres or 1971 sq. m. The county is generally hilly, and from the south-west, near the centre of Scotland, the Grampians send out various branches, mostly to the north-east. The shire is popularly divided into five districts. Of these the first is Mar, mostly between the Dee and Don, which nearly covers the southern half of the county and contains the city of Aberdeen. It is mountainous, especially Braemar (*q.v.*), which contains the greatest mass of elevated land in the British Isles. The soil on the Dee is sandy, and on the Don loamy. The second district, Formartine, between the lower Don and Ythan, has a sandy coast, which is succeeded inland by a clayey, fertile, tilled tract, and then by low hills, moors, mosses and tilled land. Buchan, the third district, lies north of the Ythan, and, comprising the north-east of the county, is next in size to Mar, parts of the coast being bold and rocky, the interior bare, low, flat, undulating and in places peaty. On the coast, 6 m. S. of Peterhead, are the Bullers of Buchan—a basin in which the sea, entering by a natural arch, boils up violently in stormy weather. Buchan Ness is the most easterly point of Scotland. The fourth district, Garioch, in the centre of the shire, is a beautiful, undulating, loamy, fertile valley, formerly called the granary of Aberdeen. Strathbogie, the fifth district, occupying a considerable area south of the Deveron, mostly consists of hills, moors and mosses. The mountains are the most striking of the physical features of the county. Ben Macdhui (4296 ft.), a magnificent mass, the second highest mountain in Great Britain, Braeriach (4248), Cairntoul (4241), Ben-na-bhuaird (3924), Ben Avon (3843), "dark" Lochnagar (3786), the subject of a well-known song by Byron, Cairn Eas (3556), Sgarsoch (3402), Culardoch (2953), are the principal heights in the division of Mar. Farther north rise the Buck of Cabrach (2368) on the Banffshire border, Tap o' Noth (1830), Bennachie (1698), a beautiful peak which from its central position is a landmark visible from many different parts of the county, and which is celebrated in John Imlah's song, "O gin I were where Gadie rins," and Foudland (1529). The chief rivers are the Dee, 90 m. long; the Don, 82 m.; the Ythan, 37 m., with mussel-beds at its mouth; the Ugie, 20 m., and the Deveron, 62 m., partly on the boundary of Banffshire. The rivers abound with salmon and trout, and the pearl mussel occurs in the Ythan and Don. A valuable pearl in the Scottish crown is said to be from the Ythan. Loch Muick, the largest of the few lakes in the county, 1310 ft. above the sea, 2¼ m. long and ¼ to ½ m. broad, lies some 8½ m. S.W. of Ballater, and has Altnagiuthasach, a royal shooting-box, near its south-western end. Loch Strathbeg, 6 m. S.E. of Fraserburgh, is only separated from the sea by a narrow strip of land. There are noted chalybeate springs at Peterhead, Fraserburgh, and Pannanich near Ballater.

Geology.—The greater part of the county is composed of crystalline schists belonging to the metamorphic rocks of the Eastern Highlands. In the upper parts of the valleys of the Dee and the Don they form well-marked groups, of which the most characteristic are (1) the black schists and phyllites, with calc-flintas, and a thin band of tremolite limestone, (2) the main or Blair Atholl limestone, (3) the quartzite. These divisions are folded on highly inclined or vertical axes trending north-east and south-west, and hence the same zones are repeated over a considerable area. The quartzite is generally regarded as the highest member of the series. Excellent sections showing the component strata occur in Glen Clunie and its tributary valleys above Braemar. Eastwards down the Dee and the Don and northwards across the plain of Buchan towards Rattray Head and Fraserburgh there is a development of biotite gneiss, partly of sedimentary and perhaps partly of igneous origin. A belt of slate which has been quarried for roofing purposes runs along the west border of the county from Turriff by Auchterless and the Foudland Hills towards the Tap o' Noth near Gartly. The metamorphic rocks have been invaded by igneous materials, some before, and by far the larger series after the folding of the strata. The basic types of the former are represented by the sills of epidiorite and hornblende gneiss in Glen Muick and Glen Callater, which have been permeated by granite and pegmatite in veins and lenticles, often foliated. The later granites subsequent to the plication of the schists have a wide distribution on the Ben Macdhui and Ben Avon range, and on Lochnagar; they stretch eastwards from Ballater by Tarland to Aberdeen and north to Bennachie. Isolated masses appear at Peterhead and at Strichen. Though consisting mainly of biotite granite, these later intrusions pass by intermediate stages into diorite, as in the area between Balmoral and the head-waters of the Gairn. The granites have been extensively quarried at Rubislaw, Peterhead and Kemnay. Serpentine and troctolite, the precise age of which is uncertain, occur at the Black Dog rock north of Aberdeen, at Belhelvie and near Old Meldrum. Where the schists of sedimentary origin have been pierced by these igneous intrusions, they are charged with contact minerals such as sillimanite, cordierite, kyanite and andalusite. Cordierite-bearing rocks occur near Ellon, at the foot of Bennachie, and on the top of the Buck of Cabrach. A banded and mottled calc-silicate hornfels occurring with the limestone at Derry Falls, W.N.W. of Braemar, has yielded malacolite, wollastonite, brown idocrase, garnet, sphene and hornblende. A larger list of minerals has been obtained from an exposure of limestone and associated beds in Glen Gairn, about four miles above the point where that river joins the Dee. Narrow belts of Old Red Sandstone, resting unconformably on the old platform of slates and schists, have been traced from the north coast at Peterhead by Turriff to Fyvie, and also from Huntly by Gartly to Kildrummy Castle. The strata consist mainly of conglomerates and sandstones, which, at Gartly and at Rhynie, are associated with lenticular bands of andesite indicating contemporaneous volcanic action. Small outliers of conglomerate and sandstone of this age have recently been found in the course of excavations in Aberdeen. The glacial deposits, especially in the belt bordering the coast between Aberdeen and Peterhead, furnish important evidence. The ice moved eastwards off the high ground at the head of the Dee and the Don, while the mass spreading outwards from the Moray Firth invaded the low plateau of Buchan; but at a certain stage there was a marked defection northwards parallel with the coast, as proved by the deposit of red clay north of Aberdeen. At a later date the local glaciers laid down materials on top of the red clay. The committee appointed by the British Association (*Report* for 1897, p. 333) proved that the Greensand, which has yielded a large suite of Cretaceous fossils at Moreseat, in the parish of Cruden, occurs in glacial drift, resting probably on granite. The strata from which the Moreseat fossils were derived are not now found in place in that part of Scotland, but Mr Jukes Brown considers that the horizon of the fossils is that of the lower Greensand of the Isle of Wight or the Aptien stage of France. Chalk flints are widely distributed in the drift between Fyvie and the east coast of Buchan. At Plaidy a patch of clay with Liassic fossils occurs. At several localities between Logie Coldstone and Dinnet a deposit of diatomite (Kieselguhr) occurs beneath the peat.

Flora and Fauna.—The tops of the highest mountains have an arctic flora. At the royal lodge on Loch Muick, 1350 ft. above the sea, grow larches, vegetables, currants, laurels, roses, &c. Some ash-trees, four or five feet in girth, are growing at 1300 ft. above the sea. Trees, especially Scotch fir and larch, grow well, and Braemar is rich in natural timber, said to surpass any in the north of Europe. Stumps of Scotch fir and oak found in peat are sometimes far larger than any now growing. The mole is found at 1800 ft. above the sea, and the squirrel at 1400. Grouse, partridges and hares are plentiful, and rabbits are often too numerous. Red deer abound in Braemar, the deer forest being the most extensive in Scotland.

Climate and Agriculture.—The climate, except in the mountainous districts, is comparatively mild, owing to the proximity of much of the shire to the sea. The mean annual temperature at Braemar is 43·6° F., and at Aberdeen 45·8°. The mean yearly rainfall varies from about 30 to 37 in. The summer climate of the upper Dee and Don valleys is the driest and most bracing in the British Isles, and grain is cultivated up to 1600 ft. above the sea, or 400 to 500 ft. higher than elsewhere in North Britain. Poor, gravelly, clayey and peaty soils prevail, but tile-draining, bones and guano, and the best methods of modern tillage, have greatly increased the produce. Indeed, in no part of Scotland has a more productive soil been made out of such unpromising material. Farm-houses and steadings have much improved, and the best agricultural implements and machines are in general use. About two-thirds of the population depend entirely on agriculture. Farms are small compared with those in the south-eastern counties. Oats are the predominant crop, wheat has practically gone out of cultivation, but barley has largely increased. The most distinctive industry is cattle-feeding. A great number of the home-bred crosses are fattened for the London and local markets, and Irish animals are imported on an extensive scale for the same purpose, while an exceedingly heavy business in dead meat for London and the south is done all over the county. Sheep, horses and pigs are also raised in large numbers.

Fisheries.—A large fishing population in villages along the coast engage in the white and herring fishery, which is the next most important industry to agriculture, its development having been due almost exclusively to the introduction of steam trawlers. The total value of the annual catch, of which between a half and a third consists of herrings, amounts to £1,000,000. Haddocks are salted and rock-dried (speldings) or smoked (finnans). The ports and creeks are divided into the fishery districts of Peterhead, Fraserburgh and Aberdeen, the last of which includes also three Kincardineshire ports. The herring season for Aberdeen, Peterhead and Fraserburgh is from June to September, at which time the ports are crowded with boats from other Scottish districts. There are valuable salmon-fishings—rod, net and stake-net—on the Dee, Don, Ythan and Ugie. The average annual despatch of salmon from Aberdeenshire is about 400 tons.

Other Industries.—Manufactures are mainly prosecuted in or near the city of Aberdeen, but throughout the rural districts there is much milling of corn, brick and tile making, smith-work, brewing and distilling, cart and farm-implement making, casting and drying of peat, and timber-felling, especially on Deeside and Donside, for pit-props, railway sleepers, laths and barrel-staves. There are a number of paper-making establishments, most of them on the Don near Aberdeen.

The chief source of mineral wealth is the noted durable granite, which is quarried at Aberdeen, Kemnay, Peterhead and elsewhere. An acre of land on being reclaimed has yielded £40 to £50 worth of causewaying stones. Sandstone and other rocks are also quarried at different parts. The imports are mostly coal, lime, timber, iron, slate, raw materials for the textile manufactures, wheat, cattle-feeding stuffs, bones, guano, sugar, alcoholic liquors, fruits. The exports are granite (rough-dressed and polished), flax, woollen and cotton goods, paper, combs, preserved provisions, oats, barley, live and dead cattle.

Communications.—From the south Aberdeen city is approached by the Caledonian (*via* Perth, Forfar and Stonehaven), and the North British (*via* Dundee, Montrose and Stonehaven) railways, and the shire is also served by the Great North of Scotland railway, whose main line runs *via* Kintore and Huntly to Keith and Elgin. There are branch lines from various points opening up the more populous districts, as from Aberdeen to Ballater by Deeside, from Aberdeen to Fraserburgh (with a branch at Maud for Peterhead and at Ellon for Cruden Bay and Boddam), from Kintore to Alford, and from Inverurie to Old Meldrum and also to Macduff. By sea there is regular communication with London, Leith, Inverness, Wick, the Orkneys and Shetlands, Iceland and the continent. The highest of the macadamized roads crossing the eastern Grampians rises to a point 2200 ft. above sea-level.

Population and Government.—In 1891 the population numbered 284,036 and in 1901 it was 304,439 (of whom 159,603 were females), or 154 persons to the sq. m. In 1901 there were 8 persons who spoke Gaelic only, and 1333 who spoke Gaelic and English. The chief towns are Aberdeen (pop. in 1901, 153,503), Bucksburn (2231), Fraserburgh (9105), Huntly (4136), Inverurie (3624), Peterhead (11,794), Turriff (2273). The Supreme Court of Justiciary sits in Aberdeen to try cases from the counties of Aberdeen, Banff and Kincardine. The three counties are under a sheriff, and there are two sheriffs-substitute resident in Aberdeen, who sit also at Fraserburgh, Huntly, Peterhead and Turriff. The sheriff courts are held in Aberdeen and Peterhead. The county sends two members to parliament—one for East Aberdeenshire and the other for West Aberdeenshire. The county town, Aberdeen (*q.v.*), returns two members. Peterhead, Inverurie and Kintore belong to the Elgin group of parliamentary burghs, the other constituents being Banff, Cullen and Elgin. The county is under school-board jurisdiction, and there are also several voluntary schools. There are higher-class schools in Aberdeen, and secondary schools at Huntly, Peterhead and Fraserburgh, and many of the other schools in the county earn grants for secondary education. The County Secondary Education Committee dispense a large sum, partly granted by the education department and partly contributed by local authorities from the "residue" grant, and support, besides the schools mentioned, local classes and lectures in agriculture, fishery and other technical subjects, in addition to subsidizing the agricultural department of the university of Aberdeen. The higher branches of education have always been thoroughly taught in the schools throughout the shire, and pupils have long been in the habit of going directly from the schools to the university.

The native Scots are long-headed, shrewd, careful, canny, active, persistent, but reserved and blunt, and without demonstrative enthusiasm. They have a physiognomy distinct from the rest of the Scottish people, and have a quick, sharp, rather angry accent. The local Scots dialect is broad, and rich in diminutives, and is noted for the use of *e* for *o* or *u*, *f* for *wh*, *d* for *th*, &c. So recently as 1830 Gaelic was the fireside language of almost every family in Braemar, but now it is little used.

History.—The country now forming the shires of Aberdeen and Banff was originally peopled by northern Picts, whom Ptolemy called Taixali, the territory being named Taixalon. Their town of Devana, once supposed to be the modern Aberdeen, has been identified by Prof. John Stuart with a site in the parish of Peterculter, where there are remains of an ancient camp at Normandykes, and by Dr W. F. Skene with a station on Loch Davan, west of Aboyne. So-called Roman camps have also been discovered on the upper Ythan and Deveron, but evidence of effective Roman occupation is still to seek. Traces of the native inhabitants, however, are much less equivocal. Weems or earth-houses are fairly common in the west. Relics of crannogs or lake-dwellings exist at Loch Ceander, or Kinnord, 5 m. north-east of Ballater, at Loch Goul in the parish of New Machar and elsewhere. Duns or forts occur on hills at Dunecht, where the dun encloses an area of two acres, Barra near Old Meldrum, Tap o' Noth, Dunnideer near Insch and other places. Monoliths, standing stones and "Druidical" circles of the pagan period abound, and there are many examples of the sculptured stones of the early Christian epoch. Efforts to convert the Picts were begun by Ternan in the 5th century, and continued by Columba (who founded a monastery at Old Deer), Drostan, Maluog and Machar, but it was long before they showed lasting results. Indeed, dissensions within the Columban church and the expulsion of the clergy from Pictland by the Pictish king Nectan in the 8th century undid most of the progress that had been made. The Vikings and Danes periodically raided the coast, but when (1040) Macbeth ascended the throne of Scotland the Northmen, under the guidance of Thorfinn, refrained from further trouble in the north-east. Macbeth was afterwards slain at Lumphanan (1057), a cairn on Perkhill marking the spot. The influence of the Norman conquest of England was felt even in Aberdeenshire. Along with numerous Anglo-Saxon exiles, there also settled in the country Flemings who introduced various industries, Saxons who brought farming, and Scandinavians who taught nautical skill. The Celts revolted more than once, but Malcolm Canmore and his successors crushed them and confiscated their lands. In the reign of Alexander I. (d. 1124) mention is first made of Aberdeen (originally called Aberdôn and, in the Norse sagas, Apardion), which received its charter from William the Lion in 1179, by which date its burgesses had already combined with those of Banff, Elgin, Inverness and other trans-Grampian communities to form a free Hanse, under which they enjoyed exceptional trading privileges. By this time, too, the Church had been organized, the bishopric of Aberdeen having been established in 1150. In the 12th and 13th centuries some of the great Aberdeenshire families arose, including the earl of Mar (*c.* 1122), the Leslies, Freskins (ancestors of the dukes of Sutherland), Durwards, Bysets, Comyns and Cheynes, and it is significant that in most cases their founders were immigrants. The Celtic thanes and their retainers slowly fused with the settlers. They declined to take advantage of the disturbed condition of the country during the wars of the Scots independence, and made common cause with the bulk of the nation. Though John Comyn (d. 1300?), one of the competitors for the throne, had considerable interests in the shire, his claim received locally little support. In 1296 Edward I. made a triumphal march to the north to terrorize the more turbulent nobles. Next year William Wa[illegible] surprised the English garrison in Aberdeen, but failed to [illegible]ure the castle. In 1303 Edward again visited the county [illegible]ting at the castle of Kildrummy, then in the possessio[illegible] Robert Bruce, who shortly afterwards became the ackn[illegible]edged leader of the Scots and made Aberdeen his headqu[illegible]rs for several months. Despite the seizure of Kildrum[illegible] Castle by the English in 1306, Bruce's prospects brighte[illegible] from 1308, when he defeated John Comyn, earl of Bucha[illegible] (d. 1313?), at Inverurie. For a hundred years after Robert [illegible]ruce's death (1329) there was intermittent anarchy in the [illegible]ure. Aberdeen itself was burned by the English in 1336, a[illegible] the re-settlement of the districts of Buchan and Strathb[illegible]gie occasioned constant quarrels on the part of the dispos[illegible]sed. Moreover, the crown had embroiled itself with some of the Highland chieftains, whose independence it sought to abolish. This policy culminated in the invasion of Aberdeenshire by Donald, lord of the Isles, who was, however, defeated at Harlaw, near Inverurie, by the earl of Mar in 1411. In the 15th century two other leading county families appeared, Sir Alexander Forbes being created Lord Forbes about 1442, and Sir Alexander Seton Lord Gordon in 1437 and earl of Huntly in 1445. Bitter feuds raged between these families for a long period, but the Gordons reached the height of their power in the first half of the 16th century, when their domains, already vast, were enhanced by the acquisition, through marriage, of the earldom of Sutherland (1514). Meanwhile commerce with the Low Countries, Poland and the Baltic had grown apace, Campvere, near Flushing in Holland, becoming the emporium of the Scottish traders, while education was fostered by the foundation of King's College at Aberdeen in 1497 (Marischal College followed a century later). At the Reformation so little intuition had the clergy of the drift of opinion that at the very time that religious structures were being despoiled in the south, the building and decoration of churches went on in the shire. The change was acquiesced in without much tumult, though rioting took place in Aberdeen and St Machar's cathedral in the city suffered damage. The 4th earl of Huntly offered some resistance, on behalf of the Catholics, to the influence of Lord James Stuart, afterwards the Regent Murray, but was defeated and killed at Corrichie on the hill of Fare in 1562. As years passed it was apparent that Presbyterianism was less generally acceptable than Episcopacy, of which system Aberdeenshire remained for generations the stronghold in Scotland. Another crisis in ecclesiastical affairs arose in 1638, when the National Covenant was ordered to be subscribed, a demand so grudgingly responded to that the marquis of Montrose visited the shire in the following year to enforce acceptance. The Cavaliers, not being disposed to yield, dispersed an armed gathering of Covenanters in the affair called the Trot of Turriff (1639), in which the first blood of the civil war was shed. The Covenanters obtained the upper hand in a few weeks, when Montrose appeared at the bridge of Dee and compelled the surrender of Aberdeen, which had no choice but to cast in its lot with the victors. Montrose, however, soon changed sides, and after defeating the Covenanters under Lord Balfour of Burleigh (1644), delivered the city to rapine. He worsted the Covenanters again after a stiff fight on the 2nd of July 1645, at Alford, a village in the beautiful Howe of Alford. Peace was temporarily restored on the "engagement" of the Scots commissioners to assist Charles I. On his return from Holland in 1650 Charles II. was welcomed in Aberdeen, but in little more than a year General Monk entered the city at the head of the Cromwellian regiments. The English garrison remained till 1659, and next year the Restoration was effusively hailed, and prelacy was once more in the ascendant. Most of the Presbyterians conformed, but the Quakers, more numerous in the shire and the adjoining county of Kincardine than anywhere else in Scotland, were systematically persecuted. After the Revolution (1688) episcopacy passed under a cloud, but the clergy, yielding to *force majeure*, gradually accepted the inevitable, hoping, as long as Queen Anne lived, that prelacy might yet be recognized as the national form of Church government. Her death dissipated these dreams, and as George I., her successor, was antipathetic to the clergy, it happened that Jacobitism and episcopalianism came to be regarded in the shire as identical, though in point of fact the non-jurors as a body never countenanced rebellion. The earl of Mar raised the standard of revolt in Braemar (6th of September 1715); a fortnight later James was proclaimed at Aberdeen cross; the Pretender landed at Peterhead on the 22nd of December, and in February 1716 he was back again in France. The collapse of the first rising ruined many of the lairds, and when the second rebellion occurred thirty years afterwards the county in the main was apathetic, though the insurgents held Aberdeen for five months, and Lord Lewis Gordon won a trifling victory for Prince Charles Edward at Inverurie (23rd of December 1745). The duke of Cumberland relieved Aberdeen at the end of February 1746, and in April the Young Pretender was a fugitive. Thereafter the people devoted themselves to agriculture, industry and commerce, which developed by leaps and bounds, and, along with equally remarkable progress in education, transformed the aspect of the shire and made the community as a whole one of the most prosperous in Scotland.

See W. Watt, *History of Aberdeen and Banff* (Edinburgh, 1900); *Collections for a History of the Shires of Aberdeen and Banff* (edited by Dr Joseph Robertson, Spalding Club); Sir A. Leith-Hay, *Castles of Aberdeenshire* (Aberdeen, 1887); J. Davidson, *Inverurie and the Earldom of the Garioch* (Edinburgh, 1878); Pratt, *Buchan* (rev. by R. Anderson), (Aberdeen, 1900); A. I. M'Connochie, *Deeside* (Aberdeen, 1895).

ABERDOUR, a village of Fifeshire, Scotland. Pleasantly situated on the shore of the Firth of Forth, 17½ m. N.W. of Edinburgh by the North British railway and 7 m. N.W. of Leith by steamer, it is much resorted to for its excellent sea-bathing. There are ruins of a castle and an old decayed church, which contains some fine Norman work. About 3 m. S.W. is Donibristle House, the seat of the earl of Murray (Moray), and the scene of the murder (Feb. 7, 1592) of James, 2nd (Stuart) earl of Murray. The island of Inchcolm, or Island of Columba, ¾ m. from the shore, is in the parish of Aberdour. As its name implies, its associations date back to the time of Columba. The primitive stone-roofed oratory is supposed to have been a hermit's cell. The Augustinian monastery was founded in 1123 by Alexander I. The buildings are well preserved, consisting of a low square tower, church, cloisters, refectory and small chapter-house. The island of Columba was occasionally plundered by English and other rovers, but in the 16th century it became the property of Sir James Stuart, whose grandson became 2nd earl of Murray by virtue of his marriage to the elder daughter of the 1st earl. From it comes the earl's title of Lord St Colme (1611).

ABERDOVEY (*Aberdyfi*: the Dyfi is the county frontier), a seaside village of Merionethshire, North Wales, on the Cambrian railway. Pop. (1901) 1466. It lies in the midst of beautiful scenery, 4 m. from Towyn, on the N. bank of the Dyfi estuary, commanding views of Snowdon, Cader Idris, Arran Mawddy and Plynlimmon. The Dyfi, here a mile broad, is crossed by a ferry to Borth sands, whence a road leads to Aberystwyth. The submerged "bells of Aberdovey" (since Seithennin "the drunkard" caused the formation of Cardigan Bay) are famous in a Welsh song. Aberdovey is a health and bathing resort.

ABERFOYLE, a village and parish of Perthshire, Scotland, 34½ m. N. by W. of Glasgow by the North British railway. Pop. of parish (1901) 1052. The village is situated at the base of Craigmore (1271 ft. high) and on the Laggan, a head-water of the Forth. Since 1885, when the duke of Montrose constructed a road over the eastern shoulder of Craigmore to join the older road at the entrance of the Trossachs pass, Aberfoyle has become the alternative route to the Trossachs and Loch Katrine. Loch Ard, about 2 m. W. of Aberfoyle, lies 105 ft. above the sea. It is 3 m. long (including the narrows at the east end) and 1 m. broad. Towards the west end is Eilean Gorm (the green isle), and near the north-western shore are the falls of Ledard. Two m. N.W. is Loch Chon, 290 ft. above the sea, 1¾ m. long, and about ½ m. broad. It drains by the Avon Dhu to Loch Ard, which is drained in turn by the Laggan. The slate quarries on Craigmore are the only industry in Aberfoyle.

ABERGAVENNY, a market town and municipal borough in the northern parliamentary division of Monmouthshire, England, 14 m. W. of Monmouth on the Great Western and the London and North-Western railways. Pop. (1901) 7795. It is situated at the junction of a small stream called the Gavenny with the river Usk; and the site, almost surrounded by lofty hills, is very beautiful. The town was formerly walled, and has the remains of a castle built soon after the conquest, frequently the scene of border strife. The church of St Mary belonged originally to a Benedictine monastery founded early in the 12th century. The existing building, however, is Decorated and Perpendicular, and contains a fine series of memorials of dates from the 13th to the 17th century. There is a free grammar school, which till 1857 had a fellowship at Jesus College, Oxford. Breweries, ironworks, quarries, brick fields and collieries in the neighbourhood are among the principal industrial establishments. Abergavenny was incorporated in 1899, and is governed by a mayor, 4 aldermen and 12 councillors. Area, 825 acres.

This was the Roman *Gobannium*, a small fort guarding the road along the valley of the Usk and ensuring quiet among the hill tribes. There is practically no trace of this fort. Abergavenny (Bergavenny) grew up under the protection of the lords of Abergavenny, whose title dated from William I. Owing to its situation, the town was frequently embroiled in the border warfare of the 12th and 13th centuries, and Giraldus Cambrensis relates how in 1175 the castle was seized by the Welsh. Hamelyn de Baalun, first lord of Abergavenny, founded the Benedictine priory, which was subsequently endowed by William de Braose with a tenth of the profits of the castle and town. At the dissolution of the priory part of this endowment went towards the foundation of a free grammar school, the site itself passing to the Gunter family. During the Civil War prior to the siege of Raglan Castle in 1645, Charles I. visited Abergavenny, and presided in person over the trial of Sir Trevor Williams and other parliamentarians. In 1639 Abergavenny received a charter of incorporation under the title of bailiff and burgesses. A charter with extended privileges was drafted in 1657, but appears never to have been enrolled or to have come into effect. Owing to the refusal of the chief officers of the corporation to take the oath of allegiance to William III. in 1688, the charter was annulled, and the town subsequently declined in prosperity. The act of 27 Henry VIII., which provided that Monmouth, as county town, should return one burgess to parliament, further stated that other ancient Monmouthshire boroughs were to contribute towards the payment of the member. In consequence of this clause Abergavenny on various occasions shared in the election, the last instance being in 1685. Reference to a market at Abergavenny is found in a charter granted to the prior by William de Braose (d. 1211). The right to hold two weekly markets and three yearly fairs, as hitherto held, was confirmed in 1657. Abergavenny was celebrated for the production of Welsh flannel, and also for the manufacture, whilst the fashion prevailed, of periwigs of goats' hair.

The title of Baron Abergavenny, in the Neville family, dates from Edward Neville (d. 1476), who was the youngest son of the 1st earl of Westmoreland by Joan Beaufort, daughter of John of Gaunt. He married the heiress of Richard, earl of Worcester, whose father had inherited the castle and estate of Abergavenny, and was summoned in 1392 to parliament as Lord Bergavenny. Edward Neville was summoned to parliament with this title in 1450. His direct male descendants ended in 1587 in Henry Neville, but a cousin, Edward Neville (d. 1622), was confirmed in the barony in 1604. From him it has descended continuously, the title being increased to an earldom in 1784; and in 1876 William Nevill (*sic*), 5th earl (b. 1826), an indefatigable and powerful supporter of the Conservative party, was created 1st marquess of Abergavenny. (See Neville.)

ABERIGH-MACKAY, GEORGE ROBERT (1848–1881), Anglo-Indian writer, son of a Bengal chaplain, was born on the 25th of July 1848, and was educated at Magdalen College School and Cambridge University. Entering the Indian education department in 1870, he became professor of English literature in Delhi College in 1873, tutor to the raja of Rutlam 1876, and principal of the Rajkumar College at Indore in 1877. He is best known for his book *Twenty-one Days in India* (1878–1879), a satire upon Anglo-Indian society and modes of thought. This book gave promise of a successful literary career; but the author died at the age of thirty-three.

ABERNETHY, JOHN (1680–1740), Irish Presbyterian divine, was born at Coleraine, county Londonderry, where his father was Nonconformist minister, on the 19th of October 1680. In his thirteenth year he entered the university of Glasgow, and on concluding his course there went on to Edinburgh, where his intellectual and social attainments gained him a ready entrance into the most cultured circles. Returning home he received licence to preach from his Presbytery before he was twenty-one. In 1701 he was urgently invited to accept charge of an important congregation in Antrim, and after an interval of two years, mostly spent in further study in Dublin, he was ordained there on the 8th of August 1703. Here he did notable work, both as a debater in the synods and assemblies of his church and as an evangelist. In 1712 he lost his wife (Susannah Jordan), and the loss desolated his life for many years. In 17[illegible] he was invited to the congregation of Usher's Quay, Dublin, and contemporaneously to what was called the Old Congregation of Belfast. The synod assigned him to Dublin. After careful consideration he declined to accede, and remained at Antrim. This refusal was regarded then as ecclesiastical high-treason; and a controversy of the most intense and disproportionate character followed, Abernethy standing firm for religious freedom and repudiating the sacerdotal assumptions of all ecclesiastical courts. The controversy and quarrel bears the name of the two camps in the conflict, the "Subscribers" and the "Non-subscribers." Out-and-out evangelical as John Abernethy was, there can be no question that he and his associates sowed the seeds of that after-struggle (1821–1840) in which, under the leadership of Dr Henry Cooke, the Arian and Socinian elements of the Irish Presbyterian Church were thrown out. Much of what he contended for, and which the "Subscribers" opposed bitterly, has been silently granted in the lapse of time. In 1726 the "Non-subscribers," spite of an almost wofully pathetic pleading against separation by Abernethy, were cut off, with due ban and solemnity, from the Irish Presbyterian Church. In 1730, although a "Non-subscriber," he was invited to Wood Street, Dublin, whither he removed. In 1731 came on the greatest controversy in which Abernethy engaged, viz. in relation to the Test Act nominally, but practically on the entire question of tests and disabilities. His stand was "against all laws that, upon account of mere differences of religious opinions and forms of worship, excluded men of integrity and ability from serving their country." He was nearly a century in advance of his age. He had to reason with those who denied that a Roman Catholic or Dissenter could be a "man of integrity and ability." His *Tracts*—afterwards collected—did fresh service, generations later, and his name is honoured by all who love freedom of conscience and opinion. He died in December 1740.

See Dr Duchal's *Life*, prefixed to *Sermons* (1762); *Diary* in MS., 6 vols. 4to; Reid's *Presbyterian Church in Ireland*, iii. 234.

ABERNETHY, JOHN (1764–1831), English surgeon, grandson of John Abernethy (see above), was born in London on the 3rd of April 1764. His father was a London merchant. Educated at Wolverhampton grammar school, he was apprenticed in 1779 to Sir Charles Blicke (1745–1815), surgeon to St Bartholomew's Hospital, London. He attended the anatomical lectures of Sir William Blizard (1743–1835) at the London Hospital, and was early employed to assist as "demonstrator"; he also attended Percival Pott's surgical lectures at St Bartholomew's Hospital, as well as the lectures of John Hunter. On Pott's resignation of the office of surgeon of St Bartholomew's, Sir Charles Blicke, who was assistant-surgeon, succeeded him, and Abernethy was elected assistant-surgeon in 1787. In this capacity he began to give lectures at his house in Bartholomew Close, which were so well attended that the governors of the hospital built a regular theatre (1790–1791), and Abernethy thus became the founder of the distinguished school of St Bartholomew's. He held the office of assistant-surgeon of the hospital for the long period of twenty-eight years, till, in 1815, he was elected principal surgeon. He had before that time been appointed lecturer in anatomy to the Royal College of Surgeons (1814). Abernethy was not a great operator, though his name is associated with the treatment of aneurism by ligature of the external iliac artery. His *Surgical Observations on the Constitutional Origin and Treatment of Local Diseases* (1809)—known as "My Book," from the great frequency with which he referred his patients to it, and to page 72 of it in particular, under that name—was one of the earliest popular works on medical science.

He taught that local diseases were frequent ne results of disordered states of the digestive organs, an re to be treated by purging and attention to diet. As lecturer he was exceedingly attractive, and his succe teaching was largely attributable to the persuasivene with which he enunciated his views. It has been said owever, that the influence he exerted on those who att ded his lectures was not beneficial in this respect, that hi pinions were delivered so dogmatically, and all who differ from him were disparaged and denounced so contemptuo y, as to repress instead of stimulating inquiry. The celebrit ne attained in his practice was due not only to his great pr essional skill, but also in part to the singularity of his manners. He used great plainness of speech in his intercourse with his patients, treating them often brusquely and sometimes even rudely. In the circle of his family and friends he was courteous and affectionate; and in all his dealings he was strictly just and honourable. He resigned his position at St Bartholomew's Hospital in 1827, and died at his residence at Enfield on the 20th of April 1831.

A collected edition of his works was published in 1830. A biography, *Memoirs of John Abernethy*, by George Macilwain, appeared in 1853.

ABERRATION (Lat. *ab*, from or away, *errare*, to wander), a deviation or wandering, especially used in the figurative sense: as in ethics, a deviation from the truth; in pathology, a mental derangement; in zoology and botany, abnormal development or structure. In optics, the word has two special applications: (1) Aberration of Light, and (2) Aberration in Optical Systems. These subjects receive treatment below.

I. Aberration of Light

This astronomical phenomenon may be defined as an apparent motion of the heavenly bodies; the stars describing annually orbits more or less elliptical, according to the latitude of the star; consequently at any moment the star appears to be displaced from its true position. This apparent motion is due to the finite velocity of light, and the progressive motion of the observer with the earth, as it performs its yearly course about the sun. It may be familiarized by the following illustrations. Alexis Claude Clairaut gave this figure: Imagine rain to be falling vertically, and a person carrying a thin perpendicular tube to be standing on the ground. If the bearer be stationary, rain-drops will traverse the tube without touching its sides; if, however, the person be walking, the tube must be inclined at an angle varying as his velocity in order that the rain may traverse the tube centrally. J. J. L. de Lalande gave the illustration of a roofed carriage with an open front: if the carriage be stationary, no rain enters; if, however, it be moving, rain enters at the front. The "umbrella" analogy is possibly the best known figure. When stationary, the most efficient position in which to hold an umbrella is obviously vertical; when walking, the umbrella must be held more and more inclined from the vertical as the walker quickens his pace. Another familiar figure, pointed out by P. L. M. de Maupertuis, is that a sportsman, when aiming at a bird on the wing, sights his gun some distance ahead of the bird, the distance being proportional to the velocity of the bird. The mechanical idea, named the parallelogram of velocities, permits a ready and easy graphical representation of these facts. Reverting to the analogy of Clairaut, let AB (fig. 1) represent the velocity of the rain, and AC the relative velocity of the person bearing the tube. The diagonal AD of the parallelogram, of which AB and AC are adjacent sides, will represent, both in direction and magnitude, the motion of the rain as apparent to the observer. Hence for the rain to centrally traverse the tube, this must be inclined at an angle BAD to the vertical; this angle is conveniently termed the *aberration* due to these two motions. The umbrella analogy is similarly explained; the most efficient position being when the stick points along the resultant AD.

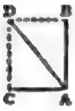

Fig. 1.

The discovery of the aberration of light in 1725, due to James Bradley, is one of the most important in the whole domain of astronomy. That it was unexpected there can be no doubt; and it was only by extraordinary perseverance and perspicuity that Bradley was able to explain it in 1727. Its origin is seated in attempts made to free from doubt the prevailing discordances as to whether the stars possessed appreciable parallaxes. The Copernican theory of the solar system—that the earth revolved annually about the sun—had received confirmation by the observations of Galileo and Tycho Brahe, and the mathematical investigations of Kepler and Newton. As early as 1573, Thomas Digges had suggested that this theory should necessitate a parallactic shifting of the stars, and, consequently, if such stellar parallaxes existed, then the Copernican theory would receive additional confirmation. Many observers claimed to have determined such parallaxes, but Tycho Brahe and G. B. Riccioli concluded that they existed only in the minds of the observers, and were due to instrumental and personal errors. In 1680 Jean Picard, in his *Voyage d'Uranibourg*, stated, as a result of ten years' observations, that *Polaris*, or the Pole Star, exhibited variations in its position amounting to 40″ annually; some astronomers endeavoured to explain this by parallax, but these attempts were futile, for the motion was at variance with that which parallax would occasion. J. Flamsteed, from measurements made in 1689 and succeeding years with his mural quadrant, similarly concluded that the declination of the Pole Star was 40″ less in July than in September. R. Hooke, in 1674, published his observations of γ *Draconis*, a star of the second magnitude which passes practically overhead in the latitude of London, and whose observations are therefore singularly free from the complex corrections due to astronomical refraction, and concluded that this star was 23″ more northerly in July than in October.

When James Bradley and Samuel Molyneux entered this sphere of astronomical research in 1725, there consequently prevailed much uncertainty as to whether stellar parallaxes had been observed or not; and it was with the intention of definitely answering this question that these astronomers erected a large telescope at the house of the latter at Kew. They determined to reinvestigate the motion of γ *Draconis*; the telescope, constructed by George Graham (1675–1751), a celebrated instrument-maker, was affixed to a vertical chimney-stack, in such manner as to permit a small oscillation of the eyepiece, the amount of which, *i.e.* the deviation from the vertical, was regulated and measured by the introduction of a screw and a plumb-line. The instrument was set up in November 1725, and observations on γ *Draconis* were made on the 3rd, 5th, 11th, and 12th of December. There was apparently no shifting of the star, which was therefore thought to be at its most southerly point. On the 17th of December, however, Bradley observed that the star was moving southwards, a motion further shown by observations on the 20th. These results were unexpected, and, in fact, inexplicable by existing theories; and an examination of the telescope showed that the observed anomalies were not due to instrumental errors. The observations were continued, and the star was seen to continue its southerly course until March, when it took up a position some 20″ more southerly than its December position. After March it began to pass northwards, a motion quite apparent by the middle of April; in June it passed at the same distance from the zenith as it did in December; and in September it passed through its most northerly position, the extreme range from north to south, *i.e.* the angle between the March and September positions, being 40″.

This motion is evidently not due to parallax, for, in this case, the maximum range should be between the June and December positions; neither was it due to observational errors. Bradley and Molyneux discussed several hypotheses in the hope of fixing the solution. One hypothesis was: while γ *Draconis* was stationary, the plumb-line, from which the angular measurements were made, varied; this would follow if the axis of the earth varied. The oscillation of the earth's axis may arise in two distinct ways; distinguished as "nutation of the axis" and "variation of latitude." Nutation, the only form of oscillation imagined by Bradley, postulates that while the earth's axis is fixed with respect to the earth, *i.e.* the north and south poles occupy permanent geographical positions, yet the axis is not directed towards a fixed point in the heavens; variation of latitude, however, is associated with the shifting of the axis within the earth, *i.e.* the geographical position of the north pole varies.

Nutation of the axis would determine a similar apparent motion for all stars: thus, all stars having the same polar distance as γ *Draconis* should exhibit the same apparent motion after or before this star by a constant interval. Many stars satisfy the condition of equality of polar distance with that of γ *Draconis*, but few were bright enough to be observed in Molyneux's telescope. One such star, however, with a right ascension nearly equal to that of γ *Draconis*, but in the opposite sense, was selected and kept under observation. This star was seen to possess an apparent motion similar to that which would be a consequence of the nutation of the earth's axis; but since its declination varied only one half as much as in the case of γ *Draconis*, it was obvious that nutation did not supply the requisite solution. The question as to whether the motion was due to an irregular distribution of the earth's atmosphere, thus involving abnormal variations in the refractive index, was also investigated; here, again, negative results were obtained.

Bradley had already perceived, in the case of the two stars previously scrutinized, that the apparent difference of declination from the maximum positions was nearly proportional to the sun's distance from the equinoctial points; and he realized the necessity for more observations before any generalization could be attempted. For this purpose he repaired to the Rectory, Wanstead, then the residence of Mrs Pound, the widow of his uncle James Pound, with whom he had made many observations of the heavenly bodies. Here he had set up, on the 19th of August 1727, a more convenient telescope than that at Kew, its range extending over 6¼° on each side of the zenith, thus covering a far larger area of the sky. Two hundred stars in the *British Catalogue* of Flamsteed traversed its field of view; and, of these, about fifty were kept under close observation. His conclusions may be thus summarized: (1) only stars near the solstitial colure had their maximum north and south positions when the sun was near the equinoxes, (2) each star was at its maximum positions when it passed the zenith at six o'clock morning and evening (this he afterwards showed to be inaccurate, and found the greatest change in declination to be proportional to the latitude of the star), (3) the apparent motions of all stars at about the same time was in the same direction.

A re-examination of his previously considered hypotheses as to the cause of these phenomena was fruitless; the true theory was ultimately discovered by a pure accident, comparable in simplicity and importance with the association of a falling apple with the discovery of the principle of universal gravitation. Sailing on the river Thames, Bradley repeatedly observed the shifting of a vane on the mast as the boat altered its course; and, having been assured that the motion of the vane meant that the boat, and not the wind, had altered its direction, he realized that the position taken up by the vane was determined by the motion of the boat and the direction of the wind. The application of this observation to the phenomenon which had so long perplexed him was not difficult, and, in 1727, he published his theory of the aberration of light—a corner-stone of the edifice of astronomical science. Let S (fig. 2) be a star and the observer be carried along the line AB; let SB be perpendicular to AB. If the observer be stationary at B, the star will appear in the direction BS; if, however, he traverses the distance BA in the same time as light passes from the star to his eye, the star will appear in the direction AS. Since, however, the observer is not conscious of his own translatory motion with the earth in its orbit, the star appears to have a displacement which is at all times parallel to the motion of the observer. To generalize this, let S (fig. 3) be the sun, ABCD the earth's orbit, and *s* the true position of a star. When the earth is at A, in consequence of aberration, the star is displaced to a point *a*, its displacement *sa* being parallel to the earth's motion at A; when the earth is at B, the star appears at *b*; and so on throughout an orbital revolution of the earth. Every star, therefore, describes an apparent orbit, which, if the line joining the sun and the star be perpendicular to the plane ABCD, will be exactly similar to that of the earth, *i.e.* almost a circle. As the star decreases in latitude, this circle will be viewed more and more obliquely, becoming a flatter and flatter ellipse until, with zero latitude, it degenerates into a straight line (fig. 4).

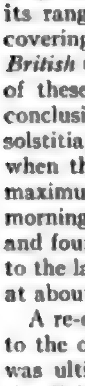

Fig. 2.

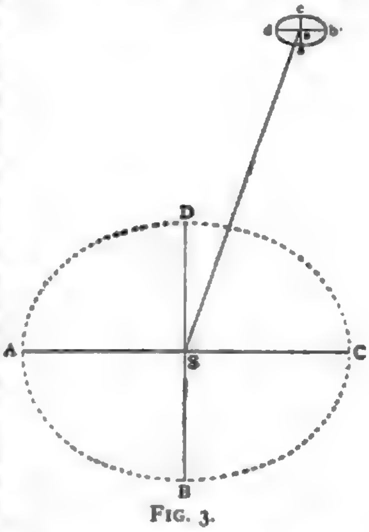

Fig. 3.

The major axis of any such aberrational ellipse is always parallel to AC, *i.e.* the ecliptic, and since it is equal to the ratio of the velocity of light to the velocity of the earth, it is necessarily constant. This constant length subtends an angle of about 40″ at the earth; the "constant of aberration" is half this angle. The generally accepted value is 20·445″, due to Struve; the last two figures are uncertain, and all that can be definitely affirmed is that the value lies between 20·43″ and 20·48″. The minor axis, on the other hand, is not constant, but, as we have already seen, depends on the latitude, being the product of the major axis into the sine of the latitude.

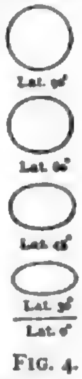

Fig. 4.

Assured that his explanation was true, Bradley corrected his observations for aberration, but he found that there still remained a residuum which was evidently not a parallax, for it did not exhibit an annual cycle. He reverted to his early idea of a nutation of the earth's axis, and was rewarded by the discovery that the earth did possess such an oscillation (see Astronomy). Bradley recognized the fact that the experimental determination of the aberration constant gave the ratio of the velocities of light and of the earth; hence, if the velocity of the earth be known, the velocity of light is determined. In recent years much attention has been given to the nature of the propagation of light from the heavenly bodies to the earth, the argument generally being centred about the relative effect of the motion of the aether on the velocity of light. This subject is discussed in the articles Aether and Light.

References.—A detailed account of Bradley's work is given in S. Rigaud, *Memoirs of Bradley* (1832), and in Charles Hutton, *Mathematical and Philosophical Dictionary* (1795); a particularly clear and lucid account is given in H. H. Turner, *Astronomical Discovery* (1904). The subject receives treatment in all astronomical works.

II. Aberration in Optical Systems

Aberration in optical systems, *i.e.* in lenses or mirrors or a series of them, may be defined as the non-concurrence of rays from the points of an object after transmission through the system; it happens generally that an image formed by such a system is irregular, and consequently the correction of optical systems for aberration is of fundamental importance to the instrument-maker. Reference should be made to the articles Reflexion, Refraction, and Caustic for the general characters of reflected and refracted rays (the article Lens considers in detail the properties of this instrument, and should also be consulted); in this article will be discussed the nature, varieties and modes of aberrations mainly from the practical point of view, *i.e.* that of the optical-instrument maker.

Aberrations may be divided in two classes: chromatic (Gr. χρῶμα, colour) aberrations, caused by the composite nature of the light generally applied (*e.g.* white light), which is dispersed by refraction, and *monochromatic* (Gr. μόνος, one) aberrations produced without dispersion. Consequently the monochromatic class includes the aberrations at reflecting surfaces of any coloured light, and at refracting surfaces of monochromatic or light of single wave length.

(*a*) *Monochromatic Aberration.*

The elementary theory of optical systems leads to the theorem: Rays of light proceeding from any "object point" unite in an "image point"; and therefore an "object space" is reproduced in an "image space." The introduction of simple auxiliary terms, due to C. F. Gauss (*Dioptrische Untersuchungen*, Göttingen, 1841), named the focal lengths and focal planes, permits the determination of the image of any object for any system (see Lens). The Gaussian theory, however, is only true so long as the angles made by all rays with the *optical axis* (the symmetrical axis of the system) are infinitely small, *i.e.* with infinitesimal objects, images and lenses; in practice these conditions are not realized, and the images projected by uncorrected systems are, in general, ill defined and often completely blurred, if the aperture or field of view exceeds certain limits. The investigations of James Clerk Maxwell (*Phil.Mag.*, 1856; *Quart. Journ. Math.*, 1858, and Ernst Abbe[1]) showed that the properties of these reproductions, *i.e.* the relative position and magnitude of the images, are not special properties of optical systems, but necessary consequences of the supposition (in Abbe) of the reproduction of all points of a space in image points (Maxwell assumes a less general hypothesis), and are independent of the manner in which the reproduction is effected. These authors proved, however, that no optical system can justify these suppositions, since they are contradictory to the fundamental laws of reflexion and refraction. Consequently the Gaussian theory only supplies a convenient method of approximating to reality; and no constructor would attempt to realize this unattainable ideal. All that at present can be attempted is, to reproduce a single plane in another plane; but even this has not been altogether satisfactorily accomplished, aberrations always occur, and it is improbable that these will ever be entirely corrected.

This, and related general questions, have been treated—besides the above-mentioned authors—by M. Thiesen (*Berlin. Akad. Sitsber.*, 1890, xxxv. 799; *Berlin.Phys.Ges. Verh.*, 1892) and H. Bruns (*Leipzig. Math. Phys. Ber.*, 1895, xxi. 325) by means of Sir W. R. Hamilton's "characteristic function" (*Irish Acad. Trans.*, "Theory of Systems of Rays," 1828, et seq.). Reference may also be made to the treatise of Czapski-Eppenstein, pp. 155-161.

A review of the simplest cases of aberration will now be given. (1) *Aberration of axial points* (Spherical aberration in the restricted sense). If S (fig. 5) be any optical system, rays proceeding from an axis point O under an angle u_1 will unite in the axis point O'_1; and those under an angle u_2 in the axis point O'_2. If there be refraction at a collective spherical surface, or through a thin positive lens, O'_2 will lie in front of O'_1 so long as the angle u_2 is greater than u_1 ("under correction"); and conversely with a dispersive surface or lenses ("over correction"). The caustic, in the first case, resembles the sign > (greater than); in the second < (less than). If the angle u_1 be very small, O'_1 is the Gaussian image; and O'_1 O'_2 is termed the "longitudinal aberration," and O'_1R the "lateral aberration" of the pencils with aperture u_2. If the pencil with the angle u_2 be that of the maximum aberration of all the pencils transmitted, then in a plane perpendicular to the axis at O'_1 there is a circular "disk of confusion" of radius O'_1R, and in a parallel plane at O'_2 another one of radius O'_2R_2; between these two is situated the "disk of least confusion."

The largest opening of the pencils, which take part in the reproduction of O, *i.e.* the angle u, is generally determined by the margin of one of the lenses or by a hole in a thin plate placed between, before, or behind the lenses of the system. This hole is termed the "stop" or "diaphragm"; Abbe used the term "aperture stop" for both the hole and the limiting margin of the lens. The component S_1 of the system, situated between the aperture stop and the object O, projects an image of the diaphragm, termed by Abbe the "entrance pupil"; the "exit pupil" is the image formed by the component S_2, which is placed behind the aperture stop. All rays which issue from O and pass through the aperture stop also pass through the entrance and exit pupils, since these are images of the aperture stop. Since the maximum aperture of the pencils issuing from O is the angle u subtended by the entrance pupil at this point, the magnitude of the aberration will be determined by the position and diameter of the entrance pupil. If the system be entirely behind the aperture stop, then this is itself the entrance pupil ("front stop"); if entirely in front, it is the exit pupil ("back stop").

If the object point be infinitely distant, all rays received by the first member of the system are parallel, and their intersections, after traversing the system, vary according to their "perpendicular height of incidence," *i.e.* their distance from the axis. This distance replaces the angle u in the preceding considerations; and the aperture, *i.e.* the radius of the entrance pupil, is its maximum value.

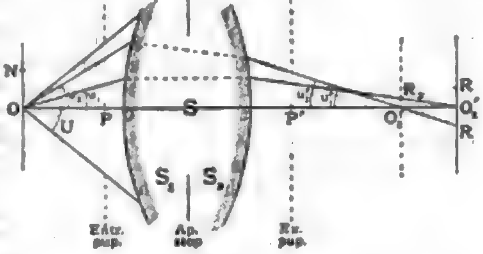

Fig. 5.

(2) *Aberration of elements, i.e. smallest objects at right angles to the axis.*—If rays issuing from O (fig. 5) be concurrent, it does not follow that points in a portion of a plane perpendicular at O to the axis will be also concurrent, even if the part of the plane be very small. With a considerable aperture, the neighbouring point N will be reproduced, but attended by aberrations comparable in magnitude to ON. These aberrations are avoided if, according to Abbe, the "sine condition," $\sin u'_1/\sin u_1 = \sin u'_2/\sin u_2$, holds for all rays reproducing the point O. If the object point O be infinitely distant, u_1 and u_2 are to be replaced by h_1 and h_2, the perpendicular heights of incidence; the "sine condition" then becomes $\sin u'_1/h_1 = \sin u'_2/h_2$. A system fulfilling this condition and free from spherical aberration is called "aplanatic" (Greek α-, privative, πλάνη, a wandering). This word was first used by Robert Blair (d. 1828), professor of practical astronomy at Edinburgh University, to characterize a superior achromatism, and, subsequently, by many writers to denote freedom from spherical aberration. Both the aberration of axis points, and the deviation from the sine condition, rapidly increase in most (uncorrected) systems with the aperture.

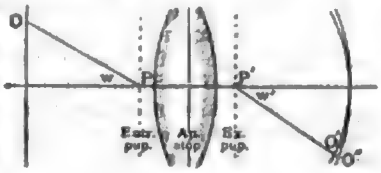

Fig. 6.

(3) *Aberration of lateral object points* (*points beyond the axis*) *with narrow pencils. Astigmatism.*—A point O (fig. 6) at a finite distance from the axis (or with an infinitely distant object, a point which subtends a finite angle at the system) is, in general, even then not sharply reproduced, if the pencil of rays issuing from it and traversing the system is made infinitely narrow by reducing the aperture stop; such a pencil consists of the rays which can pass from the object point through the now infinitely small entrance pupil. It is seen (ignoring exceptional cases) that the pencil does not meet the refracting or reflecting surface at right angles; therefore it is astigmatic (Gr. α-, privative, στίγμα, a point). Naming the central ray passing through the entrance pupil the "axis of the pencil" or "principal ray," we can say: the rays of the pencil intersect, not in one point, but in two focal lines, which we can assume to be at right angles to the principal ray; of these, one lies in the plane containing the principal ray and

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[1] The investigations of E. Abbe on geometrical optics, originally published only in his university lectures, were first compiled by S. Czapski in 1893. See below, Authorities.

the axis of the system, *i.e.* in the "first principal section" or "meridional section," and the other at right angles to it, *i.e.* in the second principal section or sagittal section. We receive, therefore, in no single intercepting plane behind the system, as, for example, a focussing screen, an image of the object point; on the other hand, in each of two planes lines O′ and O″ are separately formed (in neighbouring planes ellipses are formed), and in a plane between O′ and O″ a circle of least confusion. The interval O′O″, termed the astigmatic difference, increases, in general, with the angle W made by the principal ray OP with the axis of the system, *i.e.* with the field of view. Two "astigmatic image surfaces" correspond to one object plane; and these are in contact at the axis point; on the one lie the focal lines of the first kind, on the other those of the second. Systems in which the two astigmatic surfaces coincide are termed anastigmatic or stigmatic.

Sir Isaac Newton was probably the discoverer of astigmation; the position of the astigmatic image lines was determined by Thomas Young (*A Course of Lectures on Natural Philosophy*, 1807); and the theory has been recently developed by A. Gullstrand (*Skand. Arch. f. physiol.*, 1890, 2, p. 269; *Allgemeine Theorie der monochromat. Aberrationen*, etc., Upsala, 1900; *Arch. f. Ophth.*, 1901, 53, pp. 2, 185). A bibliography by P. Culmann is given in M. von Rohr's *Die Bilderzeugung in optischen Instrumenten* (Berlin, 1904).

(4) *Aberration of lateral object points with broad pencils. Coma.*—By opening the stop wider, similar deviations arise for lateral points as have been already discussed for axial points; but in this case they are much more complicated. The course of the rays in the meridional section is no longer symmetrical to the principal ray of the pencil; and on an intercepting plane there appears, instead of a luminous point, a patch of light, not symmetrical about a point, and often exhibiting a resemblance to a comet having its tail directed towards or away from the axis. From this appearance it takes its name. The unsymmetrical form of the meridional pencil—formerly the only one considered—is coma in the narrower sense only; other errors of coma have been treated by A. König and M. von Rohr (*op. cit.*), and more recently by A. Gullstrand (*op. cit.*; *Ann. d. Phys.*, 1905, 18, p. 941).

(5) *Curvature of the field of the image.*—If the above errors be eliminated, the two astigmatic surfaces united, and a sharp image obtained with a wide aperture—there remains the necessity to correct the curvature of the image surface, especially when the image is to be received upon a plane surface, *e.g.* in photography. In most cases the surface is concave towards the system.

(6) *Distortion of the image.*—If now the image be sufficiently sharp, inasmuch as the rays proceeding from every object point meet in an image point of satisfactory exactitude, it may happen that the image is distorted, *i.e.* not sufficiently like the object. This error consists in the different parts of the object being reproduced with different magnifications; for instance, the inner parts may differ in greater magnification than the outer ("barrel-shaped distortion"), or conversely ("cushion-shaped distortion") (see fig. 7). Systems free of this aberration are called "orthoscopic" (ὀρθός, right, σκοπεῖν, to look). This aberration is quite distinct from that of the sharpness of reproduction; in unsharp reproduction, the question of distortion arises if only parts of the object can be recognized in the figure. If, in an unsharp image, a patch of light corresponds to an object point, the "centre of gravity" of the patch may be regarded as the image point, this being the point where the plane receiving the image, *e.g.* a focussing screen, intersects the ray passing through the middle of the stop. This assumption is justified if a poor image on the focussing screen remains stationary when the aperture is diminished; in practice, this generally occurs. This ray, named by Abbe a "principal ray" (not to be confused with the "principal rays" of the Gaussian theory), passes through the centre of the entrance pupil before the first refraction, and the centre of the exit pupil after the last refraction. From this it follows that correctness of drawing depends solely upon the principal rays; and is independent of the sharpness or curvature of the image field. Referring to fig. 8, we have $O'Q'/OQ = a' \tan w'/a \tan w = 1/N$, where N is the "scale" or magnification of the image. For N to be constant for all values of w, $a' \tan w'/a \tan w$ must also be constant. If the ratio a'/a be sufficiently constant, as is often the case, the above relation reduces to the "condition of Airy," *i.e.* $\tan w'/\tan w =$ a constant. This simple relation (see *Camb. Phil. Trans.*, 1830, 3, p. 1) is fulfilled in all systems which are symmetrical with respect to their diaphragm (briefly named "symmetrical or holosymmetrical objectives"), or which consist of two like, but different-sized, components, placed from the diaphragm in the ratio of their size, and presenting the same curvature to it (hemisymmetrical objectives); in these systems $\tan w'/\tan w = 1$. The constancy of a'/a necessary for this relation to hold was pointed out by R. H. Bow (*Brit. Journ. Photog.*, 1861), and Thomas Sutton (*Photographic Notes*, 1862); it has been treated by O. Lummer and by M. von Rohr (*Zeit. f. Instrumentenk.*, 1897, 17, and 1898, 18, p. 4). It requires the middle of the aperture stop to be reproduced in the centres of the entrance and exit pupils without spherical aberration. M. von Rohr showed that for systems fulfilling neither the Airy nor the Bow-Sutton condition, the ratio $a' \tan w'/a \tan w$ will be constant for one distance of the object. This combined condition is exactly fulfilled by holosymmetrical objectives reproducing with the scale 1, and by hemisymmetrical, if the scale of reproduction be equal to the ratio of the sizes of the two components.

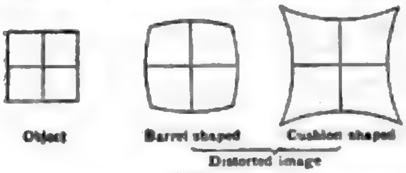

FIG. 7.

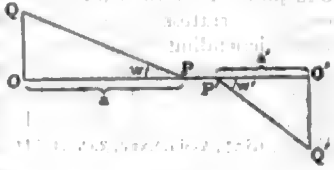

FIG. 8.

Analytic Treatment of Aberrations.—The preceding review of the several errors of reproduction belongs to the "Abbe theory of aberrations," in which definite aberrations are discussed separately; it is well suited to practical needs, for in the construction of an optical instrument certain errors are sought to be eliminated, the selection of which is justified by experience. In the mathematical sense, however, this selection is arbitrary; the reproduction of a finite object with a finite aperture entails, in all probability, an infinite number of aberrations. This number is only finite if the object and aperture are assumed to be "infinitely small of a certain order"; and with each order of infinite smallness, *i.e.* with each degree of approximation to reality (to finite objects and apertures), a certain number of aberrations is associated. This connexion is only supplied by theories which treat aberrations generally and analytically by means of indefinite series.

A ray proceeding from an object point O (fig. 9) can be defined by the co-ordinates (ξ, η) of this point O in an object plane I, at right angles to the axis, and two other co-ordinates (x, y), the point in which the ray intersects the entrance pupil, *i.e.* the plane II. Similarly the corresponding image ray may be defined by the points (ξ', η'), and (x', y'), in the planes I′ and II′. The origins of these four plane co-ordinate systems may be collinear with the axis of the optical system; and the corresponding axes may be parallel. Each of the four co-ordinates ξ', η', x', y' are functions of ξ, η, x, y; and if it be assumed that the field of view and the aperture be infinitely small, then ξ, η, x, y are of the same order of infinitesimals; consequently by expanding ξ', η', x', y' in ascending powers of ξ, η, x, y, series are obtained in which it is only necessary to consider the lowest powers. It is readily seen that if the optical system be symmetrical, the origins of the co-ordinate systems collinear with the optical axis

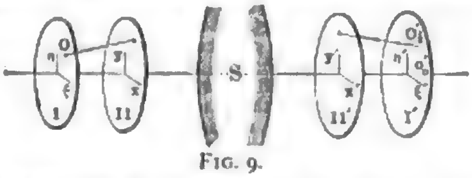

FIG. 9.

and the corresponding axes parallel, then by changing the signs of ξ, η, x, y, the values ξ', η', x', y' must likewise change their sign, but retain their arithmetical values; this means that the series are restricted to *odd* powers of the unmarked variables.

The nature of the reproduction consists in the rays proceeding from a point O being united in another point O′; in general, this will not be the case, for ξ', η' vary if ξ, η be constant, but x, y variable. It may be assumed that the planes I′ and II′ are drawn where the images of the planes I and II are formed by rays near the axis by the ordinary Gaussian rules; and by an extension of these rules, not, however, corresponding to reality, the Gauss image point O'_0, with co-ordinates ξ'_0, η'_0, of the point O at some distance from the axis could be constructed. Writing $\Delta\xi' = \xi' - \xi'_0$ and $\Delta\eta' = \eta' - \eta'_0$, then $\Delta\xi'$ and $\Delta\eta'$ are the aberrations belonging to ξ, η and x, y, and are functions of these magnitudes which, when expanded in series, contain only odd powers, for the same reasons as given above. On account of the aberrations of all rays which pass through O, a patch of light, depending in size on the lowest powers of ξ, η, x, y which the aberrations contain, will be formed in the plane I′. These degrees, named by J. Petzval (*Bericht über die Ergebnisse einiger dioptrischer Untersuchungen*, Buda Pesth, 1843; *Akad. Sitzber.*, Wien, 1857, vols. xxiv. xxvi.) "the numerical orders of the image," are consequently only odd powers; the condition for the formation of an image of the mth order is that in the series for $\Delta\xi'$ and $\Delta\eta'$ the coefficients of the powers of the 3rd, 5th . . . $(m-2)$th degrees must vanish. The images of the Gauss theory being of the third order, the next problem is to obtain an image of 5th order, or to make the coefficients of the powers of 3rd degree zero. This necessitates the satisfying of five equations; in other words, there are five alterations of the 3rd order, the vanishing of which produces an image of the 5th order.

The expression for these coefficients in terms of the constants of the optical system, *i.e.* the radii, thicknesses, refractive indices and distances between the lenses, was solved by L. Seidel (*Astr. Nach.*, 1856, p. 289); in 1840, J. Petzval constructed his portrait objective, unexcelled even at the present day, from similar calculations, which have never been published (see M. von Rohr, *Theorie und Geschichte des photographischen Objectivs*, Berlin, 1899, p. 248). The theory was elaborated by S. Finterswalder (*München. Akad. Abhandl.*, 1891, 17, p. 519), who also published a posthumous paper of Seidel containing a short view of his work (*München. Akad. Sitzber.*, 1898, 28, p. 395); a simpler form was given by A. Kerber (*Beiträge zur Dioptrik*, Leipzig, 1895–6–7–8–9). A. König and M. von Rohr (see M. von Rohr, *Die Bilderzeugung in optischen Instrumenten*, pp. 317-323) have represented Kerber's method, and have deduced the Seidel formulae from geometrical considerations based on the Abbe method, and have interpreted the analytical results geometrically (pp. 212-316).

The aberrations can also be expressed by means of the "characteristic function" of the system and its differential coefficients, instead of by the radii, &c., of the lenses; these formulae are not immediately applicable, but give, however, the relation between the number of aberrations and the order. Sir William Rowan Hamilton (*British Assoc. Report*, 1833, p. 360) thus derived the aberrations of the third order; and in later times the method was pursued by Clerk Maxwell (*Proc. London Math. Soc.*, 1874–1875; see also the treatises of R. S. Heath and L. A. Herman), M. Thiesen (*Berlin. Akad. Sitzber.*, 1890, 35, p. 804), H. Bruns (*Leipzig. Math. Phys. Ber.*, 1895, 21, p. 410), and particularly successfully by K. Schwartzschild (*Göttingen. Akad. Abhandl.*, 1905, 4, No. 1), who thus discovered the aberrations of the 5th order (of which there are nine), and possibly the shortest proof of the practical (Seidel) formulae. A. Gullstrand (*vide supra*, and *Ann. d. Phys.*, 1905, 18, p. 941) founded his theory of aberrations on the differential geometry of surfaces.

Aberrations of the third order.

The aberrations of the third order are: (1) aberration of the axis point; (2) aberration of points whose distance from the axis is very small, less than of the third order—the deviation from the sine condition and coma here fall together in one class; (3) astigmatism; (4) curvature of the field; (5) distortion.

(1) Aberration of the third order of axis points is dealt with in all text-books on optics. It is important for telescope objectives, since their apertures are so small as to permit higher orders to be neglected. For a single lens of very small thickness and given power, the aberration depends upon the ratio of the radii $r:r'$, and is a minimum (but never zero) for a certain value of this ratio; it varies inversely with the refractive index (the power of the lens remaining constant). The total aberration of two or more very thin lenses in contact, being the sum of the individual aberrations, can be zero. This is also possible if the lenses have the same algebraic sign. Of thin positive lenses with $n = 1 \cdot 5$, four are necessary to correct spherical aberration of the third order. These systems, however, are not of great practical importance. In most cases, two thin lenses are combined, one of which has just so strong a positive aberration ("under-correction," *vide supra*) as the other a negative; the first must be a positive lens and the second a negative lens; the powers, however, may differ, so that the desired effect of the lens is maintained. It is generally an advantage to secure a great refractive effect by several weaker than by one high-power lens. By one, and likewise by several, and even by an infinite number of thin lenses in contact, no more than two axis points can be reproduced without aberration of the third order. Freedom from aberration for two axis points, one of which is infinitely distant, is known as "Herschel's condition." All these rules are valid, inasmuch as the thicknesses and distances of the lenses are not to be taken into account.

(2) The condition for freedom from coma in the third order is also of importance for telescope objectives; it is known as "Fraunhofer's condition." (4) After eliminating the aberration on the axis, coma and astigmatism, the relation for the flatness of the field in the third order is expressed by the "Petzval equation," $\Sigma 1/r(n'-n) = 0$, where r is the radius of a refracting surface, n and n' the refractive indices of the neighbouring media, and Σ the sign of summation for all refracting surfaces.

Practical Elimination of Aberrations.—The existence of an optical system, which reproduces absolutely a finite plane on another with pencils of finite aperture, is doubtful; but practical systems solve this problem with an accuracy which mostly suffices for the special purpose of each species of instrument. The problem of finding a system which reproduces a given object upon a given plane with given magnification (in so far as aberrations must be taken into account) could be dealt with by means of the approximation theory; in most cases, however, the analytical difficulties are too great. Solutions, however, have been obtained in special cases (see A. König in M. von Rohr's *Die Bilderzeugung*, p. 373; K. Schwarzschild, *Göttingen. Akad. Abhandl.*, 1905, 4, Nos. 2 and 3). At the present time constructors almost always employ the inverse method: they compose a system from certain, often quite personal experiences, and test, by the trigonometrical calculation of the paths of several rays, whether the system gives the desired reproduction (examples are given in A. Gleichen, *Lehrbuch der geometrischen Optik*, Leipzig and Berlin, 1902). The radii, thicknesses and distances are continually altered until the errors of the image become sufficiently small. By this method only certain errors of reproduction are investigated, especially individual members, or all, of those named above. The analytical approximation theory is often employed provisionally, since its accuracy does not generally suffice.

In order to render spherical aberration and the deviation from the sine condition small throughout the whole aperture, there is given to a ray with a finite angle of aperture u^* (with infinitely distant objects: with a finite height of incidence h^*) the same distance of intersection, and the same sine ratio as to one neighbouring the axis (u^* or h^* may not be much smaller than the largest aperture U or H to be used in the system). The rays with an angle of aperture smaller than u^* would not have the same distance of intersection and the same sine ratio; these deviations are called "zones," and the constructor endeavours to reduce these to a minimum. The same holds for the errors depending upon the angle of the field of view, w: astigmatism, curvature of field and distortion are eliminated for a definite value, w^*; "zones of astigmatism, curvature of field and distortion" attend smaller values of w. The practical optician names such systems: "corrected for the angle of aperture u^* (the height of incidence h^*), or the angle of field of view w^*." Spherical aberration and changes of the sine ratios are often represented graphically as functions of the aperture, in the same way as the deviations of two astigmatic image surfaces of the image plane of the axis point are represented as functions of the angles of the field of view.

The final form of a practical system consequently rests on compromise; enlargement of the aperture results in a diminution of the available field of view, and *vice versa*. The following may be regarded as typical:—(1) Largest aperture; necessary corrections are—for the axis point, and sine condition; errors of the field of view are almost disregarded; example—high-power microscope objectives. (2) Largest field of view; necessary corrections are—for astigmatism, curvature of field and distortion; errors of the aperture only slightly regarded; examples—photographic widest angle objectives and oculars. Between these extreme examples stands the ordinary photographic objective: the portrait objective is corrected more with regard to aperture; objectives for groups more with regard to the field of view. (3) Telescope objectives have usually not very large apertures, and small fields of view; they should, however, possess zones as small as possible, and be built in the simplest manner. They are the best for analytical computation.

(*b*) *Chromatic or Colour Aberration.*

In optical systems composed of lenses, the position, magnitude and errors of the image depend upon the refractive indices of the glass employed (see LENS, and above, "Monochromatic Aberration"). Since the index of refraction varies with the colour or wave length of the light (see DISPERSION), it follows that a system of lenses (uncorrected) projects images of different colours in somewhat different places and sizes and with different aberrations; *i.e.* there are "chromatic differences" of the distances of intersection, of magnifications, and of monochromatic aberrations. If mixed light be employed (*e.g.* white light) all these images are formed; and since they are all ultimately intercepted by a plane (the retina of the eye, a focussing screen of a camera, &c.), they cause a confusion, named *chromatic aberration*; for instance, instead of a white margin on a dark background, there is perceived a coloured margin, or narrow spectrum. The absence of this error is termed *achromatism*, and an optical system so corrected is termed achromatic. A system is said to be "chromatically under-corrected" when it shows the same kind of chromatic error as a thin positive lens, otherwise it is said to be "over-corrected."

If, in the first place, monochromatic aberrations be neglected—in other words, the Gaussian theory be accepted—then every reproduction is determined by the positions of the focal planes, and the magnitude of the focal lengths, or if the focal lengths, as ordinarily happens, be equal, by three constants of reproduction. These constants are determined by the data of the system (radii, thicknesses, distances, indices, &c., of the lenses); therefore their dependence on the refractive index, and consequently on the colour, are calculable (the formulae are given in Czapski-Eppenstein, *Grundzüge der Theorie der optischen Instrumente* (1903, p. 166). The refractive indices for different wave lengths must be known for each kind of glass made use of. In this manner the conditions are maintained that any one constant of reproduction is equal for two different colours, *i.e.* this constant is achromatized. For example, it is possible, with one thick lens in air, to achromatize the position of a focal plane of the magnitude of the focal length. If all three constants of reproduction be achromatized, then the Gaussian image for all distances of objects is the same for the two colours, and the system is said to be in "stable achromatism."

In practice it is more advantageous (after Abbe) to determine the chromatic aberration (for instance, that of the distance of intersection) for a fixed position of the object, and express it by a sum in which each component contains the amount due to each refracting surface (see Czapski-Eppenstein, *op. cit.* p. 170; A. König in M. v. Rohr's collection, *Die Bilderzeugung*, p. 340). In a plane containing the image point of one colour, another colour produces a disk of confusion; this is similar to the confusion caused by two "zones" in spherical aberration. For infinitely distant objects the radius of the chromatic disk of confusion is proportional to the linear aperture, and independent of the focal length (*vide supra*, "Monochromatic Aberration of the Axis Point"); and since this disk becomes the less harmful with an increasing image of a given object, or with increasing focal length, it follows that the deterioration of the image is proportional to the ratio of the aperture to the focal length, *i.e.* the "relative aperture." (This explains the gigantic focal lengths in vogue before the discovery of achromatism.)

Examples.—(*a*) In a very thin lens, in air, only one constant of reproduction is to be observed, since the focal length and the distance of the focal point are equal. If the refractive index for one colour be n, and for another $n+dn$, and the powers, or reciprocals of the focal lengths, be ϕ and $\phi+d\phi$, then (1) $d\phi/\phi = dn/(n-1) = 1/\nu$; dn is called the dispersion, and ν the dispersive power of the glass.

(*b*) Two thin lenses in contact: let ϕ_1 and ϕ_2 be the powers corresponding to the lenses of refractive indices n_1 and n_2 and radii r'_1, r''_1, and r'_2, r''_2 respectively; let ϕ denote the total power, and $d\phi$, dn_1, dn_2 the changes of ϕ, n_1, and n_2 with the colour. Then the following relations hold:—

(2) $\phi = \phi_1 + \phi_2 = (n_1-1)(1/r'_1 - 1/r''_1) + (n_2-1)(1/r'_2 - 1/r''_2) = (n_1-1)k_1 + (n_2-1)k_2$; and

(3) $d\phi = k_1 dn_1 + k_2 dn_2$. For achromatism $d\phi = 0$, hence, from (3),

(4) $k_1/k_2 = -dn_2/dn_1$, or $\phi_1/\phi_2 = -\nu_1/\nu_2$. Therefore ϕ_1 and ϕ_2 must have different algebraic signs, or the system must be composed of a collective and a dispersive lens. Consequently the powers of the two must be different (in order that ϕ be not zero (equation 2)), and the dispersive powers must also be different (according to 4).

Newton failed to perceive the existence of media of different dispersive powers required by achromatism; consequently he constructed large reflectors instead of refractors. James Gregory and Leonhard Euler arrived at the correct view from a false conception of the achromatism of the eye; this was determined by Chester More Hall in 1728, Klingenstierna in 1754 and by Dollond in 1757, who constructed the celebrated achromatic telescopes. (See TELESCOPE.)

Glass with weaker dispersive power (greater ν) is named "crown glass"; that with greater dispersive power, "flint glass." For the construction of an achromatic collective lens (ϕ positive) it follows, by means of equation (4), that a collective lens I. of crown glass and a dispersive lens II. of flint glass must be chosen; the latter, although the weaker, corrects the other chromatically by its greater dispersive power. For an achromatic dispersive lens the converse must be adopted. This is, at the present day, the ordinary type, *e.g.*, of telescope objective (fig. 10); the values of the four radii must satisfy the equations (2) and (4). Two other conditions may also be postulated: one is always the elimination of the aberration on the axis; the second either the "Herschel" or "Fraunhofer condition," the latter being the best (*vide supra*, "Monochromatic Aberration"). In practice, however, it is often more useful to avoid the second condition by making the lenses have contact, *i.e.* equal radii. According to P. Rudolph (*Eder's Jahrb. f. Photog.*, 1891, 5, p. 225; 1893, 7, p. 221), cemented objectives of thin lenses permit the elimination of spherical aberration on the axis, if, as above, the collective lens has a smaller refractive index; on the other hand, they permit the elimination of astigmatism and curvature of the field, if the collective lens has a greater refractive index (this follows from the Petzval equation; see L. Seidel, *Astr. Nachr.*, 1856, p. 289). Should the cemented system be positive, then the more powerful lens must be positive; and, according to (4), to the greater power belongs the weaker dispersive power (greater ν), that is to say, crown glass; consequently the crown glass must have the greater refractive index for astigmatic and plane images. In all earlier kinds of glass, however, the dispersive power increased with the refractive index; that is, ν decreased as n increased; but some of the Jena glasses by E. Abbe and O. Schott were crown

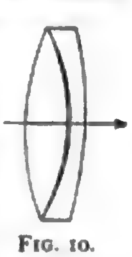
FIG. 10.

glasses of high refractive index, and achromatic systems from such crown glasses, with flint glasses of lower refractive index, are called the "new achromats," and were employed by P. Rudolph in the first "anastigmats" (photographic objectives).

Instead of making $d\phi$ vanish, a certain value can be assigned to it which will produce, by the addition of the two lenses, any desired chromatic deviation, *e.g.* sufficient to eliminate one present in other parts of the system. If the lenses I. and II. be cemented and have the same refractive index for one colour, then its effect for that one colour is that of a lens of one piece; by such decomposition of a lens it can be made chromatic or achromatic at will, without altering its spherical effect. If its chromatic effect ($d\phi/\phi$) be greater than that of the same lens, this being made of the more dispersive of the two glasses employed, it is termed "hyper-chromatic."

For two thin lenses separated by a distance D the condition for achromatism is $D=(v_1f_1+v_2f_2)\ (v_1+v_2)$; if $v_1=v_2$ (*e.g.* if the lenses be made of the same glass), this reduces to $D=\frac{1}{2}(f_1+f_2)$, known as the "condition for oculars."

If a constant of reproduction, for instance the focal length, be made equal for two colours, then it is not the same for other colours, if two different glasses are employed. For example, the condition for achromatism (4) for two thin lenses in contact is fulfilled in only one part of the spectrum, since dn_2/dn_1 varies within the spectrum. This fact was first ascertained by J. Fraunhofer, who defined the colours by means of the dark lines in the solar spectrum; and showed that the ratio of the dispersion of two glasses varied about 20% from the red to the violet (the variation for glass and water is about 50%). If, therefore, for two colours, a and b, $f_a=f_b=f$, then for a third colour, c, the focal length is different, viz. if c lie between a and b, then $f_c<f$, and *vice versa*; these algebraic results follow from the fact that towards the red the dispersion of the positive crown glass preponderates, towards the violet that of the negative flint. These chromatic errors of systems, which are achromatic for two colours, are called the "secondary spectrum," and depend upon the aperture and focal length in the same manner as the primary chromatic errors do.

In fig. 11, taken from M. von Rohr's *Theorie und Geschichte des photographischen Objectivs*, the abscissae are focal lengths, and the ordinates wave-lengths; of the latter the Fraunhofer lines used are—

A′	C	D	Green Hg.	F	G′	Violet Hg.
767·7	656·3	589·3	546·1	486·2	434·1	405·1 μμ,

and the focal lengths are made equal for the lines C and F. In the neighbourhood of 550 μμ the tangent to the curve is parallel to the axis of wave-lengths; and the focal length varies least over a fairly large range of colour, therefore in this neighbourhood the colour union is at its best. Moreover, this region of the spectrum is that which appears brightest to the human eye, and consequently this curve of the secondary spectrum, obtained by making $f_C=f_F$, is, according to the experiments of Sir G. G. Stokes (*Proc. Roy. Soc.*, 1878), the most suitable for visual instruments ("optical achromatism"). In a similar manner, for systems used in photography, the vertex of the colour curve must be placed in the position of the maximum sensibility of the plates; this is generally supposed to be at G′; and to accomplish this the F and violet mercury lines are united. This artifice is specially adopted in objectives for astronomical photography ("pure actinic achromatism"). For ordinary photography, however, there is this disadvantage: the image on the focussing-screen and the correct adjustment of the photographic sensitive plate are not in register; in astronomical photography this difference is constant, but in other kinds it depends on the distance of the objects. On this account the lines D and G′ are united for ordinary photographic objectives; the optical as well as the actinic image is chromatically inferior, but both lie in the same place; and consequently the best correction lies in F (this is known as the "actinic correction" or "freedom from chemical focus").

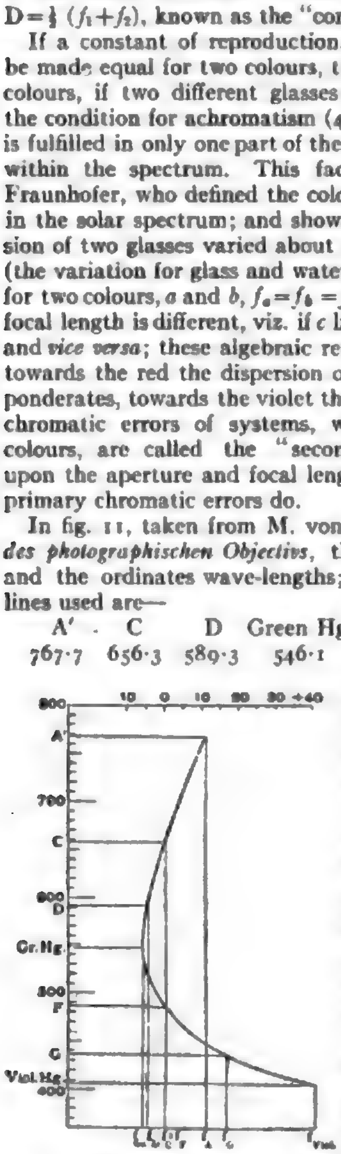

FIG. 11.—Secondary Spectrum of the combination O. 1726, O. 108. Optical correction $f_C=f_F=$ 100 mm. The ordinates give the wave-lengths in μμ. The abscissae give $f\lambda - f_C$ in 0·01 mm., commencing at $f_C f_F$.

(From M. v. Rohr, *op. cit.*)

Should there be in two lenses in contact the same focal lengths for three colours a, b, and c, *i.e.* $f_a=f_b=f_c=f$, then the relative partial dispersion $(n_c-n_b)\ (n_a-n_b)$ must be equal for the two kinds of glass employed. This follows by considering equation (4) for the two pairs of colours ac and bc. Until recently no glasses were known with a proportional degree of absorption; but R. Blair (*Trans. Edin. Soc.*, 1791, 3, p. 3), P. Barlow, and F. S. Archer overcame the difficulty by constructing fluid lenses between glass walls. Fraunhofer prepared glasses which reduced the secondary spectrum; but permanent success was only assured on the introduction of the Jena glasses by E. Abbe and O. Schott. In using glasses not having proportional dispersion, the deviation of a third colour can be eliminated by two lenses, if an interval be allowed between them; or by three lenses in contact, which may not all consist of the old glasses. In uniting three colours an "achromatism of a higher order" is derived; there is yet a residual "tertiary spectrum," but it can always be neglected.

The Gaussian theory is only an approximation; monochromatic or spherical aberrations still occur, which will be different for different colours; and should they be compensated for one colour, the image of another colour would prove disturbing. The most important is the chromatic difference of aberration of the axis point, which is still present to disturb the image, after par-axial rays of different colours are united by an appropriate combination of glasses. If a collective system be corrected for the axis point for a definite wave-length, then, on account of the greater dispersion in the negative components—the flint glasses,—over-correction will arise for the shorter wave-lengths (this being the error of the negative components), and under-correction for the longer wave-lengths (the error of crown glass lenses preponderating in the red). This error was treated by Jean le Rond d'Alembert, and, in special detail, by C. F. Gauss. It increases rapidly with the aperture, and is more important with medium apertures than the secondary spectrum of par-axial rays; consequently, spherical aberration must be eliminated for two colours, and if this be impossible, then it must be eliminated for those particular wave-lengths which are most effectual for the instrument in question (a graphical representation of this error is given in M. von Rohr, *Theorie und Geschichte des photographischen Objectivs*).

The condition for the reproduction of a surface element in the place of a sharply reproduced point—the constant of the sine relation—must also be fulfilled with large apertures for several colours. E. Abbe succeeded in computing microscope objectives free from error of the axis point and satisfying the sine condition for several colours, which therefore, according to his definition, were "aplanatic for several colours"; such systems he termed "apochromatic." While, however, the magnification of the individual zones is the same, it is not the same for red as for blue; and there is a chromatic difference of magnification. This is produced in the same amount, but in the opposite sense, by the oculars, which are used with these objectives ("compensating oculars"), so that it is eliminated in the image of the whole microscope. The best telescope objectives, and photographic objectives intended for three-colour work, are also apochromatic, even if they do not possess quite the same quality of correction as microscope objectives do. The chromatic differences of other errors of reproduction have seldom practical importances.

AUTHORITIES.—The standard treatise in English is H. D. Taylor, *A System of Applied Optics* (1906); reference may also be made to R. S. Heath, *A Treatise on Geometrical Optics* (2nd ed., 1895); and L. A. Herman, *A Treatise on Geometrical Optics* (1900). The ideas of Abbe were first dealt with in S. Czapski, *Theorie der optischen Instrumente nach Abbe*, published separately at Breslau in 1893, and as vol. ii. of Winkelmann's *Handbuch der Physik* in 1894; a second edition, by Czapski and O. Eppenstein, was published at Leipzig in 1903 with the title, *Grundzüge der Theorie der optischen Instrumente nach Abbe*, and in vol. ii. of the 2nd ed. of Winkelmann's *Handbuch der Physik*. The collection of the scientific staff of Carl Zeiss at Jena, edited by M. von Rohr, *Die Bilderzeugung in optischen Instrumenten vom Standpunkte der geometrischen Optik* (Berlin, 1904), contains articles by A. König and M. von Rohr specially dealing with aberrations. (O. E.)

ABERSYCHAN, an urban district in the northern parliamentary division of Monmouthshire, England, 11 m. N. by W. of Newport, on the Great Western, London and North-Western, and Rhymney railways. Pop. (1901) 17,768. It lies in the narrow upper valley of the Afon Lwyd on the eastern edge of the great coal and iron mining district of Glamorganshire and Monmouthshire, and its large industrial population is occupied in the mines and ironworks. The neighbourhood is wild and mountainous.

ABERTILLERY, an urban district in the western parliamentary division of Monmouthshire, England, 16 m. N.W. of Newport, on the Great Western railway. Pop. (1891) 10,846; (1901) 21,945. It lies in the mountainous mining district of Monmouthshire and Glamorganshire, in the valley of the Ebbw Fach, and the large industrial population is mainly employed in the numerous coal-mines, ironworks and tinplate works. Farther up the valley are the mining townships of NANTYGLO and BLAINA, forming an urban district with a population (1901) of 13,489.

ABERYSTWYTH, a municipal borough, market-town and seaport of Cardiganshire, Wales, near the confluence of the rivers Ystwyth and Rheidol, about the middle of Cardigan Bay. Pop. (1901) 8013. It is the terminal station of the Cambrian railway, and also of the Manchester and Milford line. It is the most popular watering-place on the west coast of Wales, and possesses a pier, and a fine sea-front which stretches from Constitution Hill at the north end of the Marine Terrace to the mouth of the harbour. The town is of modern appearance, and contains many public buildings, of which the most remarkable is the imposing but fantastic structure of the University College of Wales near the Castle Hill. Much of the finest scenery in mid-Wales lies within easy reach of Aberystwyth.

The history of Aberystwyth may be said to date from the time of Gilbert Strongbow, who in 1109 erected a fortress on the present Castle Hill. Edward I. rebuilt Strongbow's castle in 1277, after its destruction by the Welsh. Between the years 1404 and 1408 Aberystwyth Castle was in the hands of Owen Glendower, but finally surrendered to Prince Harry of Monmouth, and shortly after this the town was incorporated under the title of Ville de Lampadarn, the ancient name of the place being Llanbadarn Gaerog, or the fortified Llanbadarn, to distinguish it from Llanbadarn Fawr, the village one mile inland. It is thus styled in a charter granted by Henry VIII., but by Elizabeth's time the town was invariably termed Aberystwyth in all documents. In 1647 the parliamentarian troops razed the castle to the ground, so that its remains are now inconsiderable, though portions of three towers still exist. Aberystwyth was a contributory parliamentary borough until 1885, when its representation was merged in that of the county. In modern times Aberystwyth has become a Welsh educational centre, owing to the erection here of one of the three colleges of the university of Wales (1872), and of a hostel for women in connexion with it. In 1905 it was decided to fix here the site of the proposed Welsh National Library.

ABETTOR (from "to abet," O. Fr. *abeter*, *à* and *beter*, to bait, urge dogs upon any one; this word is probably of Scandinavian origin, meaning to cause to bite), a law term implying one who instigates, encourages or assists another to commit an offence. An abettor differs from an accessory (*q.v.*) in that he must be present at the commission of the crime; all abettors (with certain exceptions) are principals, and, in the absence of specific statutory provision to the contrary, are punishable to the same extent as the actual perpetrator of the offence. A person may in certain cases be convicted as an abettor in the commission of an offence in which he or she could not be a principal, *e.g.* a woman or boy under fourteen years of age in aiding rape, or a solvent person in aiding and abetting a bankrupt to commit offences against the bankruptcy laws.

ABEYANCE (O. Fr. *abeance*, "gaping"), a state of expectancy in respect of property, titles or office, when the right to them is not vested in any one person, but awaits the appearance or determination of the true owner. In law, the term abeyance can only be applied to such future estates as have not yet vested or possibly may not vest. For example, an estate is granted to A for life, with remainder to the heir of B, the latter being alive; the remainder is then said to be in abeyance, for until the death of B it is uncertain who his heir is. Similarly the freehold of a benefice, on the death of the incumbent, is said to be in abeyance until the next incumbent takes possession. The most common use of the term is in the case of peerage dignities. If a peerage which passes to heirs-general, like the ancient baronies by writ, is held by a man whose heir-at-law is neither a male, nor a woman who is an only child, it goes into abeyance on his death between two or more sisters or their heirs, and is held by no one till the abeyance is terminated; if eventually only one person represents the claims of all the sisters, he or she can claim the termination of the abeyance as a matter of right. The crown can also call the peerage out of abeyance at any moment, on petition, in favour of any one of the sisters or their heirs between whom it is in abeyance. The question whether ancient earldoms created in favour of a man and his "heirs" go into abeyance like baronies by writ has been raised by the claim to the earldom of Norfolk created in 1312, discussed before the Committee for Privileges in 1906. It is common, but incorrect, to speak of peerage dignities which are dormant (*i.e.* unclaimed) as being in abeyance. (J. H. R.)

ABGAR, a name or title borne by a line of kings or toparchs, apparently twenty-nine in number, who reigned in Osrhoene and had their capital at Edessa about the time of the Christian era. According to an old tradition, one of these princes, perhaps Abgar V. (Ukkāmā or Uchomo, "the black"), being afflicted with leprosy, sent a letter to Jesus, acknowledging his divinity, craving his help and offering him an asylum in his own residence, but Jesus wrote a letter declining to go, promising, however, that after his ascension he would send one of his disciples. These letters are given by Eusebius (*Eccl. Hist.* i. 13), who declares that the Syriac document from which he translates them had been preserved in the archives at Edessa from the time of Abgar. Eusebius also states that in due course Judas, son of Thaddaeus, was sent (in 340 = A.D. 29). In another form of the story, derived from Moses of Chorene, it is said further that Jesus sent his portrait to Abgar, and that this existed in Edessa (*Hist. Armen.*, ed. W. Whiston, ii. 29-32). Yet another version is found in the Syriac *Doctrina Addaei* (Addaeus = Thaddaeus), edited by G. Phillips (1876). Here it is said that the reply of Jesus was given not in writing, but verbally, and that the event took place in 343 (A.D. 32). Greek forms of the legend are found in the *Acta Thaddaei* (C. Tischendorf, *Acta apostolorum apocr.* 261 ff.).

These stories have given rise to much discussion. The testimony of Augustine and Jerome is to the effect that Jesus wrote nothing. The correspondence was rejected as apocryphal by Pope Gelasius and a Roman Synod (*c.* 495), though, it is true, this view has not been shared universally by the Roman church (Tillemont, *Mémoires*, i. 3, pp. 990 ff.). Amongst Evangelicals the spuriousness of the letters is almost generally admitted. Lipsius (*Die Edessenische Abgarsage*, 1880) has pointed out anachronisms which seem to indicate that the story is quite unhistorical. The first king of Edessa of whom we have any trustworthy information is Abgar VIII., bar Ma'nu (A.D. 176–213). It is suggested that the legend arose from a desire to trace the christianizing of his kingdom to an apostolic source.

Eusebius gives the legend in its oldest form; it was worked up in the *Doctrina Addaei* in the second half of the 4th century; and Moses of Chorene was dependent upon both these sources.

Bibliography.—R. Schmidt in Herzog-Hauck, *Realencyklopädie*; Lipsius, *Die Edessenische Abgarsage kritisch untersucht* (1880); Matthes, *Die Edessenische Abgarsage auf ihre Fortbildung untersucht* (1882); Tixeront, *Les Origines de l'église d'Edesse et la légende d'A.* (1888); A. Harnack, *Geschichte d. altchristlichen Litteratur*, i. 2 (1893); L. Duchesne, *Bulletin critique*, 1889, pp. 41-48; for the Epistles see Apocryphal Literature, sect. "New Testament" (*c*).

ABHIDHAMMA, the name of one of the three *Pitakas*, or baskets of tradition, into which the Buddhist scriptures (see Buddhism) are divided. It consists of seven works: 1. *Dhamma Sangani* (enumeration of qualities). 2. *Vibhanga* (exposition). 3. *Kathā Vatthu* (bases of opinion). 4. *Puggala Paññatti* (on individuals). 5. *Dhatu Kathā* (on relations of moral dispositions). 6. *Yamaka* (the pairs, that is, of ethical states). 7. *Patthāna* (evolution of ethical states). These have now been published by the Pali Text Society. The first has been translated into English, and an abstract of the third has been published. The approximate date of these works is probably from about 400 B.C. to about 250 B.C., the first being the oldest and the third the latest of the seven. Before the publication of the texts, when they were known only by hearsay, the term *Abhidhamma* was usually rendered "Metaphysics." This is now seen to be quite erroneous. *Dhamma* means the doctrine, and *Abhidhamma* has a relation to *Dhamma* similar to that of by-law to law. It expands, classifies, tabulates, draws corollaries from the ethical doctrines laid down in the more popular treatises. There is no metaphysics in it at all, only psychological ethics of a peculiarly dry and scholastic kind. And there is no originality in it; only endless permutations and combinations of doctrines already known and accepted. As in the course of centuries the doctrine itself, in certain schools, varied, it was felt necessary to rewrite these secondary works. This was first done, so far as is at present known, by the Sarvāstivādins (Realists), who in the century before and after Christ produced a fresh set of seven *Abhidhamma* books. These are lost in India, but still exist in Chinese translations. The translations have been analysed in a masterly way by Professor Takakusu in the article mentioned below. They deal only with psychological ethics. In the course of further centuries these books in turn were superseded by new treatises; and in one school at least, that of the Mahā-yāna (great vehicle) there was eventually developed a system of metaphysics. But the word *Abhidhamma* then fell out of use in that school, though it is still used in the schools that continue to follow the original seven books.

See *Buddhist Psychology* by Caroline Rhys Davids (London, 1900), a translation of the *Dhamma Sangani*, with valuable introduction; "Schools of Buddhist Belief," by T. W. Rhys Davids, in *Journal of the Royal Asiatic Society*, 1892, contains an abstract of the *Kathā Vatthu*; "On the *Abhidhamma* books of the Sarvāstivādins," by Prof. Takakusu, in *Journal of the Pali Text Society*, 1905.

(T. W. R. D.)

ABHORRERS, the name given in 1679 to the persons who expressed their *abhorrence* at the action of those who had signed petitions urging King Charles II. to assemble parliament. Feeling against Roman Catholics, and especially against James, duke of York, was running strongly; the Exclusion Bill had been passed by the House of Commons, and the popularity of James, duke of Monmouth, was very great. To prevent this bill from passing into law, Charles had dissolved parliament in July 1679, and in the following October had prorogued its successor without allowing it to meet. He was then deluged with petitions urging him to call it together, and this agitation was opposed by Sir George Jeffreys (*q.v.*) and Francis Wythens, who presented addresses expressing "abhorrence" of the "Petitioners," and thus initiated the movement of the *abhorrers*, who supported the action of the king. "The frolic went all over England," says Roger North; and the addresses of the Abhorrers which reached the king from all parts of the country formed a counterblast to those of the Petitioners. It is said that the terms Whig and Tory were first applied to English political parties in consequence of this dispute.

ABIATHAR (Heb. *Ebyāthar*, "the [divine] father is preeminent"), in the Bible, son of Ahimelech or Ahijah, priest at Nob. The only one of the priests to escape from Saul's massacre, he fled to David at Keilah, taking with him the ephod (1 Sam. xxii. 20 f., xxiii. 6, 9). He was of great service to David, especially at the time of the rebellion of Absalom (2 Sam. xv. 24, 29, 35, xx. 25). In 1 Kings iv. 4 Zadok and Abiathar are found acting together as priests under Solomon. In 1 Kings i. 7, 19, 25, however, Abiathar appears as a supporter of Adonijah, and in ii. 22 and 26 it is said that he was deposed by Solomon and banished to Anathoth. In 2 Sam. viii. 17 "Abiathar, the son of Ahimelech" should be read, with the Syriac, for "Ahimelech, the son of Abiathar." For a similar confusion see Mark ii. 26.

ABICH, OTTO WILHELM HERMANN VON (1806–1886), German mineralogist and geologist, was born at Berlin on the 11th of December 1806, and educated at the university in that city. His earliest scientific work related to spinels and other minerals, and later he made special studies of fumaroles, of the mineral deposits around volcanic vents and of the structure of volcanoes. In 1842 he was appointed professor of mineralogy in the university of Dorpat, and henceforth gave attention to the geology and mineralogy of Russia. Residing for some time at Tiflis he investigated the geology of the Caucasus. Ultimately he retired to Vienna, where he died on the 1st of July 1886. The mineral Abichite was named after him.

Publications.—*Vues illustratives de quelques phénomènes géologiques, prises sur le Vésuve et l'Etna, pendant les années* 1833 *et* 1834 (Berlin, 1836); *Ueber die Natur und den Zusammenhang der vulcanischen Bildungen* (Brunswick, 1841); *Geologische Forschungen in den Kaukasischen Ländern* (3 vols., Vienna, 1878, 1882, and 1887).

ABIGAIL (Heb. *Abigayil*, perhaps "father is joy"), or Abigal (2 Sam. iii. 3), in the Bible, the wife of Nabal the Carmelite, on whose death she became the wife of David (1 Sam. xxv.). By her David had a son, whose name appears in the Hebrew of 2 Sam. iii. 3 as Chileab, in the Septuagint as Daluyah, and in 1 Chron. iii. 1 as Daniel. The name Abigail was also borne by a sister of David (2 Sam. xvii. 25; 1 Chron. ii. 16 f.). From the former (self-styled "handmaid" 1 Sam. xxv. 25 f.) is derived the colloquial use of the term for a waiting-woman (cf. Abigail, the "waiting gentlewoman," in Beaumont and Fletcher's *Scornful Lady*).

ABIJAH (Heb. *Abiyyah* and *Abiyyahu*, "Yah is father"), a name borne by nine different persons mentioned in the Old Testament, of whom the most noteworthy are the following. (1) The son and successor of Rehoboam, king of Judah (2 Chron. xii. 16–xiii.), reigned about two years (918–915 B.C.). The accounts of him in the books of Kings and Chronicles are very conflicting (compare 1 Kings xv. 2 and 2 Chron. xi. 20 with 2 Chron. xiii. 2). The Chronicler tells us that he has drawn his facts from the Midrash (commentary) of the prophet Iddo. This is perhaps sufficient to explain the character of the narrative. (2) The second son of Samuel (1 Sam. viii. 2; 1 Chron. vi. 28 [13]). He and his brother Joel judged at Beersheba. Their misconduct was made by the elders of Israel a pretext for demanding a king (1 Sam. viii. 4). (3) A son of Jeroboam I., king of Israel; he died young (1 Kings xiv. 1 ff., 17). (4) Head of the eighth order of priests (1 Chron. xxiv. 10), the order to which Zacharias, the father of John the Baptist, belonged (Luke i. 5).

The alternative form *Abijam* is probably a mistake, though it is upheld by M. Jastrow.

ABILA, (1) a city of ancient Syria, the capital of the tetrarchy of Abilene, a territory whose extent it is impossible to define. It is generally called Abila of Lysanias, to distinguish it from (2) below. Abila was an important town on the imperial highway from Damascus to Heliopolis (Baalbek). The site is indicated by ruins of a temple, aqueducts, &c., and inscriptions on the banks of the river Barada at Sūk Wādi Baradā, a village called by early Arab geographers Ābil-es-Sūk, between Baalbek and Damascus. Though the names Abel and Abila differ in derivation and in meaning, their similarity has given rise to the tradition that this was the place of Abel's burial. According to Josephus, Abilene was a separate Iturean kingdom till A.D. 37, when it was granted by Caligula to Agrippa I.; in 52 Claudius granted it to Agrippa II. (See also Lysanias.) (2) A city in Perea, now Âbil-ez-Zeit.

ABILDGAARD, NIKOLAJ ABRAHAM (1744–1809), called "the Father of Danish Painting," was born at Copenhagen, the son of Sören Abildgaard, an antiquarian draughtsman of repute. He formed his style on that of Claude and of Nicolas Poussin, and was a cold theorist, inspired not by nature but by art. As a technical painter he attained remarkable success, his tone being very harmonious and even, but the effect, to a foreigner's eye, is rarely interesting. His works are scarcely known out of Copenhagen, where he won an immense fame in his own generation. He was the founder of the Danish school of painting, and the master of Thorwaldsen and Eckersberg.

ABIMELECH (Hebrew for "father of [*or* is] the king"). (1) A king of Gerar in South Palestine with whom Isaac, in the Bible, had relations. The patriarch, during his sojourn there, alleged that his wife Rebekah was his sister, but the king doubting this remonstrated with him and pointed out how easily adultery might have been unintentionally committed (Gen. xxvi.). Abimelech is called "king of the Philistines," but the title is clearly an anachronism. A very similar story is told of Abraham and Sarah (ch. xx.), but here Abimelech takes Sarah to wife, although he is warned by a divine vision before the crime is actually committed. The incident is fuller and shows a great advance in ideas of morality. Of a more primitive character, however, is another parallel story of Abraham at the court of Pharaoh, king of Egypt (xii. 10-20), where Sarah his wife is taken into the royal household, and the plagues sent by Yahweh lead to the discovery of the truth. Further incidents in Isaac's life at Gerar are narrated in Gen. xxvi. (cp. xxi. 22-34, time of Abraham), notably a covenant with Abimelech at Beer-sheba (whence the name is explained "well of the oath"); (see Abraham). By a pure error, or perhaps through a confusion in the traditions, Achish the Philistine (of Gath, 1 Sam. xxi., xxvii.), to whom David fled, is called Abimelech in the superscription to Psalm xxxiv.

(2) A son of Jerubbaal or Gideon (*q.v.*), by his Shechemite concubine (Judges viii. 31, ix.). On the death of Gideon, Abimelech set himself to assert the authority which his father had earned, and through the influence of his mother's clan won over the citizens of Shechem. Furnished with money from the treasury of the temple of Baal-berith, he hired a band of followers and slew seventy (cp. 2 Kings x. 7) of his brethren at Ophrah, his father's home. This is one of the earliest recorded instances of a practice common enough on the accession of Oriental despots. Abimelech thus became king, and extended his authority over central Palestine. But his success was short-lived, and the subsequent discord between Abimelech and the Shechemites was regarded as a just reward for his atrocious massacre. Jotham, the only one who is said to have escaped, boldly appeared on Mount Gerizim and denounced the ingratitude of the townsmen towards the legitimate sons of the man who had saved them from Midian. "Jotham's fable" of the trees who desired a king may be foreign to the context; it is a piece of popular lore, and cannot be pressed too far: the nobler trees have no wish to rule over others, only the bramble is self-confident. The "fable" appears to be antagonistic to ideas of monarchy. The origin of the conflicts which subsequently arose is not clear. Gaal, a new-comer, took the opportunity at the time of the vintage, when there was a festival in the temple, to head a revolt and seized Shechem. Abimelech, warned by his deputy Zebul, left his residence at Arumah and approached the city. In a fine bit of realism we are told how Gaal observed the approaching foe and was told by Zebul, "You see the shadow of the hills as men," and as they drew nearer Zebul's ironical remark became a taunt, "Where is now thy mouth? is not this the people thou didst despise? go now and fight them!" This revolt, which Abimelech successfully quelled, appears to be only an isolated episode. Another account tells of marauding bands of Shechemites which disturbed the district. The king disposed his men (the whole chapter is specially interesting for the full details it gives of the nature of ancient military operations), and after totally destroying Shechem, proceeded against Thebez, which had also revolted. Here, while storming the citadel, he was struck on the head by a fragment of a millstone thrown from the wall by a woman. To avoid the disgrace of perishing by a woman's hand, he begged his armour-bearer to run him through the body, but his memory was not saved from the ignominy he dreaded (2 Sam. xi. 21). It is usual to regard Abimelech's reign as the first attempt to establish a monarchy in Israel, but the story is mainly that of the rivalries of a half-developed petty state, and of the ingratitude of a community towards the descendants of its deliverer. (See, further, Jews, Judges.) (S. A. C.)

ABINGDON, a market town and municipal borough in the Abingdon parliamentary division of Berkshire, England, 6 m. S. of Oxford, the terminus of a branch of the Great Western railway from Radley. Pop. (1901) 6480. It lies in the flat valley of the Thames, on the west (right) bank, where the small river Ock flows in from the Vale of White Horse. The church of St Helen stands near the river, and its fine Early English tower with Perpendicular spire is the principal object in the pleasant views of the town from the river. The body of the church, which has five aisles, is principally Perpendicular. The smaller church of St Nicholas is Perpendicular in appearance, though parts of the fabric are older. Of a Benedictine abbey there remain a beautiful Perpendicular gateway, and ruins of buildings called the prior's house, mainly Early English, and the guest house, with other fragments. The picturesque narrow-arched bridge over the Thames near St Helen's church dates originally from 1416. There may be mentioned further the old buildings of the grammar school, founded in 1563, and of the charity called Christ's Hospital (1583); while the town-hall in the market-place, dating from 1677, is attributed to Inigo Jones. The grammar school now occupies modern buildings, and ranks among the lesser public schools of England, having scholarships at Pembroke College, Oxford. St Peter's College, Radley, 2 m. from Abingdon, is one of the principal modern public schools. It was opened in 1847. The buildings lie close to the Thames, and the school is famous for rowing, sending an eight to the regatta at Henley each year. Abingdon has manufactures of clothing and carpets and a large agricultural trade. The borough is under a mayor, four aldermen and twelve councillors. Area, 730 acres.

Abingdon (Abbedun, Abendun) was famous for its abbey, which was of great wealth and importance, and is believed to have been founded in A.D. 675 by Cissa, one of the *subreguli* of Centwin. Abundant charters from early Saxon monarchs are extant confirming various laws and privileges to the abbey, and the earliest of these, from King Ceadwalla, was granted before A.D. 688. In the reign of Alfred the abbey was destroyed by the Danes, but it was restored by Edred, and an imposing list of possessions in the Domesday survey evidences recovered prosperity. William the Conqueror in 1084 celebrated Easter at Abingdon, and left his son, afterwards Henry I., to be educated at the abbey. After the dissolution in 1538 the town sank into decay, and in 1555, on a representation of its pitiable condition, Queen Mary granted a charter establishing it as a free borough corporate with a common council consisting of a mayor, two bailiffs, twelve chief burgesses, and sixteen secondary burgesses, the mayor to be clerk of the market, coroner and a justice of the peace. The council was empowered to elect one burgess to parliament, and this right continued until the Redistribution of Seats Act of 1885. A town clerk and other officers were also appointed, and the town boundaries described in great detail. Later charters from Elizabeth, James I., James II., George II. and George III. made no considerable change. James II. changed the style of the corporation to that of a mayor, twelve aldermen and twelve burgesses. The abbot seems to have held a market from very early times, and charters for the holding of markets and fairs were granted by various sovereigns from Edward I. to George II. In the 13th and 14th centuries Abingdon was a flourishing agricultural centre with an extensive trade in wool, and a famous weaving and clothing manufacture. The latter industry declined before the reign of Queen Mary, but has since been revived.

The present Christ's Hospital originally belonged to the Gild of the Holy Cross, on the dissolution of which Edward VI. founded the hospital under its present name.

See *Victoria County History, Berkshire*; Joseph Stevenson, *Chronicon Monasterii de Abingdon*, A.D. 201–1189 (Rolls Series, 2 vols., London, 1858).

ABINGER, JAMES SCARLETT, 1st Baron (1769–1844), English judge, was born on the 13th of December 1769 in Jamaica, where his father, Robert Scarlett, had property. In the summer of 1785 he was sent to England to complete his education, and went to Trinity College, Cambridge, taking his B.A. degree in 1789. Having entered the Inner Temple he was called to the bar in 1791, and joined the northern circuit and the Lancashire sessions. Though he had no professional connexions, by steady application he gradually obtained a large practice, ultimately confining himself to the Court of King's Bench and the northern circuit. He took silk in 1816, and from this time till the close of 1834 he was the most successful lawyer at the bar; he was particularly effective before a jury, and his income reached the high-water mark of £18,500, a large sum for that period. He began life as a Whig, and first entered parliament in 1819 as member for Peterborough, representing that constituency with a short break (1822–1823) till 1830, when he was elected for the borough of Malton. He became attorney-general, and was knighted when Canning formed his ministry in 1827; and though he resigned when the duke of Wellington came into power in 1828, he resumed office in 1829 and went out with the duke of Wellington in 1830. His opposition to the Reform Bill caused his severance from the Whig leaders, and having joined the Tories he was elected, first for Colchester and then in 1832 for Norwich, for which borough he sat until the dissolution of parliament. He was appointed lord chief baron of the exchequer in 1834, and presided in that court for more than nine years. While attending the Norfolk circuit on the 2nd of April he was suddenly seized with apoplexy, and died in his lodgings at Bury on the 7th of April 1844. He had been raised to the peerage as Baron Abinger in 1835, taking his title from the Surrey estate he had bought in 1813. The qualities which brought him success at the bar were not equally in place on the bench; he was partial, dictatorial and vain; and complaint was made of his domineering attitude towards juries. But his acuteness of mind and clearness of expression remained to the end. Lord Abinger was twice married (the second time only six months before his death), and by his first wife (d. 1829) had three sons and two daughters, the title passing to his eldest son Robert (1794–1861). His second son, General Sir James Yorke Scarlett (1799–1871), leader of the heavy cavalry charge at Balaclava, is dealt with in a separate article; and his elder daughter, Mary, married John, Baron Campbell, and was herself created Baroness Stratheden (Lady Stratheden and Campbell) (d. 1860). Sir Philip Anglin Scarlett (d. 1831), Lord Abinger's younger brother, was chief justice of Jamaica.

See P. C. Scarlett, *Memoir of James, 1st Lord Abinger* (1877); Foss's *Lives of the Judges*; E. Manson, *Builders of our Law* (1904).

ABINGTON, FRANCES (1737–1815), English actress, was the daughter of a private soldier named Barton, and was, at first, a flower girl and a street singer. She then became servant to a French milliner, obtaining a taste in dress and a knowledge of French which afterwards stood her in good stead. Her first appearance on the stage was at the Haymarket in 1755 as Miranda in Mrs Centlivre's *Busybody*. In 1756, on the recommendation of Samuel Foote, she became a member of the Drury Lane company, where she was overshadowed by Mrs Pritchard and Kitty Clive. In 1759, after an unhappy marriage with her music-master, one of the royal trumpeters, she is mentioned in the bills as Mrs Abington. Her first success was in Ireland as Lady Townley, and it was only after five years, on the pressing invitation of Garrick, that she returned to Drury Lane. There she remained for eighteen years, being the original of more than thirty important characters, notably Lady Teazle (1777). Her Beatrice, Portia, Desdemona and Ophelia were no less liked than her Miss Hoyden, Biddy Tipkin, Lucy Lockit and Miss Prue. It was in the last character in *Love for Love* that Reynolds painted his best portrait of her. In 1782 she left Drury Lane for Covent Garden. After an absence from the stage from 1790 until 1797, she reappeared, quitting it finally in 1799. Her ambition, personal wit and cleverness won her a distinguished position in society, in spite of her humble origin. Women of fashion copied her frocks, and a head-dress she wore was widely adopted and known as the "Abington cap." She died on the 4th of March 1815.

ABIOGENESIS, in biology, the term, equivalent to the older terms "spontaneous generation," *Generatio aequivoca*, *Generatio primaria*, and of more recent terms such as archegenesis and archebiosis, for the theory according to which fully formed living organisms sometimes arise from not-living matter. Aristotle explicitly taught abiogenesis, and laid it down as an observed fact that some animals spring from putrid matter, that plant-lice arise from the dew which falls on plants, that fleas are developed from putrid matter, and so forth. T. J. Parker (*Elementary Biology*) cites a passage from Alexander Ross, who, commenting on Sir Thomas Browne's doubt as to "whether mice may be bred by putrefaction," gives a clear statement of the common opinion on abiogenesis held until about two centuries ago. Ross wrote: "So may he (Sir Thomas Browne) doubt whether in cheese and timber worms are generated; or if beetles and wasps in cows' dung; or if butterflies, locusts, grasshoppers, shell-fish, snails, eels, and such like, be procreated of putrefied matter, which is apt to receive the form of that creature to which it is by formative power disposed. To question this is to question reason, sense and experience. If he doubts of this let him go to Egypt, and there he will find the fields swarming with mice, begot of the mud of Nylus, to the great calamity of the inhabitants."

The first step in the scientific refutation of the theory of abiogenesis was taken by the Italian Redi, who, in 1668, proved that no maggots were "bred" in meat on which flies were prevented by wire screens from laying their eggs. From the 17th century onwards it was gradually shown that, at least in the case of all the higher and readily visible organisms, abiogenesis did not occur, but that *omne vivum e vivo*, every living thing came from a pre-existing living thing.

The discovery of the microscope carried the refutation further. In 1683 A. van Leeuwenhoek discovered bacteria, and it was soon found that however carefully organic matter might be protected by screens, or by being placed in stoppered receptacles, putrefaction set in, and was invariably accompanied by the appearance of myriads of bacteria and other low organisms. As knowledge of microscopic forms of life increased, so the apparent possibilities of abiogenesis increased, and it became a tempting hypothesis that whilst the higher forms of life arose only by generation from their kind, there was a perpetual abiogenetic fount by which the first steps in the evolution of living organisms continued to arise, under suitable conditions, from inorganic matter. It was due chiefly to L. Pasteur that the occurrence of abiogenesis in the microscopic world was disproved as much as its occurrence in the macroscopic world. If organic matter were first sterilized and then prevented from contamination from without, putrefaction did not occur, and the matter remained free from microbes. The nature of sterilization, and the difficulties in securing it, as well as the extreme delicacy of the manipulations necessary, made it possible for a very long time to be doubtful as to the application of the phrase *omne vivum e vivo* to the microscopic world, and there still remain a few belated supporters of abiogenesis. Subjection to the temperature of boiling water for, say, half an hour seemed an efficient mode of sterilization, until it was discovered that the spores of bacteria are so involved in heat-resisting membranes, that only prolonged exposure to dry, baking heat can be recognized as an efficient process of sterilization. Moreover, the presence of bacteria, or their spores, is so universal that only extreme precautions guard against a re-infection of the sterilized material. It may now be stated definitely that all known living organisms arise only from pre-existing living organisms.

So far the theory of abiogenesis may be taken as disproved. It must be noted, however, that this disproof relates only to known existing organisms. All these are composed of a definite substance, known as protoplasm (*q.v.*), and the modern refutation of abiogenesis applies only to the organic forms in which protoplasm now exists. It may be that in the progress of science it may yet become possible to construct living protoplasm from non-living material. The refutation of abiogenesis has no further bearing on this possibility than to make it probable that if protoplasm ultimately be formed in the laboratory, it will be by a series of stages, the earlier steps being the formation of some substance, or substances, now unknown, which are not protoplasm. Such intermediate stages may have existed in the past, and the modern refutation of abiogenesis has no application to the possibility of these having been formed from inorganic matter at some past time. Perhaps the words archebiosis, or archegenesis, should be reserved for the theory that protoplasm in the remote past has been developed from not-living matter by a series of steps, and many of those, notably T. H. Huxley, who took a large share in the process of refuting contemporary abiogenesis, have stated their belief in a primordial archebiosis. (See BIOGENESIS and LIFE.) (P. C. M.)

ABIPONES, a tribe of South American Indians of Guaycuran stock recently inhabiting the territory lying between Santa Fé and St Iago. They originally occupied the Chaco district of Paraguay, but were driven thence by the hostility of the Spaniards. According to Martin Dobrizhoffer, a Jesuit missionary, who, towards the end of the 18th century, lived among them for a period of seven years, they then numbered not more than 5000. They were a well-formed, handsome people, with black eyes and aquiline noses, thick black hair, but no beards. The hair from the forehead to the crown of the head was pulled out, this constituting a tribal mark. The faces, breasts and arms of the women were covered with black figures of various designs made with thorns, the tattooing paint being a mixture of ashes and blood. The lips and ears of both sexes were pierced. The men were brave fighters, their chief weapons being the bow and spear. No child was without bow and arrows; the bow-strings were made of foxes' entrails. In battle the Abipones wore an armour of tapir's hide over which a jaguar's skin was sewn. They were excellent swimmers and good horsemen. For five months in the year when the floods were out they lived on islands or even in shelters built in the trees. They seldom married before the age of thirty, and were singularly chaste. "With the Abipones," says Darwin, "when a man chooses a wife, he bargains with the parents about the price. But it frequently happens that the girl rescinds what has been agreed upon between the parents and bridegroom, obstinately rejecting the very mention of marriage. She often runs away and hides herself, and thus eludes the bridegroom." Infanticide was systematic, never more than two children being reared in one family, a custom doubtless originating in the difficulty of subsistence. The young were suckled for two years. The Abipones are now believed to be extinct as a tribe.

Martin Dobrizhoffer's Latin *Historia de Abiponibus* (Vienna, 1784) was translated into English by Sara Coleridge, at the suggestion of Southey, in 1822, under the title of *An Account of the Abipones* (3 vols.).

ABITIBBI, a lake and river of Ontario, Canada. The lake, in 49° N., 80° W., is 60 m. long and studded with islands. It is shallow, and the shores in its vicinity are covered with small timber. It was formerly employed by the Hudson's Bay Company as part of a canoe route to the fur lands of the north. The construction of the Grand Trunk Pacific railway through this district has made it of some importance. Its outlet is Abitibbi river, a rapid stream, which after a course of 200 m. joins the Moose river, flowing into James Bay.

ABJURATION (from Lat. *abjurare*, to forswear), a solemn repudiation or renunciation on oath. At common law, it signified the oath of a person who had taken sanctuary to leave the realm for ever; this was abolished in the reign of James I. The *Oath of Abjuration*, in English history, was a solemn disclaimer, taken by members of parliament, clergy and laymen against the right of the Stuarts to the crown, imposed by laws of William III., George I. and George III.; but its place has since been taken by the oath of allegiance.

ABKHASIA, or ABHASIA, a tract of Russian Caucasia, government of Kutais. The Caucasus mountains on the N. and N.E. divide it from Circassia; on the S.E. it is bounded by Mingrelia; and on the S.W. by the Black Sea. Though the country is generally mountainous, with dense forests of oak and walnut, there are some deep, well-watered valleys, and the climate is mild. The soil is fertile, producing wheat, maize, grapes, figs, pomegranates and wine. Cattle and horses are bred. Honey is produced; and excellent arms are made. This country was subdued (*c.* 550) by the Emperor Justinian, who introduced Christianity. Native dynasties ruled from 735 to the 15th century, when the region was conquered by the Turks and became Mahommedan. The Russians acquired possession of it piecemeal between 1829 and 1842, but their power was not firmly established until after 1864. Area, 2800 sq. m. The principal town is Sukhum-kaleh. Pop. 43,000, of whom two-thirds are Mingrelians and one-third Abkhasians, a Cherkess or Circassian race. The total number of Abkhasians in the two governments of Kutais and Kuban was 72,103 in 1897; large numbers emigrated to the Turkish empire in 1864 and 1878.

ABLATION (from Lat. *ablatus*, carried away), the process of removing anything; a term used technically in geology of the wearing away of a rock or glacier, and in surgery for operative removal.

ABLATITIOUS (from Lat. *ablatus*, taken away), reducing or withdrawing; in astronomy a force which interferes between the moon and the earth to lessen the strength of gravitation is called "ablatitious," just as it is called "addititious" when it increases that strength.

ABLATIVE (Lat. *ablativus*, sc. *casus*, from *ablatum*, taken away), in grammar, a case of the noun, the fundamental sense of which is direction from; in Latin, the principal language in which the case exists, this has been extended, with or without a preposition, to the instrument or agent of an act, and the place or time at, and manner in, which a thing is done. The case is also found in Sanskrit, Zend, Oscan and Umbrian, and traces remain in other languages. The "Ablative Absolute," a grammatical construction in Latin, consists of a noun in the ablative case, with a participle, attribute or qualifying word agreeing with it, not depending on any other part of the sentence, to express the time, occasion or circumstance of a fact.

ABLUTION (Lat. *ablutio*, from *abluere*, "to wash off"), a washing, in its religious use, destined to secure that ceremonial or ritualistic purity which must not be confused with the physical or hygienic cleanliness of persons and things obtained by the use of soap and water.[1] Indeed the two states may contradict each other, as in the case of the 4th-century Christian pilgrim to Jerusalem who boasted that she had not washed her face for eighteen years for fear of removing therefrom the holy chrism of baptism. The purport, then, of ablutions is to remove, not dust and dirt, but the—to us imaginary—stains contracted by contact with the dead, with childbirth, with menstruous women, with murder whether wilful or involuntary, with almost any form of bloodshed, with persons of inferior caste, with dead animal refuse, *e.g.* leather or excrement, with leprosy, madness and any form of disease. Among all races in a certain grade of development such associations are vaguely felt to be dangerous and to impair vitality. In a later stage the taint is regarded as alive, as a demon or evil spirit alighting on and passing into the things and persons exposed to contamination. In general, water, cows' urine and blood of swine are the materials used in ablutions. Of these water is the commonest, and its efficacy is enhanced if it be running, and still more if a magical or sacramental virtue has been imparted to it by ritual blessing or consecration. Some concrete examples will best illustrate the nature of such ablutions. In the *Atharva-Veda*, vii. 116, we have this allopathic remedy for fever. The patient's skin burns, that of a frog is cold to the touch; therefore tie to the foot of the bed a frog, bound with red and black thread, and wash down the sick man so that the water of ablution falls on the frog. Let the medicine man or magician pray that the fever may pass into the frog, and the frog be forthwith released, and the cure will be effected. In the old Athenian Anthesteria the blood of victims was poured over the unclean. A bath of bulls' blood was much in vogue as a baptism in the mysteries of Attis. The water must in ritual washings run off in order to carry away the miasma or unseen demon of disease; and accordingly in baptism the early Christians used living or running water. Nor was it enough that the person baptized should himself enter the water; the baptizer must pour it over his head, so that it run down his person. Similarly the Brahman takes care, after ablution of a person, to wipe the cathartic water off from head to feet downwards, that the malign influence may pass out through the feet. The same care is shown in ritual ablutions in the Bukovina and elsewhere.

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[1] In its technical ecclesiastical sense the *ablution* is the ritual washing of the chalice and of the priest's fingers after the celebration of Holy Communion in the Catholic Church. The wine and water used for this purpose are themselves sometimes called "the ablution."

Water and fire, spices and sulphur, are used in ritual cleansings, says Iamblichus in his book on mysteries (v. 23), as being specially full of the divine nature. Nevertheless in all religions, and especially in the Brahmanic and Christian, the cathartic virtue of water is enhanced by the introduction into it by means of suitable prayers and incantations of a divine or magical power. Ablutions both of persons and things are usually cathartic, that is, intended to purge away evil influences (*καθαίρειν*, to make *καθαρός*, pure). But, as Robertson Smith observes, "holiness is contagious, just as uncleanness is"; and common things and persons may become taboo, that is, so holy as to be dangerous and useless for daily life through the mere infection of holiness. Thus in Syria one who touched a dove became taboo for one whole day, and if a drop of blood of the Hebrew sin-offering fell on a garment it had to be ritually washed off. It was as necessary in the Hebrew religion for the priest to wash his hands *after* handling the sacred volume as before. Christians might not enter a church to say their prayers without first washing their hands. So Chrysostom says: "Although our hands may be already pure, yet unless we have washed them thoroughly, we do not spread them upwards in prayer." Tertullian (*c.* 200) had long before condemned this as a heathen custom; none the less, it was insisted on in later ages, and is a survival of the pagan lustrations or *περιρραντήρια*. Sozomen (vi. 6) tells how a priest sprinkled Julian and Valentinian with water according to the heathen custom as they entered his temple. The same custom prevails among Mahommedans. Porphyry (*de Abst.* ii. 44) relates that one who touched a sacrifice meant to avert divine anger must bathe and wash his clothes in running water before returning to his city and home, and similar scruples in regard to holy objects and persons have been observed among the natives of Polynesia, New Zealand and ancient Egypt. The rites, met within all lands, of pouring out water or bathing in order to produce rain from heaven, differ in their significance from ablutions with water and belong to the realm of sympathetic magic.

There are certain forms of purification which one does not know whether to describe as ablutions or anointings. Thus Demosthenes in his speech "On the crown" accused Aeschines of having "purified the initiated and wiped them clean *with* (not *from*) mud and pitch." Smearing with gypsum (*τίτανος*, *titanos*) had a similar purifying effect, and it has been suggested[1] that the Titans were no more than old-world votaries who had so disguised themselves. Perhaps the use of ashes in mourning had the same origin. In the rite of death-bed penance given in the old Mozarabic Christian ritual of Spain, ashes were poured over the sick man.

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ABNAKI ("the whitening sky at daybreak," *i.e.* Easterners), a confederacy of North American Indians of Algonquian stock, called Terrateens by the New England tribes and colonial writers. It included the Passamaquoddy, Penobscot, Norridgewock, Malecite and other tribes. It formerly occupied what is now Maine and southern New Brunswick. All the tribes were loyal to the French during the early years of the 18th century, but after the British success in Canada most of them withdrew to St Francis, Canada, subsequently entering into an agreement with the British authorities. The Abnaki now number some 1600.

For details see *Handbook of American Indians*, edited by F. W. Hodge (Washington, 1907).

ABNER (Hebrew for "father of [*or* is a] light"), in the Bible, first cousin of Saul and commander-in-chief of his army (1 Sam. xiv. 50, xx. 25). He is only referred to incidentally in Saul's history (1 Sam. xvii. 55, xxvi. 5), and is not mentioned in the account of the disastrous battle of Gilboa when Saul's power was crushed. Seizing the only surviving son, Ishbaal, he set him up as king over Israel at Mahanaim, east of the Jordan. David, who was accepted as king by Judah alone, was meanwhile reigning at Hebron, and for some time war was carried on between the two parties. The only engagement between the rival factions which is told at length is noteworthy, inasmuch as it was preceded by an encounter at Gibeon between twelve chosen men from each side, in which the whole twenty-four seem to have perished (2 Sam. ii. 12).[1] In the general engagement which followed, Abner was defeated and put to flight. He was closely pursued by Asahel, brother of Joab, who is said to have been "light of foot as a wild roe." As Asahel would not desist from the pursuit, though warned, Abner was compelled to slay him in self-defence. This originated a deadly feud between the leaders of the opposite parties, for Joab, as next of kin to Asahel, was by the law and custom of the country the avenger of his blood. For some time afterwards the war was carried on, the advantage being invariably on the side of David. At length Ishbaal lost the main prop of his tottering cause by remonstrating with Abner for marrying Rizpah, one of Saul's concubines, an alliance which, according to Oriental notions, implied pretensions to the throne (cp. 2 Sam. xvi. 21 sqq.; 1 Kings ii. 21 sqq.). Abner was indignant at the deserved rebuke, and immediately opened negotiatons with David, who welcomed him on the condition that his wife Michal should be restored to him. This was done, and the proceedings were ratified by a feast. Almost immediately after, however Joab, who had been sent away, perhaps intentionally returned and slew Abner at the gate of Hebron. The ostensible motive for the assassination was a desire to avenge Asahel, and this would be a sufficient justification for the deed according to the moral standard of the time. The conduct of David after the event was such as to show that he had no complicity in the act, though he could not venture to punish its perpetrators (2 Sam. iii. 31-39; cp. 1 Kings ii. 31 seq.). (See DAVID.)

ÅBO (Finnish *Turku*), a city and seaport, the capital of the province of Åbo-Björneborg, in the grand duchy of Finland, on the Aura-joki, about 3 m. from where it falls into the gulf of Bothnia. Pop. (1810) 10,224; (1870) 19,617; (1904) 42,639. It is 381 m. by rail from St Petersburg *via* Tavastehus, and is in regular steamer communication with St Petersburg, Vasa, Stockholm, Copenhagen and Hull. It was already a place of importance when Finland formed part of the kingdom of Sweden. When the Estates of Finland seceded from Sweden and accepted the Emperor Alexander of Russia as their grand duke at the Diet of Borgå in 1809, Åbo became the capital of the new state, and so remained till 1819 when the seat of government was transferred to Helsingfors. In November 1827 nearly the whole city was burnt down, the university and its valuable library being entirely destroyed. Before this calamity Åbo contained 1110 houses and 13,000 inhabitants; and its university had 40 professors, more than 500 students, and a library of upwards of 30,000 volumes, together with a botanical garden, an observatory and a chemical laboratory. The university has since been removed to Helsingfors. Åbo remains the ecclesiastical capital of Finland, is the seat of the Lutheran archbishop and contains a fine cathedral dating from 1258 and restored after the fire of 1827. The cathedral is dedicated to St Henry, the patron saint of Finland, an English missionary who introduced Christianity into the country in the 12th century. Åbo is the seat of the first of the three courts of appeal of Finland. It has two high schools, a school of commerce and a school of navigation. The city is second only to Helsingfors for its trade; sail-cloth, cotton and tobacco are manufactured, and there are extensive saw-mills. There is also a large trade in timber and a considerable butter export. Ship-building has considerably developed, torpedo-boats being built here for the Russian navy. Vessels drawing 9 or 10 feet come up to the town, but ships of greater draught are laden and discharged at its harbour (Bornholm, on Hyrvinsala Island), which is entered yearly by from 700 to 800 ships, of about 200,000 tons.

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[1] By J. E. Harrison, *Prolegomena to Greek Religion*, p. 493.

[1] The object of the story of the encounter is to explain the name Helkath-hazzurim, the meaning of which is doubtful (*Ency. Bib.* col. 2006; Batten in *Zeit. f. alt-test. Wissens.* 1906, pp. 90 sqq.).

ÅBO-BJÖRNEBORG, a province occupying the S.W. corner of Finland and including the Åland islands. It has a total area of 24,171 square kilometres and a population (1900) of 447,098, of whom 379,622 spoke Finnish and 67,260 Swedish; 446,900 were of the Lutheran religion. The province occupies a prominent position in Finland for its manufacture of cottons, sugar refinery, wooden goods, metals, machinery, paper, &c. Its chief towns are: Åbo (pop. 42,639), Björneborg (16,053), Raumo (5501), Nystad (4165), Mariehamn (1171), Nådendal (917).

ABODE (from "abide," to dwell, properly "to wait for," to bide), generally, a dwelling. In English law this term has a more restricted meaning than domicile, being used to indicate the place of a man's residence or business, whether that be either temporary or permanent. The law may regard for certain purposes, as a man's abode, the place where he carries on business, though he may reside elsewhere; so that the term has come to have a looser significance than *residence*, which has been defined as "where a man lives with his family and sleeps at night" (*R.* v. *Hammond*, 1852, 17 Q.B. 772). In serving a notice of action, a solicitor's place of business may be given as his abode (*Roberts* v. *Williams*, 1835, 5 L.J.M.C. 23), and in more recent decisions it has been similarly held that where a notice was required to be served under the Public Health Act 1875, either personally or to some inmate of the owner's or occupier's "place of abode," a place of business was sufficient.

ABOMASUM (*caillette*), the fourth or rennet stomach of Ruminantia. From the *omasum* the food is finally deposited in the abomasum, a cavity considerably larger than either the second or third stomach, although less than the first. The base of the abomasum is turned to the *omasum*. It is of an irregular conical form. It is that part of the digestive apparatus which is analogous to the single stomach of other Mammalia, as the food there undergoes the process of chymification, after being macerated and ground down in the three first stomachs.

ABOMEY, capital of the ancient kingdom of Dahomey, West Africa, now included in the French colony of the same name. It is 70 m. N. by rail of the seaport of Kotonu, and has a population of about 15,000. Abomey is built on a rolling plain, 800 ft. above sea-level, terminating in short bluffs to the N.W., where it is bounded by a long depression. The town was surrounded by a mud wall, pierced by six gates, and was further protected by a ditch 5 ft. deep, filled with a dense growth of prickly acacia, the usual defence of West African strongholds. Within the walls, which had a circumference of six miles, were villages separated by fields, several royal palaces, a market-place and a large square containing the barracks. In November 1892, Behanzin, the king of Dahomey, being defeated by the French, set fire to Abomey and fled northward. Under French administration the town has been rebuilt, placed (1905) in railway communication with the coast, and given an ample water supply by the sinking of artesian wells.

ABOMINATION (from Lat. *ab*, from, and *ominare*, to forebode), anything contrary to omen, and therefore regarded with aversion; a word used often in the Bible to denote evil doctrines or ceremonial practices which were impure. An incorrect derivation was *ab homine* (*i.e.* inhuman), and the spelling of the adjective "abominable" in the first Shakespeare folio is always "abhominable." Colloquially "abomination" and "abominable" are used to mean simply excessive in a disagreeable sense.

ABOR HILLS, a tract of country on the north-east frontier of India, occupied by an independent tribe called the Abors. It lies north of Lakhimpur district, in the province of eastern Bengal and Assam, and is bounded on the east by the Mishmi Hills and on the west by the Miri Hills, the villages of the tribe extending to the Dibong river. The term Abor is an Assamese word, signifying "barbarous" or "independent," and is applied in a general sense by the Assamese to many frontier tribes; but in its restricted sense it is specially given to the above tract. The Abors, together with the cognate tribes of Miris, Daphlas and Akas, are supposed to be descended from a Tibetan stock. They are a quarrelsome and sulky race, violently divided in their political relations. In former times they committed frequent raids upon the plains of Assam, and have been the object of more than one retaliatory expedition by the British government. In 1893–94 occurred the first Bor Abor expedition. Some military police sepoys were murdered in British territory, and a force of 600 troops was sent, who traversed the Abor country, and destroyed the villages concerned in the murder and all other villages that opposed the expedition. A second expedition became necessary later on, two small patrols having been treacherously murdered; and a force of 100 British troops traversed the border of the Abor country and punished the tribes, while a blockade was continued against them from 1894 to 1900.

See Colonel Dalton's *Ethnology of Bengal*, 1872.

ABORIGINES, a mythical people of central Italy, connected in legendary history with Aeneas, Latinus and Evander. They were supposed to have descended from their mountain home near Reate (an ancient Sabine town) upon Latium, whence they expelled the Siceli and subsequently settled down as Latini under a King Latinus (Dion Halic. i. 9. 60). The most generally accepted etymology of the name (*ab origine*), according to which they were the original inhabitants (= Gk. αὐτόχθονες) of the country, is inconsistent with the fact that the oldest authorities (*e.g.* Cato in his *Origines*) regarded them as Hellenic immigrants, not as a native Italian people. Other explanations suggested are *arborigines*, "tree-born," and *aberrigines*, "nomads." Historical and ethnographical discussions have led to no result; the most that can be said is that, if not a general term, "aborigines" may be the name of an Italian stock, about whom the ancients knew no more than ourselves.

In modern times the term "Aborigines" has been extended in signification, and is used to indicate the inhabitants found in a country at its first discovery, in contradistinction to colonies or new races, the time of whose introduction into the country is known.

The Aborigines' Protection Society was founded in 1838 in England as the result of a royal commission appointed at the instance of Sir T. Fowell Buxton to inquire into the treatment of the indigenous populations of the various British colonies. The inquiry revealed the gross cruelty and injustice with which the natives had been often treated. Since its foundation the society has done much to make English colonization a synonym for humane and generous treatment of savage races.

ABORTION (from Lat. *aboriri*, to fail to be born, or perish), in obstetrics, the premature separation and expulsion of the contents of the pregnant uterus. It is a common terminology to call premature labour of an accidental type a "miscarriage," in order to distinguish "abortion" as a deliberately induced act, whether as a medical necessity by the accoucheur, or as a criminal proceeding (see MEDICAL JURISPRUDENCE); otherwise the term "abortion" would ordinarily be used when occurring before the eighth month of gestation, and "premature labour" subsequently. As an accident of pregnancy, it is far from uncommon, although its relative frequency, as compared with that of completed gestation, has been very differently estimated by accoucheurs. It is more liable to occur in the earlier than in the later months of pregnancy, and it would also appear to occur more readily at the periods corresponding to those of the menstrual discharge. It may be induced by numerous causes, both of a local and general nature. Malformations of the pelvis, accidental injuries and the diseases and displacements to which the uterus is liable, on the one hand; and, on the other, various morbid conditions of the ovum or placenta leading to the death of the foetus, are among the direct local causes. The general causes embrace certain states of the system which are apt to exercise a more or less direct influence upon the progress of utero-gestation. The tendency to recurrence in persons who have previously miscarried is well known, and should ever be borne in mind with the view of avoiding any cause likely to lead to a repetition of the accident. Abortion resembles ordinary labour in its general phenomena, excepting that in the former hemorrhage often to a large extent forms one of the leading symptoms. The treatment embraces the means to be used by rest, astringents and sedatives, to prevent the occurrence when it merely threatens; or when, on the contrary, it is inevitable, to accomplish as speedily as possible the complete removal of the entire contents of the uterus.

Among primitive savage races abortion is practised to a far less extent than infanticide (*q.v.*), which offers a simpler way of getting rid of inconvenient progeny. But it is common among the American Indians, as well as in China, Cambodia and India, although throughout Asia it is generally contrary both to law and religion. How far it was considered a crime among the civilized nations of antiquity has long been debated. Those who maintain the impunity of the practice rely for their authority upon certain passages in the classical authors, which, while bitterly lamenting the frequency of this enormity, yet never allude to any laws by which it might be suppressed. For example, in one of Plato's dialogues (*Theaet.*), Socrates is made to speak of artificial abortion as a practice, not only common but allowable; and Plato himself authorizes it in his *Republic* (lib. v.). Aristotle (*Polit.* lib. vii. c. 17) gives it as his opinion that no child ought to be suffered to come into the world, the mother being above forty or the father above fifty-five years of age. Lysias maintained, in one of his pleadings quoted by Harpocration, that forced abortion could not be considered homicide, because a child *in utero* was not an animal, and had no separate existence. Among the Romans, Ovid (*Amor.* lib. ii.), Juvenal (*Sat.* vi. 594) and Seneca (*Consol. ad Hel.* 16) mention the frequency of the offence, but maintain silence as to any laws for punishing it. On the other hand, it is argued that the authority of Galen and Cicero (*pro Cluentio*) place it beyond a doubt that, so far from being allowed to pass with impunity, the offence in question was sometimes punished by death; that the authority of Lysias is of doubtful authenticity; and that the speculative reasonings of Plato and Aristotle, in matters of legislation, ought not to be confounded with the actual state of the laws. Moreover, Stobaeus (*Serm.* 73) has preserved a passage from Musonius, in which that philosopher expressly states that the ancient law-givers inflicted punishments on females who caused themselves to abort. After the spread of Christianity among the Romans, however, foeticide became equally criminal with the murder of an adult, and the barbarian hordes which afterwards overran the empire also treated the offence as a crime punishable with death. This severe penalty remained in force in all the countries of Europe until the Middle Ages. With the gradual disuse of the old barbarous punishments so universal in medieval times came also a reversal of opinion as to the magnitude of the crime involved in killing a child not yet born. But the exact period of transition is not clearly marked.

In England the Anglo-Saxons seem to have regarded abortion only as an ecclesiastical offence. Sir Matthew Hale (1609–1676) tells us that if anything is done to "a woman quick or great with child, to make an abortion, or whereby the child within her is killed, it is not murder or manslaughter by the law of England, because it is not yet *in rerum natura*." But the common law appears, nevertheless, to have treated as a misdemeanour any attempt to effect the destruction of such an infant, though unsuccessful. Blackstone (1723–1780), to be sure, a hundred years later, says that, "if a woman is quick with child, and by poison or otherwise killeth it in her womb, or if any one beat her, whereby the child dieth in her body, and she is delivered of a dead child, this, though not murder, was, by the ancient law, homicide or manslaughter." Whatever may have been the exact view taken by the common law, the offence was made statutory by an act of 1803, making the attempt to cause the miscarriage of a woman, not being, or not being proved, to be quick with child, a felony, punishable with fine, imprisonment, whipping or transportation for any term not exceeding fourteen years. Should the woman have proved to have quickened, the attempt was punishable with death. The provisions of this statute were re-enacted in 1828. The English law on the subject is now governed by the Offences against the Person Act 1861, which makes the attempting to cause miscarriage by administering poison or other noxious thing, or unlawfully using any instrument equally a felony, whether the woman be, or be not, with child. No distinction is now made as to whether the foetus is or is not alive, legislation appearing to make the offence statutory with the object of prohibiting any risk to the life of the mother. If a woman administers to herself any poison or other noxious thing, or unlawfully uses any instrument or other means to procure her own miscarriage, she is guilty of felony. The punishment for the offence is penal servitude for life or not less than three years, or imprisonment for not more than two years. If a child is born alive, but in consequence of its premature birth, or of the means employed, afterwards dies, the offence is murder; the general law as to accessories applies to the offence.

In all the countries of Europe the causing of abortion is now punishable with more or less lengthy terms of imprisonment. Indeed, the tendency in continental Europe is to regard the abortion as a crime against the unborn child, and several codes (notably that of the German Empire) expressly recognize the life of the foetus, while others make the penalty more severe if abortion has been caused in the later stages of pregnancy, or if the woman is married. According to the weight of authority in the United States abortion was not regarded as a punishable offence at common law, if the abortion was produced with the consent of the mother prior to the time when she became quick with child; but the Supreme Courts of Pennsylvania and North Carolina held it a crime at common law, which might be committed as soon as gestation had begun (*Mills* v. *Com.* 13 Pa. St. 630; *State* v. *Slagle*, 83 N.C. 630). The attempt is a punishable offence in several states, but not in Ohio. Nor was it ever murder at common law to take the life of the child at any period of gestation, even in the very act of delivery (*Mitchell* v. *Com.* 78 Ky. 204). If the death of the woman results it is murder at common law (*Com.* v. *Parker*, 9 Met. [Mass.] 263). It is now a statutory offence in all states of the Union, but the woman must be actually pregnant. In most states not only is the person who causes the abortion punishable, but also any one who supplies any drug or instrument for the purpose. The woman, however, is not an accomplice (except by statute as in Ohio, *State* v. *M'Coy*, 39 N.E. 316), nor is she guilty of any crime unless by statute as in New York (Penal Code, § 295) and California (Penal Code, § 275) and Connecticut (Gen. Stats. 1902, § 1156). She may be a witness, and her testimony does not need corroboration. The attempt is also a crime in New York (1905, *People* v. *Conrad*, 102 App. D. 566).

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ABOUKIR, a village on the Mediterranean coast of Egypt, 14¾ m. N.E. of Alexandria by rail, containing a castle used as a state prison by Mehemet Ali. Near the village are many remains of ancient buildings, Egyptian, Greek and Roman. About 2 m. S.E. of the village are ruins supposed to mark the site of Canopus. A little farther east the Canopic branch of the Nile (now dry) entered the Mediterranean.

Stretching eastward as far as the Rosetta mouth of the Nile is the spacious bay of Aboukir, where on the 1st of August 1798 Nelson fought the battle of the Nile, often referred to as the battle of Aboukir. The latter title is applied more properly to an engagement between the French expeditionary army and the Turks fought on the 25th of July 1799. Near Aboukir, on the 8th of March 1801, the British army commanded by Sir R. Abercromby landed from its transports in the face of a strenuous opposition from a French force entrenched on the beach. (See French Revolutionary Wars.)

ABOUT, EDMOND FRANÇOIS VALENTIN (1828–1885), French novelist, publicist and journalist, was born on the 14th of February 1828, at Dieuze, in Lorraine. The boy's school career was brilliant. In 1848 he entered the École Normale, taking the second place in the annual competition for admission, Taine being first. Among his college contemporaries were Taine, Francisque, Sarcey, Challemel-Lacour and the ill-starred Prévost-Paradol. Of them all About was, according to Sarcey, the most highly vitalized, exuberant, brilliant and "undisciplined." At the end of his college career he joined the French school in Athens, but if we may believe his own account, it had never been his intention to follow the professorial career, for which the École Normale was a preparation, and in 1853 he returned to France and frankly gave himself to literature and journalism. A book on Greece, *La Grèce contemporaine* (1855), which did not spare Greek susceptibilities, had an immediate success. In *Tolla* (1855) About was charged with drawing too freely on an earlier Italian novel, *Vittoria Savelli* (Paris, 1841). This caused a strong prejudice against him, and he was the object of numerous attacks, to which he was ready enough to retaliate. The *Lettres d'un bon jeune homme*, written to the *Figaro* under the signature of Valentin de Quévilly, provoked more animosities. During the next few years, with indefatigable energy, and generally with full public recognition, he wrote novels, stories, a play—which failed,—a book-pamphlet on the Roman question, many pamphlets on other subjects of the day, newspaper articles innumerable, some art criticisms, rejoinders to the attacks of his enemies, and popular manuals of political economy, *L'A B C du travailleur* (1868), *Le progrès* (1864). About's attitude towards the empire was that of a candid friend. He believed in its improvability, greeted the liberal ministry of Émile Ollivier at the beginning of 1870 with delight and welcomed the Franco-German War. That day of enthusiasm had a terrible morrow. For his own personal part he lost the loved home near Saverne in Alsace, which he had purchased in 1858 out of the fruits of his earlier literary successes. With the fall of the empire he became a republican, and, always an inveterate anti-clerical, he threw himself with ardour into the battle against the conservative reaction which made head during the first years of the republic. From 1872 onwards for some five or six years his paper, the *XIX*^{e} *Siècle*, of which he was the heart and soul, became a power in the land. But the republicans never quite forgave the tardiness of his conversion, and no place rewarded his later zeal. On the 23rd January 1884 he was elected a member of the French Academy, but died on the 16th of January 1885, before taking his seat. His journalism—of which specimens in his earlier and later manners will be found in the two series of *Lettres d'un bon jeune homme à sa cousine Madeleine* (1861 and 1863), and the posthumous collection, *Le dix-neuvième siècle* (1892)—was of its nature ephemeral. So were the pamphlets, great and small. His political economy was that of an orthodox popularizer, and in no sense epoch-making. His dramas are negligible. His more serious novels, *Madelon* (1863), *L'infâme* (1867), the three that form the trilogy of the *Vieille Roche* (1866), and *Le roman d'un brave homme* (1880)—a kind of counterblast to the view of the French workman presented in Zola's *Assommoir*—contain striking and amusing scenes, no doubt, but scenes which are often suggestive of the stage, while description, dissertation, explanation too frequently take the place of life. His best work after all is to be found in the books that are almost wholly farcical, *Le nez d'un notaire* (1862); *Le roi des montagnes* (1856); *L'homme à l'oreille cassée* (1862); *Trente et quarante* (1858); *Le cas de M. Guérin* (1862). Here his most genuine wit, his sprightliness, his vivacity, the fancy that was in him, have free play. "You will never be more than a little Voltaire," said one of his masters when he was a lad at school. It was a true prophecy. (F. T. M.)

ABRABANEL, ISAAC, called also Abravanel, Abarbanel (1437–1508), Jewish statesman, philosopher, theologian and commentator, was born at Lisbon of an ancient family which claimed descent from the royal house of David. Like many of the Spanish Jews he united scholarly tastes with political ability. He held a high place in the favour of King Alphonso V., who entrusted him with the management of important state affairs. On the death of Alphonso in 1481, his counsellors and favourites were harshly treated by his successor John, and Abrabanel was compelled to flee to Spain, where he held for eight years (1484–1492) the post of a minister of state under Ferdinand and Isabella. When the Jews were banished from Spain in 1492, no exception was made in Abrabanel's favour. He afterwards resided at Naples, Corfu and Monopoli, and in 1503 removed to Venice, where he held office as a minister of state till his death in 1508. His repute as a commentator on the Scriptures is still high; in the 17th and 18th centuries he was much read by Christians such as Buxtorf. Abrabanel often quotes Christian authorities, though he opposed Christian exegesis of Messianic passages. He was one of the first to see that for Biblical exegesis it was necessary to reconstruct the social environment of olden times, and he skilfully applied his practical knowledge of statecraft to the elucidation of the books of Samuel and Kings.

ABRACADABRA, a word analogous to Abraxas (*q.v.*), used as a magical formula by the Gnostics of the sect of Basilides in invoking the aid of beneficent spirits against disease and misfortune. It is found on Abraxas stones which were worn as amulets. Subsequently its use spread beyond the Gnostics, and in modern times it is applied contemptuously (*e.g.* by the early opponents of the evolution theory) to a conception or hypothesis which purports to be a simple solution of apparently insoluble phenomena. The Gnostic physician Serenus Sammonicus gave precise instructions as to its mystical use in averting or curing agues and fevers generally. The paper on which the word was written had to be folded in the form of a cross, suspended from the neck by a strip of linen so as to rest on the pit of the stomach, worn in this way for nine days, and then, before sunrise, cast behind the wearer into a stream running to the east. The letters were usually arranged as a triangle in one of the following ways:—

ABRACADABRA
ABRACADABR
ABRACADAB
ABRACADA
ABRACAD
ABRACA
ABRAC
ABRA
ABR
AB
A

ABRACADABRA
BRACADABR
RACADAB
ACADA
CAD
A

ABRAHAM, or Abram (Hebrew for "father is high"), the ancestor of the Israelites, the first of the great Biblical patriarchs. His life as narrated in the book of Genesis reflects the traditions of different ages. It is the latest writer (P) who mentions Abram (the original form of the name), Nahor and Ḥaran, sons of Terah, at the close of a genealogy of the sons of Shem, which includes among its members Eber the eponym of the Hebrews. Terah is said to have come from Ur of the Chaldees, usually identified with Mukayyar in south Babylonia. He migrated to Haran[1] in Mesopotamia, apparently the classical Carrhae, on a branch of the Ḥabor. Thence, after a short stay, Abram with his wife Sarai, and Lot the son of Ḥaran, and all their followers, departed for Canaan. The oldest tradition does not know of this twofold move, and seems to locate Abram's birthplace and the homes of his kindred at Ḥaran (Gen. xxiv. 4, 7, xxvii. 43). At the divine command, and encouraged by the promise that Yahweh would make of him, although hitherto childless, a great nation, he journeyed down to Shechem, and at the sacred tree (cf. xxxv. 4, Josh. xxiv. 26, Judg. ix. 6) received a new promise that the land would be given unto his seed. Having built an altar to commemorate the theophany, he removed to a spot between Bethel and Ai, where he built another altar and called upon (*i.e.* invoked) the name of Yahweh (Gen. xii. 1-9). Here he dwelt for some time, until strife arose between his herdsmen and those of Lot. Abram thereupon proposed to Lot that they should separate, and allowed his nephew the first choice. Lot preferred the fertile land lying east of the Jordan, whilst Abram, after receiving another promise from Yahweh, moved down to the oaks of Mamre in Hebron and built an altar. In the subsequent history of Lot and the destruction of Sodom and Gomorrah, Abram appears prominently in a fine passage where he intercedes with Yahweh on behalf of Sodom, and is promised that if ten righteous men can be found therein the city shall be preserved (xviii. 16-33).

A peculiar passage, more valuable for the light it throws upon primitive ideas than for its contribution to the history of Abram, narrates the patriarch's visit to Egypt. Driven by a famine to take refuge in Egypt (cf. xxvi. 1, xli. 57, xlii. 1), he feared lest his wife's beauty should arouse the evil designs of the Egyptians and thus endanger his own safety, and alleged that Sarai was his sister. This did not save her from the Pharaoh, who took her into the royal harem and enriched Abram with herds and servants. But when Yahweh "plagued Pharaoh and his house with great plagues" suspicion was aroused, and the Pharaoh rebuked the patriarch for his deceit and sent him away under an escort (xii. 10–xiii. 1). This story of Abram and his increased wealth (xiii. 2) receives no comment at the hands of the narrator, and in its present position would make Sarai over sixty years of age (xii. 4, xvii. 1, 17). A similar experience is said to have happened to Abraham and Sarah at Gerar with the Philistine king Abimelech (xx. E), but the tone of the narrative is noticeably more advanced, and the presents which the patriarch receives are compensation for the king's offence. Here, however, Sarah has reached her ninetieth year (xvii. 17). (The dates are due to the post-exilic framework in which the stories are inserted.) Still another episode of the same nature is recorded of Isaac and Rebekah at Gerar, also with Abimelech. Ethically it is the loftiest, and Isaac obtains his wealth simply through his successful farming. Arising out of the incident is an account of a covenant between Abimelech and Isaac (xxvi. 16-33, J), a duplicate of which is placed in the time of Abraham (xxi. 22-34, J and E). Beersheba, which figures in both, is celebrated by the planting of a sacred tree and (like Bethel) by the invocation of the name of Yahweh. This district is the scene of the birth of Ishmael and Isaac. As Sarai was barren (cf. xi. 30)[2] the promise that his seed should possess the land seemed incapable of fulfilment. According to one rather obscure narrative, Abram's sole heir was the servant, who was over his household, apparently a certain Eliezer of Damascus[3] (xv. 2, the text is corrupt). He is now promised as heir one of his own flesh, and a remarkable and solemn passage records how the promise was ratified by a covenant. The description is particularly noteworthy for the sudden appearance of birds of prey, which attempted to carry off the victims of the sacrificial covenant. The interpretation of the evil omen is explained by an allusion to the bondage of the Israelites in Egypt and their return in the fourth generation (xv. 16; contrast *v.* 13, after four hundred years; the chapter is extremely intricate and has the appearance of being of secondary origin). The main narrative now relates how Sarai, in accordance with custom, gave to Abram her Egyptian handmaid Hagar, who, when she found she was with child, presumed upon her position to the extent that Sarai, unable to endure the reproach of barrenness (cf. the story of Hannah, 1 Sam. i. 6), dealt harshly with her and forced her to flee (xvi. 1-14, J; on the details see ISHMAEL). Another tradition places the expulsion of Hagar after the birth of Isaac. It was thirteen years after the birth of Ishmael, according to the latest narratives, that God appeared unto Abram with a renewed promise that his posterity should inhabit the land. To mark the solemnity of the occasion, the patriarch's name was changed to Abraham, and that of his wife to Sarah.[4] A covenant was concluded with him for all time, and as a sign thereof the rite of circumcision was instituted (xvii. P). The promise of a son to Sarah made Abraham "laugh", a punning allusion to the name Isaac (*q.v.*) which appears again in other forms. Thus, it is Sarah herself who "laughs" at the idea, when Yahweh appears to Abraham at Mamre (xviii. 1-15, J), or who, when the child is born cries "God hath made me laugh; every one that heareth will laugh at me" (xxi. 6, E). Finally, there is yet another story which attributes the flight of Hagar and Ishmael to Sarah's jealousy at the sight of Ishmael's "mocking" (rather dancing or playing, the intensive form of the verb "to laugh") on the feast day when Isaac was weaned (xxi. 8 sqq.). But this last story is clearly out of place, since a child who was then fourteen years old (cf. xvii. 24, xxi. 5) could scarcely be described as a weak babe who had to be carried (xxi. 14; see the commentaries).

Abraham was now commanded by God to offer up Isaac in the land of Moriah. Proceeding to obey, he was prevented by an angel as he was about to sacrifice his son, and slew a ram which he found on the spot. As a reward for his obedience he received another promise of a numerous seed and abundant prosperity (xxii. E). Thence he returned to Beersheba. The story is one of the few told by E, and significantly teaches that human sacrifice was not required by the Almighty (cf. Mic. vi. 7 seq.). The interest of the narrative now extends to Isaac alone. To his "only son" (cp. xxii. 2, 12) Abraham gave all he had, and dismissed the sons of his concubines to the lands outside Palestine; they were thus regarded as less intimately related to Isaac and his descendants (xxv. 1-4, 6). The measures taken by the patriarch for the marriage of Isaac are circumstantially described. His head-servant was sent to his master's country and kindred to find a suitable bride, and the necessary preparation for the story is contained in the description of Nahor's family (xxii. 20-24). The picturesque account of the meeting with Rebekah throws interesting light on oriental custom. Marriage with one's own folk (cf. Gen. xxvii. 46, xxix. 19; Judg. xiv. 3), and especially with a cousin, is recommended now even as in the past. For its charm the story is comparable with the account of Jacob's experiences in the same land (xxix.). For the completion of the history of Abraham the compiler of Genesis has used P's narrative. Sarah is said to have died at a good old age, and was buried in the cave of Machpelah near Hebron, which the patriarch had purchased, with the adjoining field, from Ephron the Hittite (xxiii.); and here he himself was buried. Centuries later the tomb became a place of pilgrimage and the traditional site is marked by a fine mosque.[5]

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[1] The name is not spelt with the same guttural as Ḥaran the son of Terah.

[2] Barrenness is a *motif* which recurs in the stories of Rebekah, Rachel, the mother of Samson, and Hannah (Gen. xxv. 21, xxix. 31; Judg. xiii. 2; 1 Sam. i. 5).

[3] Abram's connexion with Damascus is supplemented in the traditions of Nicolaus of Damascus as cited by Josephus (*Antiq.* i. 7. 2).

[4] Abram (or Abiram) is a familiar and old-attested name meaning "(my) father is exalted"; the meaning of Abraham is obscure and the explanation Gen. xvii. 5 is mere word-play. It is possible that *rāhām* was originally only a dialectical form of *rām*.

[5] See Sir Charles Warren's description, Hasting's *Dict. Bible*, vol. iii. pp. 200 seq. The so-called Babylonian colouring of Gen.

The story of Abraham is of greater value for the study of Old Testament theology than for the history of Israel. He became to the Hebrews the embodiment of their ideals, and stood at their head as the founder of the nation, the one to whom Yahweh had manifested his love by frequent promises and covenants. From the time when he was bidden to leave his country to enter the unknown land, Yahweh was ever present to encourage him to trust in the future when his posterity should possess the land, and so, in its bitterest hours, Israel could turn for consolation to the promises of the past which enshrined in Abraham its hopes for the future. Not only is Abraham the founder of religion, but he, of all the patriarchal figures, stands out most prominently as the recipient of the promises (xii. 2 seq. 7, xiii. 14-17, xv., xvii., xviii. 17-19, xxii. 17 seq.; cf. xxiv. 7), and these the apostle Paul associates with the coming of Christ, and, adopting a characteristic and artificial style of interpretation prevalent in his time, endeavours to force a Messianic interpretation out of them.[1]

For the history of the Hebrews the life of Abraham is of the same value as other stories of traditional ancestors. The narratives, viewed dispassionately, represent him as an idealized sheikh (with one important exception, Gen. xiv., see below), about whose person a number of stories have gathered. As the father of Isaac and Ishmael, he is ultimately the common ancestor of the Israelites and their nomadic fierce neighbours, men roving unrestrainedly like the wild ass, troubled by and troubling every one (xvi. 12). As the father of Midian, Sheba and other Arabian tribes (xxv. 1-4), it is evident that some degree of kinship was felt by the Hebrews with the dwellers of the more distant south, and it is characteristic of the genealogies that the mothers (Sarah, Hagar and Keturah) are in the descending scale as regards purity of blood. This great ancestral figure came, it was said, from Ur in Babylonia and Ḥaran and thence to Canaan. Late tradition supposed that the migration was to escape Babylonian idolatry (Judith v., Jubilees xii.; cf. Josh. xxiv. 2), and knew of Abraham's miraculous escape from death (an obscure reference to some act of deliverance in Is. xxix. 22). The route along the banks of the Euphrates from south to north was so frequently taken by migrating tribes that the tradition has nothing improbable in itself, but the prominence given in the older narratives to the view that Ḥaran was the home gives this the preference. It was thence that Jacob, the father of the tribes of Israel, came and the route to Shechem and Bethel is precisely the same in both. A twofold migration is doubtful, and, from what is known of the situation in Palestine in the 15th century B.C., is extremely improbable. Further, there is yet another parallel in the story of the conquest by Joshua (*q.v.*), partly implied and partly actually detailed (cf. also Josh. viii. 9 with Gen. xii. 8, xiii. 3), whence it would appear that too much importance must not be laid upon any ethnological interpretation which fails to account for the three versions. That similar traditional elements have influenced them is not unlikely; but to recover the true historical foundation is difficult. The invasion or immigration of certain tribes from the east of the Jordan; the presence of Aramaean blood among the Israelites (see JACOB); the origin of the sanctity of venerable sites,—these and other consideratons may readily be found to account for the traditions. Noteworthy coincidences in the lives of Abraham and Isaac, noticed above, point to the fluctuating state of traditions in the oral stage, or suggest that Abraham's life has been built up by borrowing from the common stock of popular lore.[2] More original is the parting of Lot and Abraham at Bethel. The district was the scene of contests between Moab and the Hebrews (cf. perhaps Judg. iii.), and if this explains part of the story, the physical configuration of the Dead Sea may have led to the legend of the destruction of inhospitable and vicious cities (see SODOM AND GOMORRAH).

Different writers have regarded the life of Abraham differently. He has been viewed as a chieftain of the Amorites (*q.v.*), as the head of a great Semitic migration from Mesopotamia; or, since Ur and Ḥaran were seats of Moon-worship, he has been identified with a moon-god. From the character of the literary evidence and the *locale* of the stories it has been held that Abraham was originally associated with Hebron. The double name Abram-Abraham has even suggested that two personages have been combined in the Biblical narrative; although this does not explain the change from Sarai to Sarah.[3] But it is important to remember that the narratives are not contemporary, and that the interesting discovery of the name Abi-ramu (Abram) on Babylonian contracts of about 2000 B.C. does not prove the Abram of the Old Testament to be an historical person, even as the fact that there were "Amorites" in Babylonia at the same period does not make it certain that the patriarch was one of their number. One remarkable chapter associates Abraham with kings of Elam and the east (Gen. xiv.). No longer a peaceful sheikh but a warrior with a small army of 318 followers,[4] he overthrows a combination of powerful monarchs who have ravaged the land. The genuineness of the narrative has been strenuously maintained, although upon insufficient grounds.

> "It is generally recognized that this chapter holds quite an isolated place in the Pentateuchal history; it is the only passage which presents Abraham in the character of a warrior, and connects him with historical names and political movements, and there are no clear marks by which it can be assigned to any one of the documents of which Genesis is made up. Thus, while one school of interpreters finds in the chapter the earliest fragment of the political history of western Asia, some even holding with Ewald that the narrative is probably based on old Canaanite records, other critics, as Nöldeke, regard the whole as unhistorical and comparatively late in origin. On the latter view, which finds its main support in the intrinsic difficulties of the narrative, it is scarcely possible to avoid the conclusion that the chapter is one of the latest additions to the Pentateuch (Wellhausen and many others)."[5]

On the assumption that a recollection of some invasion in remote days may have been current, considerable interest is attached to the names. Of these, Amraphel, king of Shinar (*i.e.* Babylonia, Gen. x. 10), has been identified with Khammurabi, one of the greatest of the Babylonian kings (*c.* 2000 B.C.), and since he claims to have ruled as far west as the Mediterranean Sea, the equation has found considerable favour. Apart from chronological difficulties, the identification of the king and his country is far from certain, and at the most can only be regarded as possible. Arioch, king of Ellasar, has been connected with Eriaku of Larsa—the reading has been questioned—a contemporary with Khammurabi. Chedorlaomer, king of Elam, bears what is doubtless a genuine Elamite name. Finally, the name of Tid'al, king of Goiim, may be identical with a certain Tudḫulu the son of Gazza, a warrior, but apparently not a king, who is mentioned in a Babylonian inscription, and Goiim may stand for Gutim, the Guti being a people who lived to the east of Kurdistan. Nevertheless, there is as yet no monumental evidence in favour of the genuineness of the story, and at the most it can only be said that the author (of whatever date) has derived his names from a trustworthy source, and in representing an invasion of Palestine by Babylonian overlords has given expression to a possible situation.[6] The improbabilities and internal difficulties of the narrative remain

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xxiii. has been much exaggerated; see S. R. Driver, *Genesis*, ad loc.; S. A. Cook, *Laws of Moses*, p. 208.

[1] See H. St. J. Thackeray, *Relation of St Paul to Contemporary Jewish Thought*, p. 69 seq. (1900).

[2] On the other hand, the coincidences in xx. xxi. are due to E, who is also the author of xxii. Apart from these the narratives of Abraham are from J and P.

[3] According to Breasted (*Amer. Journ. of Sem. Lit.*, 1904, p. 36), the "field of Abram" occurs among the places mentioned in the list of the Egyptian king Shishak (No. 71-2) in the 10th century. See also his *History of Egypt*, p. 530.

[4] The number is precisely that of the total numerical value of the consonants of the name "Eliezer" (Gen. xv. 2); an astral signification has also been found.

[5] W. R. Smith, *Ency. Brit.* (9th ed., 1883), art. "Melchizedek."

[6] That the names may be those of historical personages is no proof of historical accuracy: "We cannot therefore conclude that the whole account is accurate history, any more than we can argue that Sir Walter Scott's *Anne of Geierstein* is throughout a correct account of actual events because we know that Charles the Bold and Margaret of Anjou were real people" (W. H. Bennett, *Century Bible: Genesis*, p. 186).

untouched, only the bare outlines may very well be historical. If, as most critics agree, it is a historical romance (cf., *e.g.*, the book of Judith), it is possible that a writer, preferably one who lived in the post-exilic age and was acquainted with Babylonian history, desired to enhance the greatness of Abraham by exhibiting his military success against the monarchs of the Tigris and Euphrates, the high esteem he enjoyed in Palestine and his lofty character as displayed in his interview with Melchizedek.

See further, Pinches, *Old Test. in Light of Hist. Records*, pp. 208-236; Driver, *Genesis*, p. xlix., and notes on ch. xiv.; Addis, *Documents of the Hexateuch*, ii. pp. 208-213; Carpenter and Harford-Battersby, *The Hexateuch*, i. pp. 157-159, 168; Bezold, *Bab.-Assyr. Keilinschriften*, pp. 24 sqq., 54 sqq.; A. Jeremias, *Altes Test. im Lichte d. Alten Orients*(2), pp. 343 seq.; also the literature to the art. GENESIS. Many fanciful legends about Abraham founded on Biblical accounts or spun out of the fancy are to be found in Josephus, and in post-Biblical and Mahommedan literature; for these, reference may be made to Beer, *Leben Abrahams* (1859); Grünbaum, *Neue Beiträge z. semit. Sagenkunde*, pp. 89 seq. (1893); the apocryphal "Testament of Abraham" (M. R. James in *Texts and Studies*, 1892); W. Tisdall, *Original Sources of the Quran*, *passim* (1905). (S. A. C.)

ABRAHAM A SANCTA CLARA (1644–1709), Austrian divine, was born at Kreenheinstetten, near Messkirch, in July 1644. His real name was Ulrich Megerle. In 1662 he joined the order of Barefooted Augustinians, and assumed the name by which he is known. In this order he rose step by step until he became *prior provincialis* and *definitor* of his province. Having early gained a great reputation for pulpit eloquence, he was appointed court preacher at Vienna in 1669. The people flocked to hear him, attracted by the force and homeliness of his language, the grotesqueness of his humour, and the impartial severity with which he lashed the follies of all classes of society and of the court in particular. In general he spoke as a man of the people, the predominating quality of his style being an overflowing and often coarse wit. There are, however, many passages in his sermons in which he rises to loftier thought and uses more dignified language. He died at Vienna on the 1st of December 1709. In his published writings he displayed much the same qualities as in the pulpit. Perhaps the most favourable specimen of his style is his didactic novel entitled *Judas der Erzschelm* (4 vols., Salzburg, 1686–1695).

His works have been several times reproduced in whole or in part, though with many spurious interpolations. The best edition is that published in 21 vols. at Passau and Lindau (1835–1854). See Th. G. von Karajan, *Abraham a Sancta Clara* (Vienna, 1867); Blanckenburg, *Studien über die Sprache Abrahams a S. C.* (Halle, 1897); Sexto, *Abraham a S. C.* (Sigmaringen, 1896); Schnell, *Pater A. a S. C.* (Munich, 1895); H. Mareta, *Über Judas d. Erzschelm* (Vienna, 1875).

ABRAHAM IBN DAUD (*c.* 1110–1180), Jewish historiographer and philosopher of Toledo. His historical work was the *Book of Tradition* (*Sepher Haqabala*), a chronicle down to the year 1161. This was a defence of the traditional record, and also contains valuable information for the medieval period. It was translated into Latin by Génébrad (1519). His philosophy was expounded in an Arabic work better known under its Hebrew title '*Emunah Ramah* (*Sublime Faith*). This was translated into German by Weil (1882). Ibn Daud was one of the first Jewish scholastics to adopt the Aristotelian system; his predecessors were mostly neo-Platonists. Maimonides owed a good deal to him.

ABRAHAMITES, a sect of deists in Bohemia in the 18th century, who professed to be followers of the pre-circumcised Abraham. Believing in one God, they contented themselves with the Decalogue and the Paternoster. Declining to be classed either as Christians or Jews, they were excluded from the edict of toleration promulgated by the emperor Joseph II. in 1781, and deported to various parts of the country, the men being drafted into frontier regiments. Some became Roman Catholics, and those who retained their "Abrahamite" views were not able to hand them on to the next generation.

ABRAHAM-MEN, the nickname for vagrants who infested England in Tudor times. The phrase is certainly as old as 1561, and was due to these beggars pretending that they were patients discharged from the Abraham ward at Bedlam. The genuine Bedlamite was allowed to roam the country on his discharge, soliciting alms, provided he wore a badge. This humane privilege was grossly abused, and thus gave rise to the slang phrase "to sham Abraham."

ABRANTES, a town of central Portugal, in the district of Santarem, formerly included in the province of Estremadura; on the right bank of the river Tagus, at the junction of the Madrid–Badajoz–Lisbon railway with the Guarda–Abrantes line. Pop. (1900) 7255. Abrantes, which occupies the crest of a hill covered with olive woods, gardens and vines, is a fortified town, with a thriving trade in fruit, olive oil and grain. As it commands the highway down the Tagus valley to Lisbon, it has usually been regarded as an important military position. Originally an Iberian settlement, founded about 300 B.C., it received the name Aurantes from the Romans; perhaps owing to the alluvial gold (*aurum*) found along the Tagus. Roman mosaics, coins, the remains of an aqueduct, and other antiquities have been discovered in the neighbourhood. Abrantes was captured on the 24th of November 1807 by the French under General Junot, who for this achievement was created duke of Abrantes. By the Convention of Cintra (22nd of August 1808) the town was restored to the British and Portuguese.

ABRASION (from Lat. *ab*, off, and *radere*, to scrape), the process of rubbing off or wearing down, as of rock by moving ice, or of coins by wear and tear; also used of the results of such a process as an abrasion or excoriation of the skin. In machinery, abrasion between moving surfaces has to be prevented as much as possible by the use of suitable materials, good fitting and lubrication. Engineers and other craftsmen make extensive use of abrasion, effected by the aid of such abrasives as emery and carborundum, in shaping, finishing and polishing their work.

ABRAUM SALTS (from the German *Abraum-salze*, salts to be removed), the name given to a mixed deposit of salts, including halite, carnallite, kieserite, &c., found in association with rock-salt at Stassfurt in Prussia.

ABRAXAS, or ABRASAX, a word engraved on certain antique stones, called on that account *Abraxas stones*, which were used as amulets or charms. The Basilidians, a Gnostic sect, attached importance to the word, if, indeed, they did not bring it into use. The letters of ἀβραξάς, in the Greek notation, make up the number 365, and the Basilidians gave the name to the 365 orders of spirits which, as they conceived, emanated in succession from the Supreme Being. These orders were supposed to occupy 365 heavens, each fashioned like, but inferior to that above it; and the lowest of the heavens was thought to be the abode of the spirits who formed the earth and its inhabitants, and to whom was committed the administration of its affairs. Abraxas stones are of very little value. In addition to the word Abraxas and other mystical characters, they have often cabalistic figures engraved on them. The commonest of these have the head of a fowl, and the arms and bust of a man, and terminate in the body and tail of a serpent.

ABROGATION (Lat. *abrogare*, to repeal or annul a law; *rogare*, literally "to ask," to propose a law), the annulling or repealing of a law by legislative action. Abrogation, which is the total annulling of a law, is to be distinguished from the term *derogation*, which is used where a law is only partially abrogated. Abrogation may be either express or implied. It is express either when the new law pronounces the annulment in general terms, as when in a concluding section it announces that all laws contrary to the provisions of the new one are repealed, or when in particular terms it announces specifically the preceding laws which it repeals. It is implied when the new law contains provisions which are positively contrary to the former laws without expressly abrogating those laws, or when the condition of things for which the law had provided has changed and consequently the need for the law no longer exists. The abrogation of any statute revives the provisions of the common law which had been abrogated by that statute. See STATUTE; REPEAL.

ABRUZZI E MOLISE, a group of provinces (*compartimento*) of Southern Italy, bounded N. by the province of Ascoli, N.W. and

W. by Perugia, S.W. by Rome and Caserta, S. by Benevento, E. by Foggia and N.E. by the Adriatic Sea. It comprises the provinces of Teramo (population in 1901, 307,444), Aquila (396,629), Chieti (370,907) and Campobasso (366,571), which, under the kingdom of Naples, respectively bore the names Abruzzo Ulteriore I., Abruzzo Ulteriore II., Abruzzo Citeriore (the reference being to their distance from the capital) and Molise. The total area is 6567 sq. m. and the population (1901) 1,441,551. The district is mainly mountainous in the interior, including as it does the central portion of the whole system of the Apennines and their culminating point, the *Gran Sasso d'Italia*. Towards the sea the elevation is less considerable, the hills consisting mainly of somewhat unstable clay and sand, but the zone of level ground along the coast is quite inconsiderable. The coast line itself, though over 100 miles in length, has not a single harbour of importance. The climate varies considerably with the altitude, the highest peaks being covered with snow for the greater part of the year, while the valleys running N.E. towards the sea are fertile and well watered by several small rivers, the chief of which are the Tronto, Vomano, Pescara, Sangro, Trigno and Biferno. These are fed by less important streams, such as the Aterno and Gizio, which water the valleys between the main chains of the Apennines. They are liable to be suddenly swollen by rains, and floods and landslips often cause considerable damage. This danger has been increased, as elsewhere in Italy, by indiscriminate timber-felling on the higher mountains without provision for re-afforestation, though considerable oak, beech, elm and pine forests still exist and are the home of wolves, wild boars and even bears. They also afford feeding-ground for large herds of swine, and the hams and sausages of the Abruzzi enjoy a high reputation. The rearing of cattle and sheep was at one time the chief occupation of the inhabitants, and many of them still drive their flocks down to the Campagna di Roma for the winter months and back again in the summer, but more attention is now devoted to cultivation. This flourishes especially in the valleys and in the now drained bed of the Lago Fucino. The industries are various, but none of them is of great importance. Arms and cutlery are produced at Campobasso and Agnone. At the exhibition of Abruzzese art, held at Chieti in 1905, fine specimens of goldsmiths' work of the 15th and 16th centuries, of majolica of the 17th and 18th centuries, and of tapestries and laces were brought together; and the reproduction of some of these is still carried on, the small town of Castelli being the centre of the manufacture. The river Pescara and its tributary the Tirino form an important source of power for generating electricity. The chief towns are (1) Teramo, Atri, Campli, Penne, Castellammare Adriatico; (2) Aquila, Avezzano, Celano, Tagliacozzo, Sulmona; (3) Chieti, Lanciano, Ortona, Vasto; (4) Campobasso, Agnone, Isernia. Owing to the nature of the country, communications are not easy. Railways are (1) the coast railway (a part of the Bologna–Gallipoli line), with branches from Giulianova to Teramo and from Termoli to Campobasso; (2) a line diverging S.E. from this at Pescara and running *via* Sulmona (whence there are branches *via* Aquila and Rieti to Terni, and *via* Carpinone to (*a*) Isernia and Caianello, on the line from Rome to Naples, and (*b*) Campobasso and Benevento), and Avezzano (whence there is a branch to Roccasecca) to Rome.

The name Abruzzi is conjectured to be a medieval corruption of Praetuttii. The district was, in Lombard times, part of the duchy of Spoleto, and, under the Normans, a part of that of Apulia; it was first formed into a single province in 1240 by Frederick II., who placed the *Justiciarius Aprutii* at Solmona and founded the city of Aquila. After the Hohenstauffen lost their Italian dominions, the Abruzzi became a province of the Angevin kingdom of Naples, to which it was of great strategic importance. The division into three parts was not made until the 17th century. The Molise, on the other hand, formed part of the Lombard duchy of Benevento, and was placed under the *Justiciarius* of Terra di Lavoro by Frederick II.: after various changes it became part of the Capitanata, and was only formed into an independent province in 1811. The people are remarkably conservative in beliefs, superstitions and traditions.

See V. Bindi, *Monumenti storici ed artistici degli Abruzzi* (Naples, 1889); A. de Nino, *Usi e costumi Abruzzesi* (Florence, 1879–1883).

ABSALOM (Hebrew for "father of [*or* is] peace"), in the Bible, the third son of David, king of Israel. He was deemed the handsomest man in the kingdom. His sister Tamar having been violated by David's eldest son Amnon, Absalom, after waiting two years, caused his servants to murder Amnon at a feast to which he had invited all the king's sons (2 Sam. xiii.). After this deed he fled to Talmai, "king" of Geshur (see Josh. xii. 5 or xiii. 2), his maternal grandfather, and it was not until five years later that he was fully reinstated in his father's favour (see JOAB). Four years after this he raised a revolt at Hebron, the former capital. Absalom was now the eldest surviving son of David, and the present position of the narratives (xv.-xx.)—after the birth of Solomon and before the struggle between Solomon and Adonijah—may represent the view that the suspicion that he was not the destined heir of his father's throne excited the impulsive youth to rebellion. All Israel and Judah flocked to his side, and David, attended only by the Cherethites and Pelethites and some recent recruits from Gath, found it expedient to flee. The priests remained behind in Jerusalem, and their sons Jonathan and Ahimaaz served as his spies. Absalom reached the capital and took counsel with the renowned Ahithophel. The pursuit was continued and David took refuge beyond the Jordan. A battle was fought in the "wood of Ephraim" (the name suggests a locality *west* of the Jordan) and Absalom's army was completely routed. He himself was caught in the boughs of an oak-tree, and as David had strictly charged his men to deal gently with the young man, Joab was informed. What a common soldier refused to do even for a thousand shekels of silver, the king's general at once undertook. Joab thrust three spears through the heart of Absalom as he struggled in the branches, and as though this were not enough, his ten armour-bearers came around and slew him. The king's overwhelming grief is well known. A great heap of stones was erected where he fell, whilst another monument near Jerusalem (not the modern "Absalom's Tomb," which is of later origin) he himself had erected in his lifetime to perpetuate his name (2 Sam. xviii. 17 seq.). But the latter notice does not seem to agree with xiv. 27 (cf. 1 Kings xv. 2). On the narratives in 2 Sam. xiii.-xix., see further DAVID; SAMUEL, BOOKS OF.

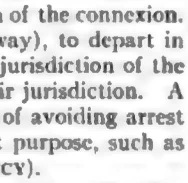
ABSALON (*c.* 1128–1201), Danish archbishop and statesman, was born about 1128, the son of Asser Rig of Fjenneslev, at whose castle he and his brother Esbjörn were brought up along with the young prince Valdemar, afterwards Valdemar I. The Rigs were as pious and enlightened as they were rich. They founded the monastery of Sorö as a civilizing centre, and after giving Absalon the rudiments of a sound education at home, which included not only book-lore but every manly and martial exercise, they sent him to the university of Paris. Absalon first appears in Saxo's Chronicle as a fellow-guest at Roskilde, at the banquet given, in 1157, by King Sweyn to his rivals Canute and Valdemar. Both Absalon and Valdemar narrowly escaped assassination at the hands of their treacherous host on this occasion, but at length escaped to Jutland, whither Sweyn followed them, but was defeated and slain at the battle of Grathe Heath. The same year (1158) which saw Valdemar ascend the Danish throne saw Absalon elected bishop of Roskilde. Henceforth Absalon was the chief counsellor of Valdemar, and the promoter of that imperial policy which, for three generations, was to give Denmark the dominion of the Baltic. Briefly, it was Absalon's intention to clear the northern sea of the Wendish pirates, who inhabited that portion of the Baltic littoral which we now call Pomerania, and ravaged the Danish coasts so unmercifully that at the accession of Valdemar one-third of the realm of Denmark lay wasted and depopulated. The very existence of Denmark demanded the suppression and conversion of these stiff-necked pagan freebooters, and to this double task Absalon devoted the best part of his life. The first expedition against the Wends, conducted by Absalon in person, set out in 1160, but it was not till 1168 that the chief Wendish fortress, at Arkona in Rügen, containing the sanctuary of their god Svantevit, was surrendered, the Wends agreeing to accept Danish suzerainty and the Christian religion at the same time. From Arkona Absalon proceeded by sea to Garz, in south Rügen, the political capital of the Wends, and an all but impregnable stronghold. But the unexpected fall of Arkona had terrified the garrison, which surrendered unconditionally at the first appearance of the Danish ships. Absalon, with only Sweyn, bishop of Aarhus, and twelve "house-carls," thereupon disembarked, passed between a double row of Wendish warriors, 6000 strong, along the narrow path winding among the morasses, to the gates of the fortress, and, proceeding to the temple of the seven-headed god Rügievit, caused the idol to be hewn down, dragged forth and burnt. The whole population of Garz was then baptized, and Absalon laid the foundations of twelve churches in the isle of Rügen. The destruction of this chief sally-port of the Wendish pirates enabled Absalon considerably to reduce the Danish fleet. But he continued to keep a watchful eye over the Baltic, and in 1170 destroyed another pirate stronghold, farther eastward, at Dievenow on the isle of Wollin. Absalon's last military exploit was the annihilation, off Strela (Stralsund), on Whit-Sunday 1184, of a Pomeranian fleet which had attacked Denmark's vassal, Jaromir of Rügen. He was now but fifty-seven, but his strenuous life had aged him, and he was content to resign the command of fleets and armies to younger men, like Duke Valdemar, afterwards Valdemar II., and to confine himself to the administration of the empire which his genius had created. In this sphere Absalon proved himself equally great. The aim of his policy was to free Denmark from the German yoke. It was contrary to his advice and warnings that Valdemar I. rendered fealty to the emperor Frederick Barbarossa at Dôle in 1162; and when, on the accession of Canute V. in 1182, an imperial ambassador arrived at Roskilde to receive the homage of the new king, Absalon resolutely withstood him. "Return to the emperor," cried he, "and tell him that the king of Denmark will in no wise show him obedience or do him homage." As the archpastor of Denmark Absalon also rendered his country inestimable services, building churches and monasteries, introducing the religious orders, founding schools and doing his utmost to promote civilization and enlightenment. It was he who held the first Danish Synod at Lund in 1167. In 1178 he became archbishop of Lund, but very unwillingly, only the threat of excommunication from the holy see finally inducing him to accept the pallium. Absalon died on the 21st of March 1201, at the family monastery of Sorö, which he himself had richly embellished and endowed.

Absalon remains one of the most striking and picturesque figures of the Middle Ages, and was equally great as churchman, statesman and warrior. That he enjoyed warfare there can be no doubt; and his splendid physique and early training had well fitted him for martial exercises. He was the best rider in the army and the best swimmer in the fleet. Yet he was not like the ordinary fighting bishops of the Middle Ages, whose sole concession to their sacred calling was to avoid the "shedding of blood" by using a mace in battle instead of a sword. Absalon never neglected his ecclesiastical duties, and even his wars were of the nature of crusades. Moreover, all his martial energy notwithstanding, his personality must have been singularly winning; for it is said of him that he left behind not a single enemy, all his opponents having long since been converted by him into friends.

See Saxo, *Gesta Danorum*, ed. Holder (Strassburg, 1886), books x.-xvi.; Steinstrup, *Danmark's Riges Historie. Oldtiden og den ældre Middelalder*, pp. 570-735 (Copenhagen, 1897-1905). (R. N. B.)

ABSCESS (from Lat. *abscedere*, to separate), in pathology, a collection of pus among the tissues of the body, the result of bacterial inflammation. Without the presence of septic organisms abscess does not occur. At any rate, every acute abscess contains septic germs, and these may have reached the inflamed area by direct infection, or may have been carried thither by the blood-stream. Previous to the formation of abscess something has occurred to lower the vitality of the affected tissue—some gross injury, perchance, or it may be that the power of resistance against bacillary invasion was lowered by reason of constitutional weakness. As the result, then, of lowered vitality, a certain area becomes congested and effusion takes place into the tissues. This effusion coagulates and a hard, brawny mass is formed which softens towards the centre. If nothing is done the softened area increases in size, the skin over it becomes thinned, loses its vitality (mortifies) and a small "slough" is formed. When the slough gives way the pus escapes and, tension being relieved, pain ceases. A local necrosis or death of tissue takes place at that part of the inflammatory swelling farthest from the healthy circulation. When the attack of septic inflammation is very acute, death of the tissue occurs *en masse*, as in the core of a boil or carbuncle. Sometimes, however, no such mass of dead tissue is to be observed, and all that escapes when the skin is lanced or gives way is the creamy pus. In the latter case the tissue has broken down in a molecular form. After the escape of the core or slough along with a certain amount of pus, a space, the *abscess-cavity*, is left, the walls of which are lined with new vascular tissue which has itself escaped destruction. This lowly organized material is called *granulation tissue*, and exactly resembles the growth which covers the floor of an ulcer. These granulations eventually fill the contracting cavity and obliterate it by forming interstitial scar-tissue. This is called *healing by second intention*. Pus may accumulate in a normal cavity, such as a joint or bursa, or in the cranial, thoracic or abdominal cavity. In all these situations, if the diagnosis is clear, the principle of treatment is evacuation and drainage. When evacuating an abscess it is often advisable to scrape away the lining of unhealthy granulations and to wash out the cavity with an antiseptic lotion. If the after-drainage of the cavity is thorough the formation of pus ceases and the watery discharge from the abscess wall subsides. As the cavity contracts the discharge becomes less, until at last the drainage tube can be removed and the external wound allowed to heal. The large collections of pus which form in connexion with disease of the spinal column in the cervical, dorsal and lumbar regions are now treated by free evacuation of the tuberculous pus, with careful antiseptic measures. The opening should be in as dependent a position as possible in order that the drainage may be thorough. If tension recurs after opening has been made, as by the blocking of the tube, or by its imperfect position, or by its being too short, there is likely to be a fresh formation of pus, and without delay the whole procedure must be gone through again. (E. O.*)

ABSCISSA (from the Lat. *abscissus*, cut off), in the Cartesian system of co-ordinates, the distance of a point from the axis of y measured parallel to the horizontal axis (axis of x). Thus PS (or OR) is the abscissa of P. The word appears for the first time in a Latin work written by Stefano degli Angeli (1623–1697), a professor of mathematics in Rome. (See GEOMETRY, § *Analytical*.)



ABSCISSION (from Lat. *abscindere*), a tearing away, or cutting off; a term used sometimes in prosody for the elision of a vowel before another, and in surgery especially for abscission of the cornea, or the removal of that portion of the eyeball situated in front of the attachments of the recti muscles; in botany, the separation of spores by elimination of the connexion.

ABSCOND (Lat. *abscondere*, to hide, put away), to depart in a secret manner; in law, to remove from the jurisdiction of the courts or so to conceal oneself as to avoid their jurisdiction. A person may "abscond" either for the purpose of avoiding arrest for a crime (see ARREST), or for a fraudulent purpose, such as the defrauding of his creditors (see BANKRUPTCY).

ABSENCE (Lat. *absentia*), the fact of being "away," either in body or mind; "absence of mind" being a condition in which the mind is withdrawn from what is passing. The special occasion roll-call at Eton College is called "Absence," which the boys attend in their tall hats. A soldier must get permission or "leave of absence" before he can be away from his regiment. Seven years' absence with no sign of life either by letter or message is held presumptive evidence of death in the law courts.

ABSENTEEISM, a term used primarily of landed proprietors who absent themselves from their estates, and live and spend their incomes elsewhere; in its more extended meaning it includes all those (in addition to landlords) who live out of a country or locality but derive their income from some source within it. Absenteeism is a question which has been much debated, and from both the economic and moral point of view there is little doubt that it has a prejudicial effect. To it has been attributed in a great measure the unprosperous condition of the rural districts of France before the Revolution, when it was unusual for the great nobles to live on their estates unless compelled to do so by a sentence involving their "exile" from Paris. It has also been an especial evil in Ireland, and many attempts were made to combat it. As early as 1727 a tax of four shillings in the pound was imposed on all persons holding offices and employments in Ireland and residing in England. This tax was discontinued in 1753, but was re-imposed in 1769. In 1774 the tax was reduced to two shillings in the pound, but was dropped after some years. It was revived by the Independent Parliament in 1782 and for some ten years brought in a substantial amount to the revenue, yielding in 1790 as much as £63,089.

AUTHORITIES.—For a discussion of absenteeism from the economic point of view see N. W. Senior, *Lectures on the Rate of Wages, Political Economy*; J. S. Mill, *Political Economy*; J. R. McCulloch, *Treatises and Essays on Money, &c.*, article "Absenteeism"; A. T. Hadley, *Economics*; on absenteeism in Ireland see A. Young, *Tour in Ireland* (1780); T. Prior, *List of Absentees* (1729); E. Wakefield, *Account of Ireland* (1812); W. E. H. Lecky, *Ireland in the 18th Century* (1892); A. E. Murray, *History of the Commercial and Financial Relations between England and Ireland* (1903); *Parliamentary Papers, Ireland*, 1830, vii., ditto, 1845, xix.-xxii.; in France, A. de Monchrétien, *Traicté de l'œkonomie politique* (1615); A. de Tocqueville, *L'Ancien Régime* (1857); H. Taine, *Les Origines de la France contemporaine, l'ancien Régime* (1876).

ABSINTHE, a liqueur or aromatized spirit, the characteristic flavouring matter of which is derived from various species of wormwood (*Artemisia absinthium*). Among the other substances generally employed in its manufacture are angelica root, sweet flag, dittany leaves, star-anise fruit, fennel and hyssop. A colourless "alcoholate" (see LIQUEURS) is first prepared, and to this the well-known green colour of the beverage is imparted by maceration with green leaves of wormwood, hyssop and mint. Inferior varieties are made by means of essences, the distillation process being omitted. There are two varieties of absinthe, the French and the Swiss, the latter of which is of a higher alcoholic strength than the former. The best absinthe contains 70 to 80% of alcohol. It is said to improve very materially by storage. There is a popular belief to the effect that absinthe is frequently adulterated with copper, indigo or other dye-stuffs (to impart the green colour), but, in fact, this is now very rarely the case. There is some reason to believe that excessive absinthe-drinking leads to effects which are specifically worse than those associated with over-indulgence in other forms of alcohol.

ABSOLUTE (Lat. *absolvere*, to loose, set free), a term having the general signification of independent, self-existent, unconditioned. Thus we speak of "absolute" as opposed to "limited" or "constitutional" monarchy, or, in common parlance, of an "absolute failure," *i.e.* unrelieved by any satisfactory circumstances. In philosophy the word has several technical uses. (1) In Logic, it has been applied to non-connotative terms which do not imply attributes (see CONNOTATION), but more commonly, in opposition to *Relative*, to terms which do not imply the existence of some other (correlative) term; *e.g.* "father" implies "son," "tutor" "pupil," and therefore each of these terms is relative. In fact, however, the distinction is formal, and, though convenient in the terminology of elementary logic, cannot be strictly maintained. The term "man," for example, which, as compared with "father," "son," "tutor," seems to be absolute, is obviously relative in other connexions; in various contexts it implies its various possible opposites, *e.g.* "woman," "boy," "master," "brute." In other words, every term which is susceptible of definition is *ipso facto* relative, for definition is precisely the segregation of the thing defined from all other things which it is not, *i.e.* implies a relation. Every term which has a meaning is, therefore, relative, if only to its contradictory.

(2) The term is used in the phrase "absolute knowledge" to imply knowledge *per se*. It has been held, however, that, since all knowledge implies a knowing subject and a known object, absolute knowledge is a contradiction in terms (see RELATIVITY). So also Herbert Spencer spoke of "absolute ethics," as opposed to systems of conduct based on particular local or temporary laws and conventions (see ETHICS).

(3) By far the most important use of the word is in the phrase "the Absolute" (see METAPHYSICS). It is sufficient here to indicate the problems involved in their most elementary form. The process of knowledge in the sphere of intellect as in that of natural science is one of generalization, *i.e.* the co-ordination of particular facts under general statements, or in other words, the explanation of one fact by another, and that other by a third, and so on. In this way the particular facts or existences are left behind in the search for higher, more inclusive conceptions; as twigs are traced to one branch, and branches to one trunk, so, it is held, all the plurality of sense-given data is absorbed in a unity which is all-inclusive and self-existent, and has no "beyond." By a metaphor this process has been described as the ὁδὸς ἄνω (as of tracing a river to its source). Other phrases from different points of view have been used to describe the idea, *e.g.* First Cause, Vital Principle (in connexion with the origin of life), God (as the author and sum of all being), Unity, Truth (*i.e.* the sum and culmination of all knowledge), *Causa Causans*, &c. The idea in different senses appears both in idealistic and realistic systems of thought.

The theories of the Absolute may be summarized briefly as follows. (1) The Absolute does not exist, and is not even in any real sense thinkable. This view is held by the empiricists, who hold that nothing is knowable save phenomena. The Absolute could not be conceived, for all knowledge is susceptible of definition and, therefore, relative. The Absolute includes the idea of necessity, which the mind cannot cognize. (2) The Absolute exists for thought only. In this theory the absolute is the unknown *x* which the human mind is logically compelled to postulate *a priori* as the only coherent explanation and justification of its thought. (3) The Absolute exists but is unthinkable, because it is an aid to thought which comes into operation, as it were, as a final explanation beyond which thought cannot go. Its existence is shown by the fact that without it all demonstration would be a mere *circulus in probando* or verbal exercise, because the existence of separate things implies some one thing which includes and explains them. (4) The Absolute both exists and is conceivable. It is argued that we do in fact conceive it in as much as we do conceive Unity, Being, Truth. The conception is so clear that its inexplicability (admitted) is of no account. Further, since the unity of our thought implies the absolute, and since the existence of things is known only to thought, it appears absurd that the absolute itself should be regarded as non-existent. The Absolute is substance in itself, the ultimate basis and matter of existence. All things are merely manifestations of it, exist in virtue of it, but are not identical with it. (5) Metaphysical idealists pursue this line of argument in a different way. For them nothing exists save thought; the only existence that can be predicated of any thing and, therefore, of the Absolute, is that it is thought. Thought creates God, things, the Absolute. (6) Finally, it has been held that we can conceive the Absolute, though our conception is only partial, just as our conception of all things is limited by the imperfect powers of human intellect. Thus the Absolute exists for us only in our thought of it (4 above). But thought itself comes from the Absolute which, being itself the pure thought of thoughts, separates from itself individual minds. It is, therefore, perfectly natural that human thought, being essentially homogeneous with the Absolute, should be able by the consideration of the universe to arrive at some imperfect conception of the source from which all is derived.

The whole controversy is obscured by inevitable difficulties in terminology. The fundamental problem is whether a thing which is by hypothesis infinite can in any sense be defined, and if it is not defined, whether it can be said to be cognized or thought. It would appear to be almost an axiom that anything which by hypothesis transcends the intellect (*i.e.* by including subject and object, knowing and known) is *ipso facto* beyond the limits of the knower. Only an Absolute can cognize an absolute.

ABSOLUTION (Lat. *absolutio* from *absolvo*, loosen, acquit), a term used in civil and ecclesiastical law, denoting the act of setting free or acquitting. In a criminal process it signifies the acquittal of an accused person on the ground that the evidence has either disproved or failed to prove the charge brought against him. In this sense it is now little used, except in Scottish law in the forms *assoilzie* and *absolvitor*. The ecclesiastical use of the word is essentially different from the civil. It refers not to an accusation, but to sin actually committed (after baptism); and it denotes the setting of the sinner free from the guilt of the sin, or from its ecclesiastical penalty (excommunication), or from both. The authority of the church or minister to pronounce absolution is based on John xx. 23; Matt. xviii. 18; James v. 16, &c. In primitive times, when confession of sins was made before the congregation, the absolution was deferred till the penance was completed; and there is no record of the use of any special formula. Men were also encouraged, *e.g.* by Chrysostom, to confess their secret sins secretly to God. In course of time changes grew up. (1) From the 3rd century onwards, secret (auricular) confession before a bishop or priest was practised. For various reasons it became more and more common, until the fourth Lateran council (1215) ordered all Christians of the Roman obedience to make a confession once a year at least. In the Greek church also private confession has become obligatory. (2) In primitive times the penitent was reconciled by imposition of hands by the bishop with or without the clergy: gradually the office was left to be discharged by priests, and the outward action more and more disused. (3) It became the custom to give the absolution to penitents immediately after their confession and before the penance was performed. (4) Until the Middle Ages the form of absolution after private confession was of the nature of a prayer, such as "May the Lord absolve thee"; and this is still the practice of the Greek church. But about the 13th century the Roman formula was altered, and the council of Trent (1551) declared that the "form" and power of the sacrament of penance lay in the words *Ego te absolvo*, &c., and that the accompanying prayers are not essential to it. Of the three forms of absolution in the Anglican Prayer Book, that in the Visitation of the Sick (disused in the church of Ireland by decision of the Synods of 1871 and 1877) runs "I absolve thee," tracing the authority so to act through the church up to Christ: the form in the Communion Service is precative, while that in Morning and Evening Prayer is indicative indeed, but so general as not to imply anything like a judicial decree of absolution. In the Lutheran church also the practice of private confession survived the Reformation, together with both the exhibitive (I forgive, &c.) and declaratory (I declare and pronounce) forms of absolution. In granting absolution, even after general confession, it is in some places still the custom for the minister, where the numbers permit of it, to lay his hands on the head of each penitent. (W. O. B.)

ABSOLUTISM, in aesthetics, a term applied to the theory that beauty is an objective attribute of things, not merely a subjective feeling of pleasure in him who perceives. It follows that there is an absolute standard of the beautiful by which all objects can be judged. The fact that, in practice, the judgments even of connoisseurs are perpetually at variance, and that the so-called criteria of one place or period are more or less opposed to those of all others, is explained away by the hypothesis that individuals are differently gifted in respect of the capacity to appreciate. (See AESTHETICS.)

In political philosophy absolutism, as opposed to constitutional government, is the despotic rule of a sovereign unrestrained by laws and based directly upon force. In the strict sense such governments are rare, but it is customary to apply the term to a state at a relatively backward stage of constitutional development.

ABSORPTION OF LIGHT. The term "absorption" (from Lat. *absorbere*) means literally "sucking up" or "swallowing," and thus a total incorporation in something, literally or figuratively; it is technically used in animal physiology for the function of certain vessels which suck up fluids; and in light and optics *absorption spectrum* and *absorption band* are terms used in the discussion of the transformation of rays in various media.

If a luminous body is surrounded by empty space, the light which it emits suffers no loss of energy as it travels outwards. The intensity of the light diminishes merely because the total energy, though unaltered, is distributed over a wider and wider surface as the rays diverge from the source. To prove this, it will be sufficient to mention that an exceedingly small deficiency in the transparency of the free aether would be sufficient to prevent the light of the fixed stars from reaching the earth, since their distances are so immense. But when light is transmitted through a material medium, it always suffers some loss, the light energy being *absorbed* by the medium, that is, converted partially or wholly into other forms of energy such as heat, a portion of which transformed energy may be re-emitted as radiant energy of a lower frequency. Even the most transparent bodies known absorb an appreciable portion of the light transmitted through them. Thus the atmosphere absorbs a part of the sun's rays, and the greater the distance which the rays have to traverse the greater is the proportion which is absorbed, so that on this account the sun appears less bright towards sunset. On the other hand, light can penetrate some distance into all substances, even the most opaque, the absorption being, however, extremely rapid in the latter case.

The nature of the surface of a body has considerable influence on its power of absorbing light. Platinum black, for instance, in which the metal is in a state of fine division, absorbs nearly all the light incident on it, while polished platinum reflects the greater part. In the former case the light penetrating between the particles is unable to escape by reflexion, and is finally absorbed.

The question of absorption may be considered from either of two points of view. We may treat it as a *superficial* effect, especially in the case of bodies which are opaque enough or thick enough to prevent all transmission of light, and we may investigate how much is reflected at the surface and how much is absorbed; or, on the other hand, we may confine our attention to the light which enters the body and inquire into the relation between the decay of intensity and the depth of penetration. We shall take these two cases separately.

Absorptive Power.—When none of the radiations which fall on a body penetrates through its substance, then the ratio of the amount of radiation of a given wave-length which is absorbed to the total amount received is called the "absorptive power" of the body for that wave-length. Thus if the body absorbed half the incident radiation its absorptive power would be ½, and if it absorbed all the incident radiation its absorptive power would be 1. A body which absorbs all radiations of all wave-lengths would be called a "perfectly black body." No such body actually exists, but such substances as lamp-black and platinum-black approximately fulfil the condition. The fraction of the incident radiation which is not absorbed by a body gives a measure of its *reflecting power*, with which we are not here concerned. Most bodies exhibit a selective action on light, that is to say, they readily absorb light of particular wave-lengths, light of other wave-lengths not being largely absorbed. All bodies when heated emit the same kind of radiations which they absorb—an important principle known as the principle of the equality of radiating and absorbing powers. Thus black substances such as charcoal are very luminous when heated. A tile of white porcelain with a black pattern on it will, if heated red-hot, show the pattern bright on a darker ground. On the other hand, those substances which either are good reflectors or good transmitters, are not so luminous at the same temperature; for instance, melted silver, which reflects well, is not so luminous as carbon at the same temperature, and common salt, which is very transparent for most kinds of radiation, when poured in a fused condition out of a bright red-hot crucible, looks almost like water, showing only a faint red glow for a moment or two. But all such bodies appear to lose their distinctive properties when heated in a vessel which nearly encloses them, for in that case those radiations which they do not emit are either transmitted through them from the walls of the vessel behind, or else reflected from their surface. This fact may be expressed by saying that the radiation within a heated enclosure is the same as that of a perfectly black body.

Coefficient of Absorption, and Law of Absorption.—The law which governs the rate of decay of light intensity in passing through any medium may be readily obtained. If I_0 represents the intensity of the light which enters the surface, I_1 the intensity after passing through 1 centimetre, I_2 the intensity after passing through 2 centimetres, and so on; then we should expect that whatever fraction of I_0 is absorbed in the first centimetre, the same fraction of I_1 will be absorbed in the second. That is, if an amount jI_0 is absorbed in the first centimetre, jI_1 is absorbed in the second, and so on. We have then

$$I_1 = I_0(1-j)$$
$$I_2 = I_1(1-j) = I_0(1-j)^2$$
$$I_3 = I_2(1-j) = I_0(1-j)^3$$

and so on, so that if I is the intensity after passing through a thickness t in centimetres

$$I = I_0(1-j)^t \qquad (1).$$

We might call j, which is the proportion absorbed in one centimetre, the "coefficient of absorption" of the medium. It would, however, not then apply to the case of a body for which the whole light is absorbed in less than one centimetre. It is better then to define the coefficient of absorption as a quantity k such that k/n of the light is absorbed in $1/n$th part of a centimetre, where n may be taken to be a very large number. The formula (1) then becomes

$$I = I_0 e^{-kt} \qquad (2)$$

where e is the base of Napierian logarithms, and k is a constant which is practically the same as j for bodies which do not absorb very rapidly.

There is another coefficient of absorption (κ) which occurs in Helmholtz's theory of dispersion (see DISPERSION). It is closely related to the coefficient k which we have just defined, the equation connecting the two being $k = 4\pi\kappa/\lambda$, λ being the wave-length of the incident light.

The law of absorption expressed by the formula (2) has been verified by experiments for various solids, liquids and gases. The method consists in comparing the intensity after transmission through a layer of known thickness of the absorbent with the intensity of light from the same source which has not passed through the medium, k being thus obtained for various thicknesses and found to be constant. In the case of solutions, if the absorption of the solvent is negligible, the effect of increasing the concentration of the absorbing solute is the same as that of increasing the thickness in the same ratio. In a similar way the absorption of light in the coloured gas chlorine is found to be unaltered if the thickness is reduced by compression, because the density is increased in the same ratio that the thickness is reduced. This is not strictly the case, however, for such gases and vapours as exhibit well-defined bands of absorption in the spectrum, as these bands are altered in character by compression.

If white light is allowed to fall on some coloured solutions, the transmitted light is of one colour when the thickness of the solution is small, and of quite another colour if the thickness is great. This curious phenomenon is known as ***dichromatism*** (from δι-, two, and χρῶμα, colour). Thus, when a strong light is viewed through a solution of chlorophyll, the light seen is a brilliant green if the thickness is small, but a deep blood-red for thicker layers. This effect can be explained as follows. The solution is moderately transparent for a large number of rays in the neighbourhood of the green part of the spectrum; it is, on the whole, much more opaque for red rays, but is readily penetrated by certain red rays belonging to a narrow region of the spectrum. The small amount of red transmitted is at first quite overpowered by the green, but having a smaller coefficient of absorption, it becomes finally predominant. The effect is complicated, in the case of chlorophyll and many other bodies, by selective reflexion and fluorescence.

For the molecular theory of absorption, see SPECTROSCOPY.

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(J. R. C.)

ABSTEMII (a Latin word, from *abs*, away from, *temetum*, intoxicating liquor, from which is derived the English "abstemious" or temperate), a name formerly given to such persons as could not partake of the cup of the Eucharist on account of their natural aversion to wine. Calvinists allowed these to communicate in the species of bread only, touching the cup with their lip; a course which was deemed a profanation by the Lutherans. Among several Protestant sects, both in Great Britain and America, *abstemii* on a somewhat different principle have appeared in modern times. These are total abstainers, who maintain that the use of stimulants is essentially sinful, and allege that the wine used by Christ and his disciples at the supper was unfermented. They accordingly communicate in the unfermented "juice of the grape."

ABSTINENCE (from Lat. *abstinere*, to abstain), the fact or habit of refraining from anything, but usually from the indulgence of the appetite and especially from strong drink. "Total abstinence" and "total abstainer" are associated with taking the pledge to abstain from alcoholic liquor (see TEMPERANCE). In the discipline of the Christian Church abstinence is the term for a less severe form of Fasting (*q.v.*).

ABSTRACTION (Lat. *abs* and *trahere*), the process or result of drawing away; that which is drawn away, separated or derived. Thus the noun is used for a summary, compendium or epitome of a larger work, the gist of which is given in a concentrated form. Similarly an absent-minded man is said to be "abstracted," as paying no attention to the matter in hand. In philosophy the word has several closely related technical senses. (1) In formal logic it is applied to those terms which denote qualities, attributes, circumstances, as opposed to concrete terms, the names of things; thus "friend" is concrete, "friendship" abstract. The term which expresses the connotation of a word is therefore an abstract term, though it is probably not itself connotative; adjectives are concrete, not abstract, *e.g.* "equal" is concrete, "equality" abstract (cf. Aristotle's *aphaeresis* and *prosthesis*). (2) The process of abstraction takes an important place both in psychological and metaphysical speculation. The psychologist finds among the earliest of his problems the question as to the process from the perception of things seen and heard to mental conceptions, which are ultimately distinct from immediate perception (see PSYCHOLOGY). When the mind, beginning with isolated individuals, groups them together in virtue of perceived resemblances and arrives at a unity in plurality, the process by which attention is diverted from individuals and concentrated on a single inclusive concept (*i.e.* classification) is one of abstraction. All orderly thought and all increase of knowledge depend partly on establishing a clear and accurate connexion between particular things and general ideas, rules and principles. The nature of the resultant concepts belongs to the great controversy between Nominalism, Realism and Conceptualism. Metaphysics, again, is concerned with the ultimate problems of matter and spirit; it endeavours to go behind the phenomena of sense and focus its attention on the fundamental truths which are the only logical bases of natural science. This, again, is a process of abstraction, the attainment of abstract ideas which, apart from the concrete individuals, are conceived as having a substantive existence. The final step in the process is the conception of the Absolute (*q.v.*), which is abstract in the most complete sense.

Abstraction differs from Analysis, inasmuch as its object is to select a particular quality for consideration in itself as it is found in all the objects to which it belongs, whereas analysis considers all the qualities which belong to a single object.

ABSTRACT OF TITLE, in English law, an epitome of the various instruments and events under and in consequence of which the vendor of an estate derives his title thereto. Such an abstract is, upon the sale or mortgage of an estate, prepared by some competent person for the purchaser or mortgagee, and verified by his solicitor by a comparison with the original deeds. (See CONVEYANCING.)

ABT, FRANZ (1819–1885), German composer, was born on the 22nd of December 1819 at Eilenburg, Saxony, and died at Wiesbaden on the 31st of March 1885. The best of his popular songs have become part of the recognized art-folk-music of Germany; his vocal works, solos, part-songs, &c., enjoyed an extraordinary vogue all over Europe in the middle of the 19th century, but in spite of their facile tunefulness have few qualities of lasting beauty. Abt was kapellmeister at Bernburg in 1841, at Zurich in the same year and at Brunswick from 1852 to 1882, when he retired to Wiesbaden.

ABU, a mountain of Central India, situated in 24° 36′ N. lat. and 72° 43′ E. long., within the Rajputana state of Sirohi. It is an isolated spur of the Aravalli range, being completely detached from that chain by a narrow valley 7 miles across, in which flows the western Banas. It rises from the surrounding plains of Marwar like a precipitous granite island, its various peaks ranging from 4000 to 5653 feet. The elevations and platforms of the mountain are covered with elaborately sculptured shrines, temples and tombs. On the top of the hill is a small round platform containing a cavern, with a block of granite, bearing the impression of the feet of Data-Bhrigu, an incarnation of Vishnu. This is the chief place of pilgrimage for the Jains, Shrawaks and Banians. The two principal temples are situated at Deulwara, about the middle of the mountain, and five miles south-west of Guru Sikra, the highest summit. They are built of white marble, and are pre-eminent alike for their beauty and as typical specimens of Jain architecture in India. The more modern of the two was built by two brothers, rich merchants, between the years 1197 and 1247, and for delicacy of carving and minute beauty of detail stands almost unrivalled, even in this land of patient and lavish labour. The other was built by another merchant prince, Vimala Shah, apparently about A.D. 1032, and, although simpler and bolder in style, is as elaborate as good taste would allow in a purely architectural object. It is one of the oldest as well as one of the most complete examples of Jain architecture known. The principal object within the temple is a cell lighted only from the door, containing a cross-legged seated figure of the god Parswanath. The portico is composed of forty-eight pillars, the whole enclosed in an oblong courtyard about 140 feet by 90 feet, surrounded by a double colonnade of smaller pillars, forming porticos to a range of fifty-five cells, which enclose it on all sides, exactly as they do in a Buddhist monastery (*vihāra*). In this temple, however, each cell, instead of being the residence of a monk, is occupied by an image of Parswanath, and over the door, or on the jambs of each, are sculptured scenes from the life of the deity. The whole interior is magnificently ornamented.

Abu is now the summer residence of the governor-general's agent for Rajputana, and a place of resort for Europeans in the hot weather. It is 16 miles from the Abu road station of the Rajputana railway. The annual mean temperature is about 70°, rising to 90° in April; but the heat is never oppressive. The annual rainfall is about 68 inches. The hills are laid out with driving-roads and bridle-paths, and there is a beautiful little lake. The chief buildings are a church, club, hospital and a Lawrence asylum school for the children of British soldiers.

ABU-BEKR (573–634), the name ("Father of the virgin") of the first of the Mahommedan caliphs (see CALIPH). He was originally called Abd-el-Ka'ba ("servant of the temple"), and received the name by which he is known historically in consequence of the marriage of his virgin daughter Ayesha to Mahomet. He was born at Mecca in the year A.D. 573, a Koreishite of the tribe of Beni-Taim. Possessed of immense wealth, which he had himself acquired in commerce, and held in high esteem as a judge, an interpreter of dreams and a depositary of the traditions of his race, his early accession to Islamism was a fact of great importance. On his conversion he assumed the name of Abd-Alla (*servant of God*). His own belief in Mahomet and his doctrines was so thorough as to procure for him the title El Siddik (*the faithful*), and his success in gaining converts was correspondingly great. In his personal relationship to the prophet he showed the deepest veneration and most unswerving devotion. When Mahomet fled from Mecca, Abu-Bekr was his sole companion, and shared both his hardships and his triumphs, remaining constantly with him until the day of his death. During his last illness the prophet indicated Abu-Bekr as his successor by desiring him to offer up prayer for the people. The choice was ratified by the chiefs of the army, and ultimately confirmed, though Ali, Mahomet's son-in-law, disputed it, asserting his own title to the dignity. After a time Ali submitted, but the difference of opinion as to his claims gave rise to the controversy which still divides the followers of the prophet into the rival factions of Sunnites and Shiites. Abu-Bekr had scarcely assumed his new position (632), under the title Califet-Resul-Allah (*successor of the prophet of God*), when he was called to suppress the revolt of the tribes Hejaz and Nejd, of which the former rejected Islamism and the latter refused to pay tribute. He encountered formidable opposition from different quarters, but in every case he was successful, the severest struggle being that with the impostor Mosailima, who was finally defeated by Khalid at the battle of Akraba. Abu-Bekr's zeal for the spread of the new faith was as conspicuous as that of its founder had been. When the internal disorders had been repressed and Arabia completely subdued, he directed his generals to foreign conquest. The Irak of Persia was overcome by Khalid in a single campaign, and there was also a successful expedition into Syria. After the hard-won victory over Mosailima, Omar, fearing that the sayings of the prophet would be entirely forgotten when those who had listened to them had all been removed by death, induced Abu-Bekr to see to their preservation in a written form. The record, when completed, was deposited with Hafsa, daughter of Omar, and one of the wives of Mahomet. It was held in great reverence by all Moslems, though it did not possess canonical authority, and furnished most of the materials out of which the Koran, as it now exists, was prepared. When the authoritative version was completed all copies of Hafsa's record were destroyed, in order to prevent possible disputes and divisions. Abu-Bekr died on the 23rd of August 634. Shortly before his death, which one tradition ascribes to poison, another to natural causes, he indicated Omar as his successor, after the manner Mahomet had observed in his own case.

ABU HAMED, a town of the Anglo-Egyptian Sudan on the right bank of the Nile, 345 m. by rail N. of Khartum. It stands at the centre of the great S-shaped bend of the Nile, and from it the railway to Wadi Halfa strikes straight across the Nubian desert, a little west of the old caravan route to Korosko. A branch railway, 138 m. long, from Abu Hamed goes down the right bank of the Nile to Kareima in the Dongola mudiria. The town is named after a celebrated sheikh buried here, by whose tomb travellers crossing the desert used formerly to deposit all superfluous goods, the sanctity of the saint's tomb ensuring their safety.

ABŪ ḤANĪFA AN-NUʽMĀN IBN THĀBIT, Mahommedan canon lawyer, was born at Kufa in A.H. 80 (A.D. 699) of non-Arab and probably Persian parentage. Few events of his life are known to us with any certainty. He was a silk-dealer and a man of considerable means, so that he was able to give his time to legal studies. He lectured at Kufa upon canon law (*fiqh*) and was a consulting lawyer (*mufti*), but refused steadily to take any public post. When al-Manṣūr, however, was building Bagdad (145–140) Abū Ḥanifa was one of the four overseers whom he appointed over the craftsmen (G. Le Strange, *Baghdad during the Abbasid Caliphate*, p. 17). In A.H. 150 (A.D. 767) he died there under circumstances which are very differently reported. A persistent but apparently later tradition asserts that he died in prison after severe beating, because he refused to obey al-Manṣūr's command to act as a judge (cadi, *qāḍi*). This was to avoid a responsibility for which he felt unfit—a frequent attitude of more pious Moslems. Others say that al-Mahdī, son of al-Manṣūr, actually constrained him to be a judge and that he died a few days after. It seems certain that he did suffer imprisonment and beating for this reason, at the hands of an earlier governor of Kūfa under the Omayyads (Ibn Qutaiba, *Ma'ārif*, p. 248). Also that al-Manṣūr desired to make him judge, but compromised upon his inspectorship of buildings (so in Tabari). A late story is that the judgeship was only a pretext with al-Manṣūr, who considered him a partisan of the 'Alids and a helper with his wealth of Ibrāhīm ibn 'Abd Allāh in his insurrection at Kufa in 145 (Weil, *Geschichte*, ii. 53 ff.).

For many personal anecdotes see de Slane's transl. of Ibn Khallikan iii. 555 ff., iv. 272 ff. For his place as a speculative jurist in the history of canon law, see Mahommedan Law. He was buried in eastern Bagdad, where his tomb still exists, one of the few surviving sites from the time of al-Manṣūr, the founder. (Le Strange 191 ff.)

See C. Brockelmann, *Geschichte*, i. 169 ff.; Nawawi's *Biogr. Dict.* pp. 698-770; Ibn Hajar al-Haitami's *Biography*, publ. Cairo, A.H. 1304; legal bibliography under Mahommedan Law. (D. B. Ma.)

ABU KLEA, a halting-place for caravans in the Bayuda Desert, Anglo-Egyptian Sudan. It is on the road from Merawi to Metemma and 20 m. N. of the Nile at the last-mentioned place. Near this spot, on the 17th of January 1885, a British force marching to the relief of General Gordon at Khartum was attacked by the Mahdists, who were repulsed. On the 19th, when the British force was nearer Metemma, the Mahdists renewed the attack, again unsuccessfully. Sir Herbert Stewart, the commander of the British force, was mortally wounded on the 19th, and among the killed on the 17th was Col. F. G. Burnaby (see Egypt, *Military Operations*).

ABŪ-L-'ALĀ UL-MA'ARRĪ [Abū-l-'Alā Aḥmad ibn 'Abdallāh ibn Sulaimān] (973–1057), Arabian poet and letter-writer, belonged to the South Arabian tribe Tanukh, a part of which had migrated to Syria before the time of Islam. He was born in 973 at Ma'arrat un-Nu'mān, a Syrian town nineteen hours' journey south of Aleppo, to the governor of which it was subject at that time. He lost his father while he was still an infant, and at the age of four lost his eyesight owing to smallpox. This, however, did not prevent him from attending the lectures of the best teachers at Aleppo, Antioch and Tripoli. These teachers were men of the first rank, who had been attracted to the court of Saif-ud-Daula, and their teaching was well stored in the remarkable memory of the pupil. At the age of twenty-one Abū-l-'Alā returned to Ma'arra, where he received a pension of thirty dinars yearly. In 1007 he visited Bagdad, where he was admitted to the literary circles, recited in the salons, academies and mosques, and made the acquaintance of men to whom he addressed some of his letters later. In 1009 he returned to Ma'arra, where he spent the rest of his life in teaching and writing. During this period of scholarly quiet he developed his characteristic advanced views on vegetarianism, cremation of the dead and the desire for extinction after death.

Of his works the chief are two collections of his poetry and two of his letters. The earlier poems up to 1029 are of the kind usual at the time. Under the title of *Saqt uz-Zand* they have been published in Bulaq (1869), Beirūt (1884) and Cairo (1886). The poems of the second collection, known as the *Luzūm ma lam yalzam*, or the *Luzūmiyyāt*, are written with the difficult rhyme in two consonants instead of one, and contain the more original, mature and somewhat pessimistic thoughts of the author on mutability, virtue, death, &c. They have been published in Bombay (1886) and Cairo (1889). The letters on various literary and social subjects were published with commentary by Shain Effendi in Beirut (1894), and with English translation, &c., by Prof. D. S. Margoliouth in Oxford (1898). A second collection of letters, known as the *Risālat ul-Ghufrān*, was summarized and partially translated by R. A. Nicholson in the *Journal of the Royal Asiatic Society* (1900, pp. 637 ff.; 1902, pp. 75 ff., 337 ff., 813 ff.).

Bibliography.—C. Rieu, *De Abu-l-'Alae Poetae Arabici vita et carminibus* (Bonn, 1843); A. von Kremer, *Über die philosophischen Gedichte des Abu-l-'Ala* (Vienna, 1888); cf. also the same writer's articles in the *Zeitschrift der deutschen morgenlandischen Gesellschaft* (vols. xxix., xxx., xxxi. and xxxviii.). For his life see the introduction to D. S. Margoliouth's edition of the letters, supplemented by the same writer's articles "Abu-l-'Ala al-Ma'arri's Correspondence on Vegetarianism" in the *Journal of the Royal Asiatic Society* (1902, pp. 289 ff.). (G. W. T.)

ABŪ-L-'ATĀHIYA [Abū Isḥāq Ismā'īl ibn Qāsim al-'Anazī] (748–828), Arabian poet, was born at 'Ain ut-Tamar in the Hijāz near Medina. His ancestors were of the tribe of 'Anaza. His youth was spent in Kufa, where he was engaged for some time in selling pottery. Removing to Bagdad, he continued his business there, but became famous for his verses, especially for those addressed to 'Utba, a slave of the caliph al-Mahdī. His affection was unrequited, although al-Mahdī, and after him Harūn al-Rashid, interceded for him. Having offended the caliph, he was in prison for a short time. The latter part of his life was more ascetic. He died in 828 in the reign of al-Ma'mūn. The poetry of Abū-l-'Atāhiya is notable for its avoidance of the artificiality almost universal in his days. The older poetry of the desert had been constantly imitated up to this time, although it was not natural to town life. Abū-l-'Atāhiya was one of the first to drop the old *qasida* (elegy) form. He was very fluent and used many metres. He is also regarded as one of the earliest philosophic poets of the Arabs. Much of his poetry is concerned with the observation of common life and morality, and at times is pessimistic. Naturally, under the circumstances, he was strongly suspected of heresy.

His poems (*Diwān*) with life from Arabian sources have been published at the Jesuit Press in Beirūt (1887, 2nd ed. 1888). On his position in Arabic literature see W. Ahlwardt, *Diwân des Abu Nowas* (Greifswald, 1861), pp. 21 ff.; A. von Kremer, *Culturgeschichte des Orients* (Wien, 1877), vol. ii. pp. 372 ff. (G. W. T.)

ABULFARAJ [Abū-l-Faraj 'Alī ibn ul-Ḥuṣain ul-Isbahānī] (897–967), Arabian scholar, was a member of the tribe of the Quraish (Koreish) and a direct descendant of Marwān, the last of the Omayyad caliphs. He was thus connected with the Omayyad rulers in Spain, and seems to have kept up a correspondence with them and to have sent them some of his works. He was born in Ispahān, but spent his youth and made his early studies in Bagdad. He became famous for his knowledge of early Arabian antiquities. His later life was spent in various parts of the Moslem world, in Aleppo with Saif-ud-Daula (to whom he dedicated the *Book of Songs*), in Rai with the Buyid vizier Ibn 'Abbād and elsewhere. In his last years he lost his reason. In religion he was a Shiite. Although he wrote poetry, also an anthology of verses on the monasteries of Mesopotamia and Egypt, and a genealogical work, his fame rests upon his *Book of Songs* (*Kitāb ul-Aghānī*), which gives an account of the chief Arabian songs, ancient and modern, with the stories of the composers and singers. It contains a mass of information as to the life and customs of the early Arabs, and is the most valuable authority we have for their pre-Islamic and early Moslem days. A part of it was published by J. G. L. Kosegarten with Latin translation (Greifswald, 1840). The text was published in 20 vols. at Bulaq in 1868. Vol. xxi. was edited by R. E. Brünnow (Leyden, 1888). A volume of elaborate indices was edited by I. Guidi (Leyden, 1900), and a missing fragment of the text was published by J. Wellhausen in the *Zeitschrift der deutschen morgenländischen Gesellschaft*, vol. 50, pp. 146 ff.

For his life see M'G. de Slane's translation of Ibn Khallikan's *Biographical Dictionary*, vol. ii. pp. 249 ff. (G. W. T.)

ABUL FAZL, wazir and historiographer of the great Mogul emperor, Akbar, was born in the year A.D. 1551. His career as a minister of state, brilliant though it was, would probably have been by this time forgotten but for the record he himself has left of it in his celebrated history. The *Akbar Nameh*, or *Book of Akbar*, as Abul Fazl's chief literary work, written in Persian, is called, consists of two parts—the first being a complete history of Akbar's reign and the second, entitled *Ain-i-Akbari*, or *Institutes of Akbar*, being an account of the religious and political constitution and administration of the empire. The style is singularly elegant, and the contents of the second part possess a unique and lasting interest. An excellent translation of the *Ain* by Francis Gladwin was published in Calcutta, 1783–1786. It was reprinted in London very inaccurately, and copies of the original edition are now exceedingly rare and correspondingly valuable. It was also translated by Professor Blockmann in 1848. Abul Fazl died by the hand of an assassin, while returning from a mission to the Deccan in 1602. The murderer was instigated by Prince Selim, afterwards Jahangir, who had become jealous of the minister's influence.

ABULFEDA [Abū-l-Fidā' Ismā'īl ibn 'Alī 'Imād-ud-Dnī] (1273–1331), Arabian historian and geographer, was born at Damascus, whither his father Malik ul-Afdal, brother of the prince of Hamah, had fled from the Mongols. He was a descendant of Ayyūb, the father of Saladin. In his boyhood he devoted himself to the study of the Koran and the sciences, but from his twelfth year was almost constantly engaged in military expeditions, chiefly against the crusaders. In 1285 he was present at the assault of a stronghold of the knights of St John, and he took part in the sieges of Tripoli, Acre and Qal'at ar-Rūm. In 1298 he entered the service of the Mameluke Sultan Malik al-Nāṣir and after twelve years was invested by him with the governorship of Hamah. In 1312 he became prince with the title Malik us-Sālih, and in 1320 received the hereditary rank of sultan with the title Malik ul-Mu'ayyad. For more than twenty years altogether he reigned in tranquillity and splendour, devoting himself to the duties of government and to the composition of the works to which he is chiefly indebted for his fame. He was a munificent patron of men of letters, who came in large numbers to his court. He died in 1331. His chief historical work in *An Abridgment of the History of the Human Race*, in the form of annals extending from the creation of the world to the year 1329 (Constantinople, 2 vols. 1869). Various translations of parts of it exist, the earliest being a Latin rendering of the section relating to the Arabian conquests in Sicily, by Dobelius, Arabic professor at Palermo, in 1610 (preserved in Muratori's *Rerum Italicarum Scriptores*, vol. i.). The section dealing with the pre-Islamitic period was edited with Latin translation by H. O. Fleischer under the title *Abulfedae Historia Ante-Islamica* (Leipzig, 1831). The part dealing with the Mahommedan period was edited, also with Latin translation, by J. J. Reiske as *Annales Muslemici* (5 vols., Copenhagen, 1789–1794). His *Geography* is, like much of the history, founded on the works of his predecessors, and so ultimately on the work of Ptolemy. A long introduction on various geographical matters is followed by twenty-eight sections dealing in tabular form with the chief towns of the world. After each name are given the longitude, latitude, "climate," spelling, and then observations generally taken from earlier authors. Parts of the work were published and translated as early as 1650 (cf. Carl Brockelmann's *Geschichte der Arabischen Litteratur*, Berlin, 1902, vol. ii. pp. 44-46). The text of the whole was published by M'G. de Slane and M. Reinaud (Paris, 1840), and a French translation with introduction by M. Reinaud and Stanislas Guyard (Paris, 1848–1883). (G. W. T.)

ABŪ-L-QĀSIM [Khalaf ibn 'Abbās uz-Zahrāwī], Arabian physician and surgeon, generally known in Europe as ABULCASIS, flourished in the tenth century at Cordova as physician to the caliph 'Abdur-Rahmān III. (912–961). No details of his life are known. A part of his compendium of medicine was published in Latin in the 16th century as *Liber theoricae nec non practicae Alsaharavii* (Augsburg, 1519). His manual of surgery was published at Venice in 1497, at Basel in 1541, and at Oxford *Abulcasis de Chirurgia arabice et latine cura Johannis Channing* (2 vols. 1778).

For his other works see Carl Brockelmann, *Geschichte der arabischen Litteratur* (Weimar, 1898), vol. i. pp. 239-240. (G. W. T.)

ABUNDANTIA ("Abundance"), a Roman goddess, the personification of prosperity and good fortune. Modelled after the Greek Demeter, she is practically identical with Copia, Annona and similar goddesses. On the coins of the later Roman emperors she is frequently represented holding a cornucopia, from which she shakes her gifts, thereby at the same time indicating the liberality of the emperor or empress. She may be compared with Domina Abundia (Old Fr. *Dame Habonde*, *Notre Dame d'Abondance*), whose name often occurs in poems of the Middle Ages, a beneficent fairy, who brought plenty to those whom she visited (Grimm, *Teutonic Mythology*, tr. 1880, i. 286-287).

ABŪ NUWĀS [Abū 'Alī Hal-asan ibn Hāni'al-Ḥakamī] (*c.* 756–810), known as Abū Nuwās, Arabian poet, was born in al-Ahwāz, probably about 756. His mother was a Persian, his father a soldier, a native of Damascus. His studies were made in Baṣra under Abū Zaid and Abū 'Ubaida (*q.v.*), and in Kufa under Khalaf al-Aḥmar. He is also said to have spent a year with the Arabs in the desert to gain purity of language. Settling in Bagdad he enjoyed the favour of Harūn al-Rashīd and al-Amīn, and died there probably about 810. The greater part of his life was characterized by great licentiousness and disregard of religion, but in his later days he became ascetic. Abū Nuwās is recognized as the greatest poet of his time. His mastery of language has led to extensive quotation of his verses by Arabian scholars. Genial, cynical, immoral, he drew on all the varied life of his time for the material of his poems. In his wine-songs especially the manners of the upper classes of Bagdad are revealed. He was one of the first to ridicule the set form of the *qasīda* (elegy) as unnatural, and has satirized this form in several poems. See I. Goldziher, *Abhandlungen zur Arabischen Philologie* (Leyden, 1896), i. pp. 145 ff. His poems were collected by several Arabian editors. One such collection (the MS. of which is now in Vienna) contains nearly 5000 verses grouped under the ten headings: wine, hunting, praise, satire, love of youths, love of women, obscenities, blame, elegies, renunciation of the world. His collected poems (*Dīwān*) have been published in Cairo (1860) and in Beirūt (1884). The wine-songs were edited by W. Ahlwardt under the title *Diwān des Abu Nowas. I. Die Weinlieder* (Greifswald, 1861). (G. W. T.)

ABU SIMBEL, or IPSAMBUL, the name of a group of temples of Rameses II. (*c.* 1250 B.C.) in Nubia, on the left bank of the Nile, 56 m. by river S. of Korosko. They are hewn in the cliffs at the riverside, at a point where the sandstone hills on the west reach the Nile and form the southern boundary of a wider portion of the generally barren valley. The temples are three in number. The principal temple, probably the greatest and most imposing of all rock-hewn monuments, was discovered by Burckhardt in 1812 and opened by Belzoni in 1817. (The front has been cleared several times, most recently in 1892, but the sand is always pressing forward from the north end.) The hillside was recessed to form the façade, backed against which four immense seated colossi of the king, in pairs on either side of the entrance, rise from a platform or forecourt reached from the river by a flight of steps. The colossi are no less than 65 ft. in height, of nobly placid design, and are accompanied by smaller figures of Rameses' queen and their sons and daughters; behind and over them is the cornice, with the dedication below in a line of huge hieroglyphs, and a long row of apes, standing in adoration of the rising sun above. The temple is dedicated primarily to the solar gods Amenrē of Thebes and Raharakht of Heliopolis, the true sun god; it is oriented to the east so that the rays of the sun in the early morning penetrate the whole length of two great halls to the innermost sanctuary and fall upon the central figures of Amenrē and Rameses, which are there enthroned with Ptah of Memphis and Raharakht on either side. The interior of the temple is decorated with coloured sculpture of fine workmanship and in good preservation; the scenes are more than usually interesting; some are of religious import (amongst them Rameses as king making offerings to himself as god), others illustrate war in Syria, Libya and Ethiopia: another series depicts the events of the famous battle with the Hittites and their allies at Kadesh, in which Rameses saved the Egyptian camp and army by his personal valour. Historical stelae of the same reign are engraved inside and outside the temple; the most interesting is that recording the marriage with a Hittite princess in the 34th year. Not the least important feature of the temple belongs to a later age, when some Greek, Carian and Phoenician soldiers of one of the kings named Psammetichus (apparently Psammetichus II., 594–589 B.C.) inscribed their names upon the two southern colossi, doubtless the only ones then clear of sand. These graffiti are of the highest value for the early history of the alphabet, and as proving the presence of Greek mercenaries in the Egyptian armies of the period. The upper part of the second colossus (from the south) has fallen; the third was repaired by Sethos II. not many years after the completion of the temple. This great temple was wholly rock-cut, and is now threatened by gradual ruin by sliding on the planes of stratification. A small temple, immediately to the south of the first, is believed to have had a built antechamber: it is the earliest known example of a "birth chapel," such as was usually attached to Ptolemaic temples for the accommodation of the divine mother-consort and her son. The third and northernmost temple, separated from the others by a ravine, is on a large scale; the colossi of the façade are six in number and 33 ft. high, representing Rameses and his queen Nefrēre, who dedicated the temple to the goddess Hathōr. The whole group forms a singular monument of Rameses' unbounded pride and self-glorification.

See EGYPT; J. H. Breasted, *Ancient Records, Egypt*, vol. iii. pp. 124 et seq., esp. 212; "The Temples of Lower Nubia," in the *American Journal of Semitic Languages and Literatures*, October 1906. (F. LL. G.)

ABŪ TAMMĀM [Ḥabīb ibn Aus] (807–846), Arabian poet, was, like Buḥturī, of the tribe of Ṭāi (though some say he was the son of a Christian apothecary named Thaddeus, and that his genealogy was forged). He was born in Jāsim (Josem), a place to the north-east of the Sea of Tiberias or near Manbij (Hierapolis). He seems to have spent his youth in Homs, though, according to one story, he was employed during his boyhood in selling water in a mosque in Cairo. His first appearance as a poet was in Egypt, but as he failed to make a living there he went to Damascus and thence to Mosul. From this place he made a visit to the governor of Armenia, who awarded him richly. After 833 he lived mostly in Bagdad, at the court of the caliph Mo'tasim. From Bagdad he visited Khorassan, where he enjoyed the favour of 'Abdallah ibn Ṭāhir. About 845 he was in Ma'arrat un-Nu'mān, where he met Buḥturī. He died in Mosul. Abu Tammām is best known in literature as the compiler of the collection of early poems known as the *Hamāsa* (*q.v.*). Two other collections of a similar nature are ascribed to him. His own poems have been somewhat neglected owing to the success of his compilations, but they enjoyed great repute in his lifetime, and were distinguished for the purity of their style, the merit of the verse and the excellent manner of treating subjects. His poems (*Diwān*) were published in Cairo (A.D. 1875).

See Life in Ibn Khallikan's *Biographical Dictionary*, trans. by M'G. de Slane (Paris and London, 1842), vol. i. pp. 348 ff.; and in the *Kitāb ul-Aghāni* (Book of Songs) of Abulfaraj (Bulaq, 1869), vol. xv. pp. 100-108. (G. W. T.)

ABUTILON (from the Arabic *aubūtīlūn*, a name given by Avicenna to this or an allied genus), in botany, a genus of plants, natural order Malvaceae (Mallows), containing about eighty species, and widely distributed in the tropics. They are free-growing shrubs with showy bell-shaped flowers, and are favourite greenhouse plants. They may be grown outside in England during the summer months, but a few degrees of frost is fatal to them. They are readily propagated from cuttings taken in the spring or at the end of the summer. A large number of horticultural varieties have been developed by hybridization, some of which have a variegated foliage.

ABUTMENT, a construction in stone or brickwork designed to receive and resist the lateral pressure of an arch, vault or strut. When built outside a wall it is termed a buttress.

ABŪ UBAIDA [Ma'mar ibn ul-Muthanna] (728–825), Arabian scholar, was born a slave of Jewish Persian parents in Başra, and in his youth was a pupil of Abū'Amr ibn ul-'Alā. In 803 he was called to Bagdad by Harūn al-Rashīd. He died in Başra. He was one of the most learned and authoritative scholars of his time in all matters pertaining to the Arabic language, antiquities and stories, and is constantly cited by later authors and compilers. Jābiz held him to be the most learned scholar in all branches of human knowledge, and Ibn Hishām accepted his interpretation even of passages in the Koran. The titles of 105 of his works are mentioned in the *Fihrist*, and his *Book of Days* is the basis of parts of the history of Ibn al-Athīr and of the *Book of Songs* (see ABULFARAJ), but nothing of his (except a song) seems to exist now in an independent form. He is often described as a Kharijite. This, however, is true only in so far as he denied the privileged position of the Arab people before God. He was, however, a strong supporter of the Shu'ūbite movement, *i.e.* the movement which protested against the idea of the superiority of the Arab race over all others. This is especially seen in his satires on Arabs (which made him so hated that no man followed his bier when he died). He delighted in showing that words, fables, customs, &c., which the Arabs believed to be peculiarly their own, were derived from the Persians. In these matters he was the great rival of Asma'ī (*q.v.*).

See *Life* in Ibn Khallikān's *Biographical Dictionary*, trans. by M'G. de Slane (Paris and London, 1842), vol. iii. pp. 388-398; also I. Goldziher's *Muhammedanische Studien* (Halle, 1888), vol. i. pp. 194-206. (G. W. T.)

ABYDOS, an ancient city of Mysia, in Asia Minor, situated at Nagara Point on the Hellespont, which is here scarcely a mile broad. It probably was originally a Thracian town, but was afterwards colonized by Milesians. Here Xerxes crossed the strait on his bridge of boats when he invaded Greece. Abydos is celebrated for the vigorous resistance it made against Philip V. of Macedon (200 B.C.), and is famed in story for the loves of Hero and Leander. The town remained till late Byzantine times the toll station of the Hellespont, its importance being transferred to the Dardanelles (*q.v.*), after the building of the "Old Castles" by Sultan Mahommed II. (*c.* 1456).

See Choiseul-Gouffier, *Voyage dans l'empire ottoman* (Paris, 1842).

ABYDOS, one of the most ancient cities of Upper Egypt, about 7 m. W. of the Nile in lat. 26° 10′ N. The Egyptian name was *Abdu*, "the hill of the symbol or reliquary," in which the sacred head of Osiris was preserved. Thence the Greeks named it Abydos, like the city on the Hellespont; the modern Arabic name is *Arabet el Madfuneh*. The history of the city begins in the late prehistoric age, it having been founded by the pre-Menite kings (Petrie, *Abydos*, ii. 64), whose town, temple and tombs have been found there. The kings of the Ist dynasty, and some of the IInd dynasty, were also buried here, and the temple was renewed and enlarged by them. Great forts were built on the desert behind the town by three kings of the IInd dynasty. The temple and town continued to be rebuilt at intervals down to the times of the XXXth dynasty, and the cemetery was used continuously. In the XIIth dynasty a gigantic tomb was cut in the rock by Senwosri (or Senusert) III. Seti I. in the XIXth dynasty founded a great new temple to the south of the town in honour of the ancestral kings of the early dynasties; this was finished by Rameses (or Ramessu) II., who also built a lesser temple of his own. Mineptah (Merenptah) added a great Hypogeum of Osiris to the temple of Seti. The latest building was a new temple of Nekhtnebf in the XXXth dynasty. From the Ptolemaic times the place continued to decay and no later works are known (Petrie, *Abydos*, i. and ii.).

The worship here was of the jackal god Upuaut (Ophois, Wepwoi), who "opened the way" to the realm of the dead, increasing from the Ist dynasty to the time of the XIIth dynasty and then disappearing after the XVIIIth. Anher appears in the XIth dynasty; and Khentamenti, the god of the western Hades, rises to importance in the middle kingdom and then vanishes in the XVIIIth. The worship here of Osiris in his various forms begins in the XIIth dynasty and becomes more important in later times, so that at last the whole place was considered as sacred to him (*Abydos*, ii. 47).

The temples successively built here on one site were nine or ten in number, from the Ist dynasty, 5500 B.C. to the XXVIth dynasty, 500 B.C. The first was an enclosure, about 30 × 50 ft., surrounded by a thin wall of unbaked bricks. Covering one wall of this came the second temple of about 40 ft. square in a wall about 10 ft. thick. An outer *temenos* (enclosure) wall surrounded the ground. This outer wall was thickened about the IInd or

IIIrd dynasty. The old temple entirely vanished in the IVth dynasty, and a smaller building was erected behind it, enclosing a wide hearth of black ashes. Pottery models of offerings are found in the ashes, and these were probably the substitutes for sacrifices decreed by Cheops (Khufu) in his temple reforms. A great clearance of temple offerings was made now, or earlier, and a chamber full of them has yielded the fine ivory carvings and the glazed figures and tiles which show the splendid work of the Ist dynasty. A vase of Menes with purple inlaid hieroglyphs in green glaze and the tiles with relief figures are the most important pieces. The noble statuette of Cheops in ivory, found in the stone chamber of the temple, gives the only portrait of this greatest ruler. The temple was rebuilt entirely on a larger scale by Pepi I. in the VIth dynasty. He placed a great stone gateway to the temenos, an outer temenos wall and gateway, with a colonnade between the gates. His temple was about 40×50 ft. inside, with stone gateways front and back, showing that it was of the processional type. In the XIth dynasty Menthotp (Mentuhotep) III. added a colonnade and altars. Soon after, Sankhkerē entirely rebuilt the temple, laying a stone pavement over the area, about 45 ft. square, besides subsidiary chambers. Soon after Senwosri (Senusert) I. in the XIIth dynasty laid massive foundations of stone over the pavement of his predecessor. A great temenos was laid out enclosing a much larger area, and the temple itself was about three times the earlier size.

The XVIIIth dynasty began with a large chapel of Amasis (Ahmosi, Aahmes) I., and then Tethmosis (Thothmes, Tahutmes) III. built a far larger temple, about 130×200 ft. He made also a processional way past the side of the temple to the cemetery beyond, with a great gateway of granite. Rameses III. added a large building; and Amasis II. in the XXVIth dynasty rebuilt the temple again, and placed in it a large monolith shrine of red granite, finely wrought. The foundations of the successive temples were comprised within about 18 ft. depth of ruins; these needed the closest examination to discriminate the various buildings, and were recorded by over 4000 measurements and 1000 levellings (Petrie, *Abydos*, ii.).

The temple of Seti I. was built on entirely new ground half a mile to the south of the long series of temples just described. This is the building best known as the Great Temple of Abydos, being nearly complete and an impressive sight. A principal object of it was the adoration of the early kings, whose cemetery, to which it forms a great funerary chapel, lies behind it. The long list of the kings of the principal dynasties carved on a wall is known as the "Table of Abydos." There were also seven chapels for the worship of the king and principal gods. At the back were large chambers connected with the Osiris worship (Caulfield, *Temple of the Kings*); and probably from these led out the great Hypogeum for the celebration of the Osiris mysteries, built by Mineptah (Murray, *Osireion*). The temple was originally 550 ft. long, but the forecourts are scarcely recognizable, and the part in good state is about 250 ft. long and 350 ft. wide, including the wing at the side. Excepting the list of kings and a panegyric on Rameses II., the subjects are not historical but mythological. The work is celebrated for its delicacy and refinement, but lacks the life and character of that in earlier ages. The sculptures have been mostly published in hand copy, not facsimile, by Mariette in his *Abydos*, i. The adjacent temple of Rameses II. was much smaller and simpler in plan; but it had a fine historical series of scenes around the outside, of which the lower parts remain. A list of kings, similar to that of Seti, formerly stood here; but the fragments were removed by the French consul and sold to the British Museum.

The Royal Tombs of the earliest dynasties were placed about a mile back on the great desert plain. The earliest is about 10×20 ft. inside, a pit lined with brick walls, and originally roofed with timber and matting. Others also before Menes are 15×25 ft. The tomb probably of Menes is of the latter size. After this the tombs increase in size and complexity. The tomb-pit is surrounded by chambers to hold the offerings, the actual sepulchre being a great wooden chamber in the midst of the brick-lined pit. Rows of small tomb-pits for the servants of the king surround the royal chamber, many dozens of such burials being usual. By the end of the IInd dynasty the type changed to a long passage bordered with chambers on either hand, the royal burial being in the middle of the length. The greatest of these tombs with its dependencies covered a space of over 3000 square yards. The contents of the tombs have been nearly destroyed by successive plunderers; enough remained to show that rich jewellery was placed on the mummies, a profusion of vases of hard and valuable stones from the royal table service stood about the body, the store-rooms were filled with great jars of wine, perfumed ointment and other supplies, and tablets of ivory and of ebony were engraved with a record of the yearly annals of the reigns. The sealings of the various officials, of which over 200 varieties have been found, give an insight into the public arrangements (Petrie, *Royal Tombs*, i. and ii.).

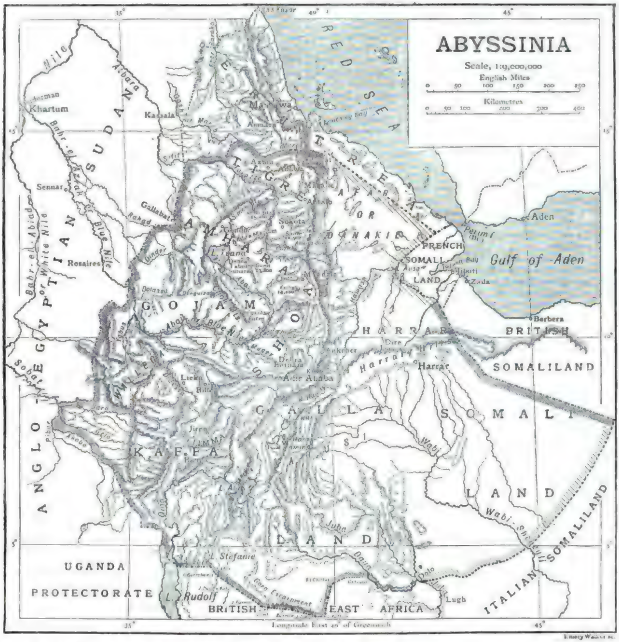
The cemetery of private persons begins in the Ist dynasty with some pit tombs in the town. It was extensive in the XIIth and XIIIth dynasties and contained many rich tombs. In the XVIIIth-XXth dynasties a large number of fine tombs were made, and later ages continued to bury here till Roman times. Many hundred funeral steles were removed by Mariette's workmen, without any record of the burials (Mariette, *Abydos*, ii. and iii.). Later excavations have been recorded by Ayrton, *Abydos*, iii.; MacIver, *El Amrah and Abydos*; and Garstang, *El Arabah*.

The forts lay behind the town. That known as Shunet ez Zebib is about 450×250 ft. over all, and still stands 30 ft. high. It was built by Khasekhemui, the last king of the IInd dynasty. Another fort nearly as large adjoined it, and is probably rather older. A third fort of a squarer form is now occupied by the Coptic convent; its age cannot be ascertained (Ayrton, *Abydos*, iii.). (W. M. F. P.)

ABYSS (Gr. ἀ-, privative, *βυσσός*, bottom), a bottomless depth; hence any deep place. From the late popular *abyssimus* (superlative of Low Latin *abyssus*) through the French *abisme* (i.e. *abîme*) is derived the poetic form *abysm*, pronounced as late as 1616 to rhyme with *time*. The adjective "abyssal" or "abysmal" has been used by zoologists to describe deep regions of the sea; hence *abysmal* zone, *abysmal* flora and fauna, *abysmal* accumulations, the deposit on the abysmal bed of the ocean. In heraldry, the abyss is the middle of an escutcheon. In the Greek version of the Old Testament the word represents (1) the original chaos (Gen. i. 2), (2) the Hebrew *tehom* ("a surging water-deep"), which is used also in apocalyptic and kabbalistic literature and in the New Testament for hell, the place of punishment (cf. Eurip. *Phoen.* for the "yawning chasm of Tartarus"); in the Revised (not the Authorized) version *abyss* is generally used for this idea. Primarily in the Septuagint cosmography the word is applied (*a*) to the waters under the earth which originally covered it, and from which the springs and rivers are supplied, (*b*) to the waters of the firmament which were regarded as closely connected with those below. Derivatively, from the general idea of depth, it acquired the meaning of the place of the dead, though apparently never quite the same as Sheol. In *Revelation* it is the prison of evil spirits whence they may occasionally be let loose, and where Satan is doomed to spend 1000 years. Beneath the altar in the temple of Jerusalem there was believed to be a passage which led down to the abyss of the world, where the foundation-stone of the earth was laid. In rabbinical cosmography the abyss is a region of Gehenna situated below the ocean bed and divided into three or seven parts imposed one above the other. In the Kabbalah the abyss as the opening into the lower world is the abode of evil spirits, and corresponds to the opening of the abyss to the world above. In general the abyss is regarded vaguely as a place of indefinite extent, the abode of mystery and sorrow.

See G. Schiaparelli, *Astronomy in the Old Testament* (Eng. trans., Oxford, 1905).

ABYSSINIA (officially ETHIOPIA), an inland country and empire of N.E. Africa lying, chiefly, between 5° and 15° N. and 35° and 42° E. It is bounded N. by Eritrea (Italian), W.


ABYSSINIA
Scale, 1:9,000,000
English Miles
0 50 100 150 200 250
Kilometres
0 50 100 200 300 400
RED SEA
ERITREA
Massawa
Annesley Bay
Kassala
Khartum
Omdurman
Sennar
Gallabat
Rosaires
ANGLO-EGYPTIAN SUDAN
Nile
Atbara
Bahr el Azrak
Blue Nile
Bahr-el-Abiad or White Nile
Rahad
Dinder
TIGRE
Aksum
Adwa
Makale
Sokota
AMHARA
L. Tsana
AFAR OR DANAKIL
FRENCH SOMALI LAND
Perim I.
Aden
Gulf of Aden
Jibuti
Zeila
Berbera
BRITISH SOMALILAND
GOJAM
Abai or Blue Nile
SHOA
Hawash
HARRAR
Dire Dawa
Harrar
Ankober
Debra Berhan
Adis Ababa
WALEGA
Lieka
Billo
Sobat
Pibor
Akobo
Baro
GALLA
Jiren
LIMMU
KAFFA
GALLA LAND
SOMALI LAND
Wabi
Wabi Shebeli
Juba
Daua
Dolo
Lugh
ITALIAN SOMALILAND
L. Stefanie
L. Rudolf
Goro Escarpment
UGANDA PROTECTORATE
BRITISH EAST AFRICA
15°
40°
45°
35°
10°
5°
Longitude East 40° of Greenwich

Emery Walker sc.

by the Anglo-Egyptian Sudan, S. by British East Africa, S.E. and E. by the British, Italian and French possessions in Somaliland and on the Red Sea. The coast lands held by European powers, which cut off Abyssinia from access to the sea, vary in width from 40 to 250 miles. The country approaches nearest to the ocean on its N.E. border, where the frontier is drawn about 40 m. from the coast of the Red Sea. Abyssinia is narrowest in the north, being here 230 m. across from east to west. It broadens out southward to a width of 900 m. along the line of 9° N., and resembles in shape a triangle with its apex to the north. It is divided into Abyssinia proper (*i.e.* Tigré, Amhara, Gojam, &c.), Shoa, Kaffa and Galla land—all these form a geographical unit—and central Somaliland with Harrar. To the S.W. Abyssinia also includes part of the low country of the Sobat tributary of the Nile. The area of the whole state is about 350,000 sq. m., of which Abyssinian Somaliland covers fully a third.

(1) *Physical Features.*— Between the valley of the Upper Nile and the low lands which skirt the south-western shores of the Red Sea and the Gulf of Aden is a region of elevated plateaus from which rise various mountain ranges. These tablelands and mountains constitute Abyssinia, Shoa, Kaffa and Galla land. On nearly every side the walls of the plateaus rise with considerable abruptness from the plains, constituting outer mountain chains. The Abyssinian highlands are thus a clearly marked orographic division. From Ras Kasar (18° N.) to Annesley Bay (15° N.) the eastern wall of the plateau runs parallel to the Red Sea. It then turns due S. and follows closely the line of 40° E. for some 400 m. About 9° N. there is a break in the wall, through which the river Hawash flows eastward. The main range at this point trends S.W., while south of the Hawash valley, which is some 3000 ft. below the level of the mountains, another massif rises in a direct line south. This

second range sends a chain (the Harrar hills) eastward to the Gulf of Aden. The two chief eastern ranges maintain a parallel course S. by W., with a broad upland valley between—in which valley are a series of lakes—to about 3° N., the outer (eastern) spurs of the plateau still keeping along the line of 40° E. The southern escarpment of the plateau is highly irregular, but has a general direction N.W. and S.E. from 6° N. to 3° N. It overlooks the depression in which is Lake Rudolf and—east of that lake—southern Somaliland. The western wall of the plateau from 6° N. to 11° N. is well marked and precipitous. North of 11° N. the hills turn more to the east and fall more gradually to the plains at their base. On its northern face also the plateau falls in terraces to the level of the eastern Sudan. The eastern escarpment is the best defined of these outer ranges. It has a mean height of from 7000 to 8000 ft., and in many places rises almost perpendicularly from the plain. Narrow and deep clefts, through which descend mountain torrents to lose themselves in the sandy soil of the coast land, afford means of reaching the plateau, or the easier route through the Hawash valley may be chosen. On surmounting this rocky barrier the traveller finds that the encircling rampart rises little above the normal level of the plateau.

(2) The aspect of the highlands is most impressive. The northern portion, lying mainly between 10° and 15° N., consists of a huge mass of Archaean rocks with a mean height of from 7000 to 7500 ft. above the sea, and is flooded in a deep central depression by the waters of Lake Tsana. Above the plateau rise several irregular and generally ill-defined mountain ranges which attain altitudes of from 12,000 to over 15,000 ft. Many of the mountains are of weird and fantastic shape. Characteristic of the country are the enormous fissures which divide it, formed in the course of ages by the erosive action of water. They are in fact the valleys of the rivers which, rising on the uplands or mountain sides, have cut their way to the surrounding lowlands. Some of the valleys are of considerable width; in other cases the opposite walls of the gorges are but two or three hundred yards apart, and fall almost vertically thousands of feet, representing an erosion of hard rock of many millions of cubic feet. One result of the action of the water has been the formation of numerous isolated flat-topped hills or small plateaus, known as *ambas*, with nearly perpendicular sides. The highest peaks are found in the Simen (or Semien) and Gojam ranges. The Simen Mountains lie N.E. of Lake Tsana and culminate in the snow-covered peak of Daschan (Dajan), which has an altitude of 15,160 ft. A few miles east and north respectively of Dajan are Mounts Biuat and Abba Jared, whose summits are a few feet only below that of Dajan. In the Chok Mountains in Gojam Agsias Fatra attains a height of 13,600 ft.

Parallel with the eastern escarpment are the heights of Baila (12,500 ft.), Abuna Josef (13,780 ft.), and Kollo (14,100 ft.), the last-named being S.W. of Magdala. The valley between these hills and the eastern escarpment is one of the longest and most profound chasms in Abyssinia. Between Lake Tsana and the eastern hills are Mounts Guna (13,800 ft.) and Uara Sahia (13,000 ft.). The figures given are, however, approximate only. The southern portion of the highlands—the 10° N. roughly marks the division between north and south—has more open tableland than the northern portion and fewer lofty peaks. Though there are a few heights between 10,000 and 12,000 ft., the majority do not exceed 8000 ft. But the general character of the southern regions is the same as in the north—a much-broken hilly plateau.

Most of the Abyssinian uplands have a decided slope to the north-west, so that nearly all the large rivers find their way in that direction to the Nile. Such are the Takazzé in the north, the Abai in the centre, and the Sobat in the south, and through these three arteries is discharged about four-fifths of the entire drainage. The rest is carried off, almost due north by the Khor Baraka, which occasionally reaches the Red Sea south of Suakin; by the Hawash, which runs out in the saline lacustrine district near the head of Tajura Bay; by the Webi Shebeli (Wabi-Shebeyli) and Juba, which flow S.E. through Somaliland, though the Shebeli fails to reach the Indian Ocean; and by the Omo, the main feeder of the closed basin of Lake Rudolf.

The Takazzé, which is the true upper course of the Atbara, has its head-waters in the central tableland; and falls from about 7000 to 2500 ft. in the tremendous crevasse through which it sweeps round west, north and west again down to the western terraces, where it passes from Abyssinian to Sudan territory. During the rains the Takazzé (*i.e.* the "Terrible") rises some 18 ft. above its normal level, and at this time forms an impassable barrier between the northern and central provinces. In its lower course the river is known by the Arab name Setit. The Setit is joined (14° 10′ N., 36° E.) by the Atbara, a river formed by several streams which rise in the mountains W. and N.W. of Lake Tsana. The Gash or Mareb is the most northerly of the Abyssinian rivers which flow towards the Nile valley. Its head-waters rise on the landward side of the eastern escarpment within 50 miles of Annesley Bay on the Red Sea. It reaches the Sudan plains near Kassala, beyond which place its waters are dissipated in the sandy soil. The Mareb is dry for a great part of the year, but like the Takazzé is subject to sudden freshets during the rains. Only the left bank of the upper course of the river is in Abyssinian territory, the Mareb here forming the boundary between Eritrea and Abyssinia.

(3) The Abai—that is, the upper course of the Blue Nile—has its source near Mount Denguiza in the Gojam highlands (about 11° N. and 37° E.), and first flows for 70 m. nearly due north to the south side of Lake Tsana. Tsana (*q.v.*), which stands from 2500 to 3000 ft. below the normal level of the plateau, has somewhat the aspect of a flooded crater. It has an area of about 1100 sq. m., and a depth in some parts of 250 ft. At the south-east corner the rim of the crater is, as it were, breached by a deep crevasse through which the Abai escapes, and here develops a great semicircular bend like that of the Takazzé, but in the reverse direction—east, south and north-west—down to the plains of Sennar, where it takes the name of Bahr-el-Azrak or Blue Nile. The Abai has many tributaries. Of these the Bashilo rises near Magdala and drains eastern Amhara; the Jamma rises near Ankober and drains northern Shoa; the Muger rises near Adis Ababa and drains south-western Shoa; the Didessa, the largest of the Abai's affluents, rises in the Kaffa hills and has a generally S. to N. course; the Yabus runs near the western edge of the plateau escarpment. All these are perennial rivers. The right-hand tributaries, rising mostly on the western sides of the plateau, have steep slopes and are generally torrential in character. The Bolassa, however, is perennial, and the Rahad and Dinder are important rivers in flood-time.

In the mountains and plateaus of Kaffa and Galla in the south-west of Abyssinia rise the Baro, Gelo, Akobo and other of the chief affluents of the Sobat tributary of the Nile. The Akobo, in about 7° 50′ N. and 33° E., joins the Pibor, which in about 8½° N. and 33° 20′ E. unites with the Baro, the river below the confluence taking the name of Sobat. These rivers descend from the mountains in great falls, and like the other Abyssinian streams are unnavigable in their upper courses. The Baro on reaching the plain becomes, however, a navigable stream affording an open waterway to the Nile. The Baro, Pibor and Akobo form for 250 m. the W. and S.W. frontiers of Abyssinia (see NILE, SOBAT and SUDAN).

The chief river of Abyssinia flowing east is the Hawash (Awash, Awasi), which rises in the Shoan uplands and makes a semicircular bend first S.E. and then N.E. It reaches the Afar (Danakil) lowlands through a broad breach in the eastern escarpment of the plateau, beyond which it is joined on its left bank by its chief affluent, the Germama (Kasam), and then trends round in the direction of Tajura Bay. Here the Hawash is a copious stream nearly 200 ft. wide and 4 ft. deep, even in the dry season, and during the floods rising 50 or 60 ft. above low-water mark, thus inundating the plains for many miles along both its banks. Yet it fails to reach the coast, and after a winding course of about 500 m. passes (in its lower reaches) through a series of *badds* (lagoons) to Lake Aussa, some 60 or 70 m. from the head of Tajura Bay. In this lake the river is lost. This remarkable phenomenon is explained by the position of Aussa in the centre of a saline lacustrine depression several hundred feet below sea-level. While most of the other lagoons are highly saline, with thick incrustations of salt round their margins, Aussa remains fresh throughout the year, owing to the great body of water discharged into it by the Hawash.

Another lacustrine region extends from the Shoa heights south-west to the Samburu (Lake Rudolf) depression. In this chain of lovely upland lakes, some fresh, some brackish, some completely closed, others connected by short channels, the chief links in their order from north to south are:—Zwai, communicating southwards with Hara and Lamina, all in the Arusi Galla territory; then Abai with an outlet to a smaller tarn in the romantic Baroda and Gamo districts, skirted on the west sides by grassy slopes and wooded ranges from 6000 to nearly 9000 ft. high; lastly, in the Asille country, Lake Stefanie, the Chuwaha of the natives, completely closed and falling to a level of about 1800 ft. above the sea. To the same system obviously belongs the neighbouring Lake Rudolf (*q.v.*), which is larger than all the rest put together. This lake receives at its northern end the waters of the Omo, which rises in the Shoa highlands and is a perennial river with many affluents. In its course of some 370 m. it has a total fall of about 6000 ft. (from 7600 at its source to 1600 at lake-level), and is consequently a very rapid stream, being broken by the Kokobi and other falls, and navigable only for a short distance above its mouth. The chief rivers of Somaliland (*q.v.*), the Webi Shebeli and the Juba (*q.v.*), have their rise on the south-eastern slopes of the Abyssinian escarpment, and the greater part of their course is through territory belonging to Abyssinia. There are numerous hot springs in Abyssinia, and earthquakes, though of no great severity, are not uncommon.

(4) *Geology.*—The East African tableland is continued into Abyssinia. Since the visit of W. T. Blanford in 1870 the geology has received little attention from travellers. The following formations are represented:—

Sedimentary and Metamorphic.	
Recent.	Coral, alluvium, sand.
Tertiary.	(?) Limestones of Harrar.
Jurassic.	Antalo Limestones.
Triassic (?).	Adigrat Sandstones.
Archaean.	Gneisses, schists, slaty rocks.
Igneous.	
Recent.	Aden Volcanic Series.
Tertiary, Cretaceous (?).	Magdala group.
Jurassic.	Ashangi group.

Archaean.—The metamorphic rocks compose the main mass of the tableland, and are exposed in every deep valley in Tigré and along the valley of the Blue Nile. Mica schists form the prevalent rocks. Hornblende schists also occur and a compact felspathic rock in the Suris defile. The foliae of the schists strike north and south.

Triassic (?).—In the region of Adigrat the metamorphic rocks are invariably overlain by white and brown sandstones, unfossiliferous, and attaining a maximum thickness of 1000 feet. They are overlain by the fossiliferous limestones of the Antalo group. Around Chelga and Adigrat coal-bearing beds occur, which Blanford suggests may be of the same age as the coal-bearing strata of India. The Adigrat Sandstone possibly represents some portion of the Karroo formation of South Africa.

Jurassic.—The fossiliferous limestones of Antalo are generally horizontal, but are in places much disturbed when interstratified with trap rocks. The fossils are all characteristic Oolite forms and include species of *Hemicidaris*, *Pholadomya*, *Ceromya*, *Trigonia* and *Alaria*.

Igneous Rocks.—Above a height of 8000 ft. the country consists of bedded traps belonging to two distinct and unconformable groups. The lower (Ashangi group) consists of basalts and dolerites often amygdaloidal. Their relation to the Antalo limestones is uncertain, but Blanford considers them to be not later in age than the Oolite. The upper (Magdala group) contains much trachytic rock of considerable thickness, lying perfectly horizontally, and giving rise to a series of terraced ridges characteristic of central Abyssinia. They are interbedded with unfossiliferous sandstones and shales. Of more recent date (probably Tertiary) are some igneous rocks, rich in alkalis, occurring in certain localities in southern Abyssinia. Of still more recent date are the basalts and ashes west of Massawa and around Annesley Bay and known as the Aden Volcanic Series. With regard to the older igneous rocks, the enormous amount they have suffered from denudation is a prominent feature. They have been worn into deep and narrow ravines, sometimes to a depth of 3000 to 4000 ft.

(5) *Climate.*—The climate of Abyssinia and its dependent territories varies greatly. Somaliland and the Danakil lowlands have a hot, dry climate producing semi-desert conditions; the country in the lower basin of the Sobat is hot, swampy and malarious. But over the greater part of Abyssinia as well as the Galla highlands the climate is very healthy and temperate. The country lies wholly within the tropics, but its nearness to the equator is counterbalanced by the elevation of the land. In the deep valleys of the Takazzé and Abai, and generally in places below 4000 ft., the conditions are tropical and fevers are prevalent. On the uplands, however, the air is cool and bracing in summer, and in winter very bleak. The mean range of temperature is between 60° and 80° F. On the higher mountains the climate is Alpine in character. The atmosphere on the plateaus is exceedingly clear, so that objects are easily recognizable at great distances. In addition to the variation in climate dependent on elevation, the year may be divided into three seasons. Winter, or the cold season, lasts from October to February, and is followed by a dry hot period, which about the middle of June gives place to the rainy season. The rain is heaviest in the Takazzé basin in July and August. In the more southern districts of Gojam and Wallega heavy rains continue till the middle of September, and occasionally October is a wet month. There are also spring and winter rains; indeed rain often falls in every month of the year. But the rainy season proper, caused by the south-west monsoon, lasts from June to mid-September, and commencing in the north moves southward. In the region of the Sobat sources the rains begin earlier and last longer. The rainfall varies from about 30 in. a year in Tigré and Amhara to over 40 in. in parts of Galla land. The rainy season is of great importance not only to Abyssinia but to the countries of the Nile valley, as the prosperity of the eastern Sudan and Egypt is largely dependent upon the rainfall. A season of light rain may be sufficient for the needs of Abyssinia, but there is little surplus water to find its way to the Nile; and a shortness of rain means a low Nile, as practically all the flood water of that river is derived from the Abyssinian tributaries (see Nile).

(6) *Flora and Fauna.*—As in a day's journey the traveller may pass from tropical to almost Alpine conditions of climate, so great also is the range of the flora and fauna. In the valleys and lowlands the vegetation is dense, but the general appearance of the plateaus is of a comparatively bare country with trees and bushes thinly scattered over it. The glens and ravines on the hillside are often thickly wooded, and offer a delightful contrast to the open downs. These conditions are particularly characteristic of the northern regions; in the south the vegetation on the uplands is more luxuriant. Among the many varieties of trees and plants found are the date palm, mimosa, wild olive, giant sycamores, junipers and laurels, the myrrh and other gum trees (gnarled and stunted, these flourish most on the eastern foothills), a magnificent pine (the Natal yellow pine, which resists the attacks of the white ant), the fig, orange, lime, pomegranate, peach, apricot, banana and other fruit trees; the grape vine (rare), blackberry and raspberry; the cotton and indigo plants, and occasionally the sugar cane. There are in the south large forests of valuable timber trees; and the coffee plant is indigenous in the Kaffa country, whence it takes

provided, Coptic teachers were brought from Egypt and school buildings were erected.

The Abyssinian calendar is as follows:—The Abyssinian year of 365 days (366 in leap-year) begins on the 1st of Maskarram, which corresponds to about the 10th of September. The months have thirty days each, and are thus named: Maskarram, Tekemt, Hadar, Tahsas, Tarr, Yekatit, Magawit, Miaziah, Genbot, Sanni, Hamle, Nas'hi. The remaining five days in the year, termed Pagmen or Quaggimi (six in leap-year, the extra day being named Kadis Yohannis), are put in at the end and treated as holidays. Abyssinian reckoning is about seven years eight months behind the Gregorian. Festivals, such as Easter, fall a week later than in western Europe.

Army.—A small standing army is maintained in each province of Abyssinia proper. Every able-bodied Abyssinian is expected to join the army in case of need, and a force, well armed with modern weapons, approaching 250,000 can be placed in the field. The cavalry is chiefly composed of Galla horsemen. (F. R. C.)

ETHNOLOGY

(11) The population of the empire is estimated at from 3,500,000 to 5,000,000. The inhabitants consist mainly of the Abyssinians, the Galla and the Somali (the two last-named peoples are separately noticed). Of non-African races the most numerous are Armenians, Indians, Jews and Greeks. There is a small colony of British, French, Italians and Russians. The following remarks apply solely to Abyssinia proper and its inhabitants. It should be remembered that the term "Abyssinian" is purely geographical, and has little or no ethnical significance; it is derived from the Arabic *Habesh*, "mixed," and was a derisive name applied by the Arabs to the heterogeneous inhabitants of the Abyssinian plateau.

Abyssinia appears to have been originally peopled by the eastern branch of the Hamitic family, which has occupied this region from the remotest times, and still constitutes the great bulk of its inhabitants, though the higher classes are now strongly Semitized. The prevailing colour in the central provinces (Amhara, Gojam) is a deep brown, northwards (Tigré, Lasta) it is a pale olive, and here even fair complexions are seen. Southwards (Shoa, Kobbo, Amuru) a decided chocolate and almost sooty black is the rule. Many of the people are distinctly negroid, with big lips, small nose, broad at the base, and frizzly or curly black hair. The negroid element in the population is due chiefly to the number of negro women who have been imported into the harems of the Abyssinians. The majority, however, may be described as a mixed Hamito-Semitic people, who are in general well formed and handsome, with straight and regular features, lively eyes, hair long and straight or somewhat curled and in colour dark olive, approaching to black. The Galla, who came originally from the south, are not found in many parts of the country, but predominate in the Wollo district, between Shoa and Amhara. It is from the Galla that the Abyssinian army is largely recruited, and, indeed, there are few of the chiefs who have not an admixture of Galla blood in their veins.

As regards language, several of the indigenous groups, such as the Khamtas of Lasta, the Agau or Agaos of Agaumeder ("Agao land") and the Falashas (*q.v.*), the so-called "Jews" of Abyssinia, still speak rude dialects of the old Hamitic tongue. But the official language and that of all the upper classes is of Semitic origin, derived from the ancient Himyaritic, which is the most archaic member of the Semitic linguistic family. Geez, as it is called, was introduced with the first immigrants from Yemen, and although no longer spoken is still studied as the liturgical language of the Abyssinian Christians. Its literature consists of numerous translations of Jewish, Greek and Arabic works, besides a valuable version of the Bible. (See ETHIOPIA.) The best modern representative of Geez is the Tigrina of Tigré and Lasta, which is much purer but less cultivated than the Amharic dialect, which is used in state documents, is current in the central and southern provinces and is much affected by Hamitic elements. All are written in a peculiar syllabic script which, unlike all other Semitic forms, runs from left to right, and is derived from that of the Sabaeans and Minaeans, still extant in the very old rock-inscriptions of south Arabia.

The hybridism of the Abyssinians is reflected in their political and social institutions, and especially in their religious beliefs and practices. On a seething mass of African heathendom, already in early times affected by primitive Semitic ideas, was suddenly imposed a form of Christianity which became the state religion. While the various ethnical elements have been merged in the composite Abyssinian nation, the primitive and more advanced religious ideas have nowhere been fused in a uniform Christian system. Foreigners are often surprised at the strange mixture of savagery and lofty notions in a Christian community which, for instance, accounts accidental manslaughter as wilful murder. Recourse is still had to dreams as a means of detecting crime. A priest is summoned, and, if his prayers and curses fail, a small boy is drugged, and "whatever person he dreams of is fixed on as the criminal. . . . If the boy does not dream of the person whom the priest has determined on as the criminal, he is kept under drugs until he does what is required of him" (Count Gleichen, *With the Mission to Menelik*, chap. xvi., 1898).

The Abyssinian character reflects the country's history. Murders and executions are frequent, yet cruelty is not a marked feature of their character; and in war they seldom kill their prisoners. When a man is convicted of murder, he is handed over to the relatives of the deceased, who may either put him to death or accept a ransom. When the murdered person has no relatives, the priests take upon themselves the office of avengers. The natural indolence of the people has been fostered by the constant wars, which have discouraged peaceful occupations. The soldiers live by plunder, the monks by alms. The haughtiest Abyssinian is not above begging, excusing himself with the remark, "God has given us speech for the purpose of begging." The Abyssinians are vain and selfish, irritable but easily appeased; and are an intelligent bright people, fond of gaiety. On every festive occasion, as a saint's day, birth, marriage, &c., it is customary for a rich man to collect his friends and neighbours, and kill a cow and one or two sheep. The principal parts of the cow are eaten raw while yet warm and quivering, the remainder being cut into small pieces and cooked with the favourite sauce of butter and red pepper paste. The raw meat eaten in this way is considered to be very superior in taste and much more tender than when cold. The statement by James Bruce respecting the cutting of steaks from a live cow has frequently been called in question, but there can be no doubt that Bruce actually saw what he narrates. Mutton and goat's flesh are the meats most eaten: pork is avoided on religious grounds, and the hare is never touched, possibly, as in other countries, from superstition. Many forms of game are forbidden; for example, all water-fowl. The principal drinks are *mèse*, a kind of mead, and *bousa*, a sort of beer made from fermented cakes. The Abyssinians are heavy eaters and drinkers, and any occasion is seized as an excuse for a carouse. Old and young, of both sexes, pass days and nights in these *symposia*, at which special customs and rules prevail. Little bread is eaten, the Abyssinian preferring a thin cake of durra meal or *teff*, kneaded with water and exposed to the sun till the dough begins to rise, when it is baked. Salt is a luxury; "he eats salt" being said of a spendthrift. Bars of rock-salt, after serving as coins, are, when broken up, used as food. There is a general looseness of morals: marriage is a very slight tie, which can be dissolved at any time by either husband or wife. Polygamy is by no means uncommon. Hence there is little family affection, and what exists is only between children of the same father and mother. Children of the same father, but of different mothers, are said to be "always enemies to each other." (Samuel Gobat's *Journal of a Three Years' Residence in Abyssinia*, 1834.)

The dress of the Abyssinians is much like that of the Arabs. It consists of close-fitting drawers reaching below the knees, with a sash to hold them, and a large white robe. The Abyssinian, however, is beginning to adopt European clothes on the upper part of the body, and European hats are becoming common.

The Christian Abyssinians usually go barehead and barefoot, in contrast to the Mahommedans, who wear turbans and leather sandals. The women's dress is a smock with sleeves loose to the wrist, where they fit tightly. The priests wear a white jacket with loose sleeves, a head-cloth like a turban and a special type of shoe with turned-up toes and soles projecting at the heel. In the Woldeba district hermits dress in ochre-yellow cloths, while the priests of some sects wear hides dyed red. Clothes are made of cotton, though the nobles and great people wear silk robes presented by the emperor as a mark of honour. The possessor of one of these is allowed to appear in the royal presence wearing it instead of having one shoulder bared, as is the usual Abyssinian method of showing respect. A high-born man covers himself to the mouth in the presence of inferiors. The men either cut their hair short or plait it; married women plait their hair and wind round the head a black or parti-coloured silk handkerchief; girls wear their hair short. In the hot season no Abyssinian goes without a flag-shaped fan of plaited rushes. The Christian Abyssinians, men and women, wear a blue silk cord round the neck, to which is often attached a crucifix. For ornament women wear silver ankle-rings with bells, silver necklaces and silver or gold rosettes in the ears. Silver rings on fingers and also on toes are common. The women are very fond of strong scents, which are generally oils imported from India and Ceylon. The men scarcely ever appear without a long curved knife, generally they carry shield and spear as well. Although the army has been equipped with modern rifles, the common weapon of the people is the matchlock, and slings are still in use. The original arms were a sickle-shaped sword, spear and shield. The Abyssinians are great hunters and are also clever at taming wild beasts. The nobles hunt antelopes with leopards, and giraffes and ostriches with horse and greyhound. In elephant-hunting iron bullets weighing a quarter of a pound are used; throwing-clubs are employed for small game, and lions are hunted with the spear. Lion skins belong to the emperor, but the slayer keeps a strip to decorate his shield.

Stone and mortar are used in building, but the Abyssinian houses are of the roughest kind, being usually circular huts, ill made and thatched with grass. These huts are sometimes made simply of straw and are surrounded by high thorn hedges, but, in the north, square houses, built in stories, flat-roofed, the roof sometimes laid at the same slope as the hillside, and some with pitched thatched roofs, are common. The inside walls are plastered with cow-dung, clay and finely chopped straw. None of the houses have chimneys, and smoke soon colours the interior a dark brown. Generally the houses are filthy and ill ventilated and swarm with vermin. Drainage and sanitary arrangements do not exist. The caves of the highlands are often used as dwellings. The most remarkable buildings in Abyssinia are certain churches hewn out of the solid rock. The chief native industries are leather-work, embroidery and filigree metal-work; and the weaving of straw mats and baskets is extensively practised. The baskets are particularly well made, and are frequently used to contain milk.

Abyssinian art is crude and is mainly reserved for rough frescoes in the churches. These frescoes, however, often exhibit considerable skill, and are indicative of the lively imagination of their painters. They are in the Byzantine style and the colouring is gaudy. Saints and good people are always depicted full face, the devil and all bad folk are shown in profile. Among the finest frescoes are those in the church of the Holy Trinity at Adowa and those in the church at Kwarata, on the shores of Lake Tsana. The churches are usually circular in form, the walls of stone, the roof thatched.

The chief musical instruments are rough types of trumpets and flutes, drums, tambourines and cymbals, and quadrangular harps.

History

(12) Abyssinia, or at least the northern portion of it, was included in the tract of country known to the ancients as Ethiopia, the northern limits of which reached at one time to about Syene. The connexion between Egypt and Ethiopia was in early times very intimate, and occasionally the two countries were under the same ruler, so that the arts and civilization of the one naturally found their way into the other. In early times, too, the Hebrews had commercial intercourse with the Ethiopians; and according to Abyssinian tradition the queen of Sheba who visited Solomon was a monarch of their country, and from their son Menelek the kings of Abyssinia claim descent. During the Captivity many of the Jews settled here and brought with them a knowledge of the Jewish religion. Under the Ptolemies, the arts as well as the enterprise of the Greeks entered Ethiopia, and led to the establishment of Greek colonies. A Greek inscription at Adulis, no longer extant, but copied by Cosmas of Alexandria, and preserved in his *Topographia Christiana*, records that Ptolemy Euergetes, the third of the Greek dynasty in Egypt, invaded the countries on both sides of the Red Sea, and having reduced most of the provinces of Tigré to subjection, returned to the port of Adulis, and there offered sacrifices to Jupiter, Mars and Neptune. Another inscription, not so ancient, found at Axum, states that Aizanas, king of the Axumites, the Homerites, &c., conquered the nation of the Bogos, and returned thanks to his father, the god Mars, for his victory. Out of these Greek colonies appears to have arisen the kingdom of Auxume which flourished from the 1st to the 7th century A.D. and was at one time nearly coextensive with Abyssinia proper. The capital Auxume and the seaport Adulis were then the chief centres of the trade with the interior of Africa in gold dust, ivory, leather, aromatics, &c. At Axum, the site of the ancient capital, many vestiges of its former greatness still exist; and the ruins of Adulis, which was once a seaport on the bay of Annesley, are now about 4 m. from the shore (see ETHIOPIA, *The Axumite Kingdom*).

Introduction of Christianity.

(13) Christianity was introduced into the country by Frumentius (*q.v.*), who was consecrated first bishop of Ethiopia by St Athanasius of Alexandria about A.D. 330. From the scanty evidence available it would appear that the new religion at first made little progress, and the Axumite kings seem to have been among the latest converts. Towards the close of the 5th century a great company of monks are believed to have established themselves in the country. Since that time monachism has been a power among the people and not without its influence on the course of events. In the early part of the 6th century the king of the Homerites, on the opposite coast of the Red Sea, having persecuted the Christians, the emperor Justinian I. requested the king of Auxume, Caleb or El-Esbaha, to avenge their cause. He accordingly collected an army, crossed over into Arabia, and conquered Yemen (*c.* 525), which remained subject to Ethiopia for about fifty years. This was the most flourishing period in the annals of the country. The Ethiopians possessed the richest part of Arabia, carried on a large trade, which extended as far as India and Ceylon, and were in constant communication with the Greek empire. Their expulsion from Arabia, followed by the conquest of Egypt by the Mahommedans in the middle of the 7th century, changed this state of affairs, and the continued advances of the followers of the Prophet at length cut them off from almost every means of communication with the civilized world; so that, as Gibbon says, "encompassed by the enemies of their religion, the Ethiopians slept for near a thousand years, forgetful of the world by whom they were forgotten." About A.D. 1000, a Jewish princess, Judith, conceived the design of murdering all the members of the royal family, and of establishing herself in their stead. During the execution of this project, the infant king was carried off by some faithful adherents, and conveyed to Shoa, where his authority was acknowledged, while Judith reigned for forty years over the rest of the kingdom, and transmitted the crown to her descendants. In 1268 the kingdom was restored to the royal house in the person of Yekūnō Amlāk.

(14) Towards the close of the 15th century the Portuguese missions into Abyssinia began. A belief had long prevailed in Europe of the existence of a Christian kingdom in the far east, whose monarch was known as Prester John, and various

Portuguese influence.

expeditions had been sent in quest of it. Among others who had engaged in this search was Pedro de Covilham, who arrived in Abyssinia in 1490, and, believing that he had at length reached the far-famed kingdom, presented to the negūs, or emperor of the country, a letter from his master the king of Portugal, addressed to Prester John. Covilham remained in the country, but in 1507 an Armenian named Matthew was sent by the negūs to the king of Portugal to request his aid against the Mahommedans. In 1520 a Portuguese fleet, with Matthew on board, entered the Red Sea in compliance with this request, and an embassy from the fleet visited the negūs, Lebna Dengel Dawit (David) II., and remained in Abyssinia for about six years. One of this embassy was Father Francisco Alvarez, from whom we have the earliest and not the least interesting account of the country. Between 1528 and 1540 armies of Mahommedans, under the renowned general Mahommed Gran (or Granyé, probably a Somali or a Galla), entered Abyssinia from the low country to the south-east, and overran the kingdom, obliging the emperor to take refuge in the mountain fastnesses. In this extremity recourse was again had to the Portuguese. John Bermudez, a subordinate member of the mission of 1520, who had remained in the country after the departure of the embassy, was, according to his own statement (which is untrustworthy), ordained successor to the *abuna* (archbishop), and sent to Lisbon. Bermudez certainly came to Europe, but with what credentials is not known. Be that as it may, a Portuguese fleet, under the command of Stephen da Gama, was sent from India and arrived at Massawa in February 1541. Here he received an ambassador from the negūs beseeching him to send help against the Moslems, and in the July following a force of 450 musqueteers, under the command of Christopher da Gama, younger brother of the admiral, marched into the interior, and being joined by native troops were at first successful against the enemy; but they were subsequently defeated, and their commander taken prisoner and put to death (August 1542). On the 21st of February 1543, however, Mahommed Granyé was shot in an engagement and his forces totally routed. After this, quarrels arose between the negūs and Bermudez, who had returned to Abyssinia with Christopher da Gama and who now wished the emperor publicly to profess himself a convert to Rome. This the negūs refused to do, and at length Bermudez was obliged to make his way out of the country. The Jesuits who had accompanied or followed the da Gama expedition into Abyssinia, and fixed their headquarters at Fremona (near Adowa), were oppressed and neglected, but not actually expelled. In the beginning of the 17th century Father Pedro Paez arrived at Fremona, a man of great tact and judgment, who soon rose into high favour at court, and gained over the emperor to his faith. He directed the erection of churches, palaces and bridges in different parts of the country, and carried out many useful works. His successor Mendez was a man of much less conciliatory manners, and the feelings of the people became strongly excited against the intruders, till at length, on the death of the negūs Sysenius, Socinius or Seged I., and the accession of his son Fasilidas in 1633, they were all sent out of the country, after having had a footing there for nearly a century and a half. The French physician C. J. Poncet, who went there in 1698, *via* Sennar and the Blue Nile, was the only European that afterwards visited the country before Bruce in 1769. James Bruce's main object was to discover the sources of the Nile, which he was convinced lay in Abyssinia. Accordingly, leaving Massawa in September 1769, he travelled *via* Axum to Gondar, where he was well received by King Tekla Haimanot II. He accompanied the king on a warlike expedition round Lake Tsana, moving S. round the eastern shore, crossing the genuine Blue Nile (Abai) close to its point of issue from the lake and returning *via* the western shore. On a second expedition of his own he proved to his own satisfaction that the river originated some 40 miles S.W. of the lake at a place called Geesh (4th of November 1770). He showed that this river flowed into the lake, and left it by its now well-known outlet. Bruce subsequently returned to Egypt (end of 1772) *via* Gondar, the upper Atbara, Sennar, the Nile and the Korosko desert (see Bruce, James).

Visits of Poncet and Bruce.

Position of the negūs negusti.

(15) In order to attain a clear view of native Abyssinian history, as distinct from the visits and influence of Europeans, it must be borne in mind that during the last three hundred years, and indeed for a longer period, for the old chroniclers may be trusted to have given a somewhat distorted view of the importance of the particular chieftains with whom they came in contact, the country has been merely a conglomeration of provinces and districts, ill defined, loosely connected and generally at war with each other. Of these the chief provinces have been Tigré (northern), Amhara (central) and Shoa (southern). The seat of government, or rather of overlordship, has usually been in Amhara, the ruler of which, calling himself negūs negusti (king of kings, or emperor), has exacted tribute, when he could, from the other provinces. The title of negūs negusti has been to a considerable extent based on the blood in the veins of the claimant. All the emperors have based their claims on their direct descent from Solomon and the queen of Sheba; but it is needless to say that in many, if not in most, cases their success has been due more to the force of their arms than to the purity of their lineage. Some of the rulers of the larger provinces have at times been given, or have given themselves, the title of negūs or king, so that on occasion as many as three, or even more, negūses have been reigning at the same time; and this must be borne in mind by the student of Abyssinian history in order to avoid confusion of rulers. The whole history of the country is in fact one gloomy record of internecine wars, barbaric deeds and unstable governments, of adventurers usurping thrones, only to be themselves unseated, and of raids, rapine and pillage. Into this chaos enter from time to time broad rays of sunshine, the efforts of a few enlightened monarchs to evolve order from disorder, and to supply to their people the blessings of peace and civilization. Bearing these matters in mind, we find that during the 18th century the most prominent and beneficent rulers were the emperor Yesu of Gondar, who died about 1720, Sebastié, negūs of Shoa (1703–1718), Amada Yesus of Shoa, who extended his kingdom and founded Ankober (1743–1774), Tekla Giorgis of Amhara (1770–1798?) and Asfa Nassen of Shoa (1774–1807), the latter being especially renowned as a wise and benevolent monarch. The first years of the 19th century were disturbed by fierce campaigns between Guxa, ras of Gondar, and Wolda Selassié, ras of Tigré, who were both striving for the crown of Guxa's master, the emperor Eguala Izeion. Wolda Selassié was eventually the victor, and practically ruled the whole country till his death in 1816 at the age of eighty.

British mission and missionary enterprise.

(16) Mention must here be made of the first British mission, under Lord Valentia and Mr Henry Salt, which was sent in 1805 to conclude an alliance with Abyssinia, and obtain a port on the Red Sea in case France secured Egypt by dividing up the Turkish empire with Russia. This mission was succeeded by many travellers, missionaries and merchants of all countries, and the stream of Europeans continued until well into Theodore's reign. For convenience' sake we insert at this point a partial list of missionaries and others who visited the country during the second third of the 19th century—merely calling attention to the fact that their visits were distributed over widely different parts of the country, ruled by distinct lines of monarchs or governors. In 1830 Protestant missionary enterprise was begun by Samuel Gobat and Christian Kugler, who were sent out by the Church Missionary Society, and were well received by the ras of Tigré. Mr Kugler died soon after his arrival, and his place was subsequently supplied by Mr C. W. Isenberg, who was followed by Dr Ludwig Krapf, the discoverer of Mount Kenya, and others. Mr (afterwards Bishop) Gobat proceeded to Gondar, where he also met with a favourable reception. In 1833 he returned to Europe, and published a journal of his residence in Abyssinia. In 1834 Gobat went back to Tigré, but in 1836 ill health compelled him to leave. In 1838 other missionaries were obliged to leave the country, owing to the opposition of the native

priests. Messrs Isenberg and Krapf went south, and established themselves at Shoa. The former soon after returned to England, but Mr Krapf remained in Shoa till March 1842, when he removed to Mombasa. Dr E. Rüppell, the German naturalist, visited the country in 1831, and remained nearly two years. M. E. Combes and M. Tamisier arrived at Massawa in 1835, and visited districts which had not been traversed by Europeans since the time of the Portuguese. One who did much at the time to extend our geographical knowledge of the country was Dr C. T. Beke (*q.v.*), who was there from 1840 to 1843. Mr Mansfield Parkyns was there from 1843 to 1846, and wrote the most interesting book on the country since the time of Bruce. Bishop Gobat having conceived the idea of sending lay missionaries into the country, who would engage in secular occupations as well as carry on missionary work, Dr Krapf returned to Abyssinia in 1855 with Mr Flad as pioneers of that mission; Krapf, however, was not permitted to remain in the country. Six lay workers came out at first, and they were subsequently joined by others. Their secular work, however, appears to have been more valuable to Theodore than their preaching, so that he employed them as workmen to himself, and established them at Gaffat, near his capital. Mr Stern arrived in Abyssinia in 1860, and after a visit to Europe returned in 1863, accompanied by Mr and Mrs Rosenthal.[1]

Rivalry of British and French factions.

(17) Wolda Selassié of Tigré was succeeded in 1817, through force of arms, by Sabagadis of Agamé, and the latter, as ras of Tigré, introduced various Englishmen, whom he much admired, into the country. He increased the prosperity of his land considerably, but by so doing roused the jealousy of Ras Marié of Amhara—to whom he had refused tribute—and Ubié, son of Hailo Mariam, a governor of Simen. In an ensuing battle (in January 1831), both Sabagadis and Marié were killed, and Ubié retired to watch events from his own province. Marié was shortly succeeded in the ras-ship of Amhara by Ali, a nephew of Guxa and a Mahommedan. But Ubié, who was aiming at the crown, soon attacked Ras Ali, and after several indecisive campaigns proclaimed himself negûs of Tigré. To him came many French missionaries and travellers, chief of whom were Lieut. Lefebvre, charged (1839) with political and geographical missions, and Captains Galinier and Ferret, who completed for him a useful triangulation and survey of Tigré and Simen (1840–1842). The brothers Antoine and Arnaud d'Abbadie (*q.v.*) spent ten years (1838–1848) in the country, making scientific investigations of great value, and also involving themselves in the stormy politics of the country. Northern Abyssinia was now divided into two camps, the one, Amhara and Ras Ali, under Protestant British, and the other, Tigré and Ubié, under Roman Catholic French, influence. The latent hostility between the two factions threatened at one time to develop into a religious war, but no serious campaigns took place until Kassa (later Theodore) appeared on the scene.

Rise of the emperor Theodore.

(18) Lij (= Mr) Kassa was born in Kwara, a small district of Western Amhara, in 1818. His father was a small local chief, and his uncle was governor of the districts of Dembea, Kwara and Chelga between Lake Tsana and the undefined N.W. frontier. He was educated in a monastery, but preferred a more active life, and by his talents and energy came rapidly to the front. On the death of his uncle he was made chief of Kwara, but in consequence of the arrest of his brother Bilawa by Ras Ali, he raised the standard of revolt against the latter, and, collecting a large force, repeatedly beat the troops that were sent against him by the ras (1841–1847). On one occasion peace was restored by his receiving Tavavich, daughter of Ras Ali, in marriage; and this lady is said to have been a good and wise counsellor during her lifetime. He next turned his arms against the Turks, in the direction of Massawa, but was defeated; and the mother of Ras Ali having insulted him in his fallen condition, he proclaimed his independence. As his power was increasing, to the detriment of both Ras Ali and Ubié, these two princes combined against him, but were heavily defeated by him at Gorgora (on the southern shore of Lake Tsana) in 1853. Ubié retreated to Tigré, and Ras Ali fled to Begemeder, where he eventually died. Kassa now ruled in Amhara, but his ambition was to attain to supreme power, and he turned his attention to conquering the remaining chief divisions of the country, Gojam, Tigré and Shoa, which still remained unsubdued. Berro, ras of Gojam, in order to save himself, attempted to combine with Tigré, but his army was intercepted by Kassa and totally destroyed, himself being taken prisoner and executed (May 1854). Shortly afterwards Kassa moved against Tigré, defeated Ubié's forces at Deragié, in Simen (February 1855), took their chief prisoner and proclaimed himself negûs negusti of Ethiopia under the name of Theodore III. He now turned his attention to Shoa.

Growing power of Shoa.

(19) Retracing our steps for a moment in that direction, we find that in 1813 Sahela (or Sella) Selassié, younger son of the preceding ras, Wassen Seged, had proclaimed himself negûs or king. His reign was long and beneficent. He restored the towns of Debra-Berhan and Angolala, and founded Entotto, the strong stone-built town whose ruins overlook the modern capital, Adis Ababa. In the terrible "famine of St Luke" in 1835, Selassié still further won the hearts of his subjects by his wise measures and personal generosity; and by extending his hospitality to Europeans, he brought his country within the closer ken of civilized European powers. During his reign he received the missions of Major W. Cornwallis Harris, sent by the governor-general of India (1841), and M. Rochet d'Héricourt, sent by Louis Philippe (1843), with both of whom he concluded friendly treaties on behalf of their respective governments. He also wrote to Pope Pius IX., asking that a Roman Catholic bishop should be sent to him. This request was acceded to, and the pope despatched Monsignor Massaja to Shoa. But before the prelate could reach the country, Selassié was dead (1847), leaving his eldest son, Haeli Melicoth, to succeed him. Melicoth at once proclaimed himself negûs, and by sending for Massaja, who had arrived at Gondar, gave rise to the suspicion that he wished to have himself crowned as emperor. By increasing his dominions at the expense of the Gallas, he still further roused the jealousy of the northerners, and a treaty which he concluded with Ras Ali against Kassa in 1850 determined the latter to crush him at the earliest opportunity.

Thus it was that in 1855 Kassa, under the name of the emperor Theodore, advanced against Shoa with a large army. Dissensions broke out among the Shoans, and after a desperate and futile attack on Theodore at Debra-Berhan, Haeli Melicoth died of exhaustion and fever, nominating with his last breath his eleven-year-old son Menelek[2] as successor (November 1855). Dargé, Haeli's brother, took charge of the young prince, but after a hard fight with Angeda, one of Theodore's rases, was obliged to capitulate. Menelek was handed over to the negûs, taken to Gondar, and there trained in Theodore's service.

(20) Theodore was now in the zenith of his career. He is described as being generous to excess, free from cupidity, merciful to his vanquished enemies, and strictly continent, but subject to violent bursts of anger and possessed of unyielding pride and fanatical religious zeal. He was also a man of education and intelligence, superior to those among whom he lived, with natural talents for governing and gaining the esteem of others. He had, further, a noble bearing and majestic walk, a frame capable of enduring any amount of fatigue, and is said to have been "the best shot, the best spearman, the best runner, and the best horseman in Abyssinia." Had he contented himself with the sovereignty of Amhara and Tigré, he might have maintained his position; but he was led to exhaust his strength against the Wollo Gallas, which was probably one of the chief causes of his ruin. He obtained several victories over that people, ravaged their country, took possession of Magdala, which he afterwards made his principal stronghold, and enlisted many of the chiefs and their followers in his own ranks. As has been shown, he also reduced the kingdom of Shoa, and took Ankober, the capital;

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[1] Since Theodore's time Protestant missionary work, except by natives, has been stopped.

[2] Menelek means "a second self."

but in the meantime his own people were groaning under his heavy exactions, rebellions were breaking out in various parts of his provinces, and his good queen Tavavich was now dead.

Theodore's quarrel with Great Britain.

The British consul, Walter C. Plowden, who was strongly attached to Theodore, having been ordered by his government in 1860 to return to Massawa, was attacked on his way by a rebel named Garred, mortally wounded, and taken prisoner. Theodore attacked the rebels, and in the action the murderer of Mr Plowden was slain by his friend and companion Mr J. T. Bell, an engineer, but the latter lost his life in preserving that of Theodore. The deaths of the two Englishmen were terribly avenged by the slaughter or mutilation of nearly 2000 rebels. Theodore soon after married his second wife Terunish, the proud daughter of the late governor of Tigré, who felt neither affection nor respect for the upstart who had dethroned her father, and the union was by no means a happy one. In 1862 he made a second expedition against the Gallas, which was stained with atrocious cruelties. Theodore had now given himself up to intoxication and lust. When the news of Mr Plowden's death reached England, Captain C. D. Cameron was appointed to succeed him as consul, and arrived at Massawa in February 1862. He proceeded to the camp of the king, to whom he presented a rifle, a pair of pistols and a letter in the queen's name. In October Captain Cameron was sent home by Theodore, with a letter to the queen of England, which reached the Foreign Office on the 12th of February 1863. This letter was put aside and no answer returned, and to this in no small degree are to be attributed the difficulties that subsequently arose with that country. In November despatches were received from England, but no answer to the emperor's letter, and this, together with a visit paid by Captain Cameron to the Egyptian frontier town of Kassala, greatly offended him; accordingly in January 1864 Captain Cameron and his suite, with Messrs Stern and Rosenthal, were cast into prison. When the news of this reached England, the government resolved, when too late, to send an answer to the emperor's letter, and selected Mr Hormuzd Rassam to be its bearer. He arrived at Massawa in July 1864, and immediately despatched a messenger requesting permission to present himself before the emperor. Neither to this nor a subsequent application was any answer returned till August 1865, when a curt note was received, stating that Consul Cameron had been released, and if Mr Rassam still desired to visit the king, he was to proceed by the route of Gallabat. Later in the year Theodore became more civil, and the British party on arrival at the king's camp in Damot, on the 25th of January 1866, were received with all honour, and were afterwards sent to Kwarata, on Lake Tsana, there to await the arrival of the captives. The latter reached Kwarata on the 12th of March, and everything appeared to proceed favourably. A month later they started for the coast, but had not proceeded far when they were all brought back and put into confinement. Theodore then wrote a letter to the queen, requesting European workmen and machinery to be sent to him, and despatched it by Mr Flad. The Europeans, although detained as prisoners, were not at first unkindly treated; but in the end of June they were sent to Magdala, where they were soon afterwards put in chains. They suffered hunger, cold and misery, and were in constant fear of death, till the spring of 1868 when they were relieved by the British troops.

(21) In the meantime the power of Theodore in the country was rapidly waning. Shoa had already shaken off his yoke; Gojam was virtually independent; Walkeit and Simen were under a rebel chief; and Lasta, Waag and the country about Lake Ashangi had submitted to Wagshum Gobassié, who had also overrun Tigré and appointed Dejaj Kassai his governor. The latter, however, in 1867 rebelled against his master and assumed the supreme power of that province. This was the state of matters when the English troops made their appearance in the country. With a view if possible to effect the release of the prisoners by conciliatory measures, Mr Flad was sent back, with some artisans and machinery, and a letter from the queen, stating that these would be handed over to his majesty on the release of the prisoners and their return to Massawa. This, however, failed to influence the emperor, and the English government at length saw that they must have recourse to arms. In July 1867, therefore, it was resolved to send an army into Abyssinia to enforce the release of the captives, under Sir Robert Napier (1st Baron Napier of Magdala). The landing-place selected was Mulkutto (Zula), on Annesley Bay, the point of the coast nearest to the site of the ancient Adulis, and we are told that "the pioneers of the English expedition followed to some extent in the footsteps of the adventurous soldiers of Ptolemy, and met with a few faint traces of this old-world enterprise" (C. R. Markham). The force amounted to upwards of 16,000 men, besides 12,640 belonging to the transport service, and followers, making in all upwards of 32,000 men. The task to be accomplished was to march over 400 miles of a mountainous and little-known country, inhabited by savage tribes, to the camp or fortress of Theodore, and compel him to deliver up his captives. The commander-in-chief landed on the 7th of January 1868, and soon after the troops began to move forward through the pass of Senafé, and southward through the districts of Agamé, Tera, Endarta, Wojerat, Lasta and Wadela. In the meantime Theodore had been reduced to great straits. His army, which at one time numbered over 100,000 men, was rapidly deserting him, and he could hardly obtain food for his followers. He resolved to quit his captial Debra-Tabor, which he burned, and set out with the remains of his army for Magdala. During this march he displayed an amount of engineering skill in the construction of roads, of military talent and fertility of resource, that excited the admiration and astonishment of his enemies. On the afternoon of the 10th of April a force of about 3000 men suddenly poured down upon the English in the plain of Arogié, a few miles from Magdala. They advanced again and again to the charge, but were each time driven back, and finally retired in good order. Early next morning Theodore sent Lieut. Prideaux, one of the captives, and Mr Flad, accompanied by a native chief, to the English camp to sue for peace. Answer was returned, that if he would deliver up all the Europeans in his hands, and submit to the queen of England, he would receive honourable treatment. The captives were liberated and sent away, and accompanying a letter to the English general was a present of 1000 cows and 500 sheep, the acceptance of which would, according to Eastern custom, imply that peace was granted. Through some misunderstanding, word was sent to Theodore that the present would be accepted, and he felt that he was now safe; but in the evening he learned that it had not been received, and despair again seized him. Early next morning he attempted to escape with a few of his followers, but subsequently returned. The same day (13th April) Magdala was stormed and taken, practically without loss, and within they found the dead body of the emperor, who had fallen by his own hand. The inhabitants and troops were subsequently sent away, the fortifications destroyed and the town burned. The queen Terunish having expressed her wish to go back to her own country, accompanied the British army, but died during the march, and her son Alamayahu, the only legitimate son of the emperor, was brought to England, as this was the desire of his father.[1] The success of the expedition was in no small degree owing to the aid afforded by the several native chiefs through whose country it passed, and no one did more in this way than Dejaj Kassa or Kassai of Tigré. In acknowledgment of this, several pieces of ordnance, small arms and ammunition, with much of the surplus stores, were handed over to him, and the English troops left the country in May 1868.

Sir Robert Napier's expedition.

Menelek II., king of Shoa.

(22) It is now time to return to the story of the young prince Menelek, who, as we have seen, had been nominated by his late father as ruler of Shoa, but was in Theodore's power in Tigré. The following table shows his descent since the beginning of the 19th century:—

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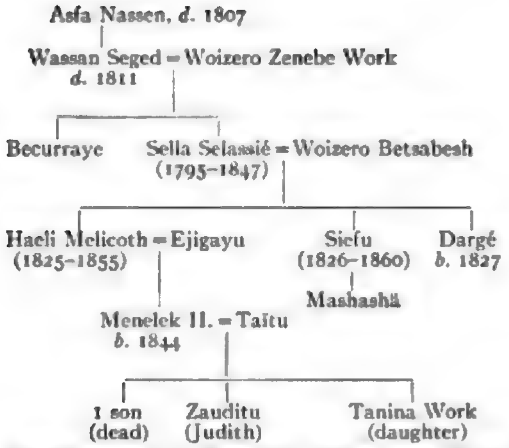
[1] He was subsequently sent to school at Rugby, but died in his nineteenth year, on the 14th of November 1879. He was buried at St George's Chapel, Windsor.



On the retirement of Theodore's forces from Shoa in 1855, Siefu, brother of Haeli Melicoth, proclaimed himself negûs of Shoa at Ankober, and beat the local representatives of the northern government. The emperor returned, however, in 1858, and after several repulses succeeded in entering Ankober, where he behaved with great cruelty, murdering or mutilating all the inhabitants. Siefu kept up a gallant defence for two more years, but was then killed by Kebret, one of his own chiefs. Thus chaos again reigned supreme in Shoa. In 1865, Menelek, now a *dejasmach*[1] of Tigré, took advantage of Theodore's difficulties with the British government and escaped to Workitu, queen of the Wollo Galla country. The emperor, who held as hostage a son of Workitu, threatened to kill the boy unless Menelek were given up; but the gallant queen refused, and lost both her son and her throne. The fugitive meanwhile arrived safely in Shoa, and was there acclaimed as negûs. For the next three years Menelek devoted himself to strengthening and disciplining his army, to legislation, to building towns, such as Liché (near Debra-Berhan), Worra Hailu (Wollo Galla country), &c., and to repelling the incursions of the Gallas. On the death of Theodore (13th April 1868) many Shoans, including Ras Dargé, were released, and Menelek began to feel himself strong enough, after a few preliminary minor campaigns, to undertake offensive operations against the northern princes. But these projects were of little avail, for Kassai of Tigré, as above mentioned, had by this time (1872) risen to supreme power in the north. With the help of the rifles and guns presented to him by the British, he had beaten Ras Bareya of Tigré, Wagshum Gobassié of Amhara and Tekla Giorgis of Condar, and after proclaiming himself negûs negusti under the name of Johannes or John, was now preparing to march on Shoa. Here, however, Menelek was saved from probable destruction through the action of Egypt. This power had, by the advice of Werner Munzinger (*q.v.*), their Swiss governor of Massawa, seized and occupied in 1872 the northern province of Bogos; and, later on, insisted on occupying Hamasen also, for fear Bogos should be attacked. John, after futile protests, collected an army, and with the assistance of Ras Walad Michael, hereditary chief of Bogos, advanced against the Egyptian forces, who were under the command of one Arendrup, a Dane. Meeting near the Mareb, the Egyptians were beaten in detail, and almost annihilated at Gundet (13th November 1875). An avenging expedition was prepared in the spring of the following year, and, numbering 14,000 men under Ratib Pasha, Loring (American), and Prince Hassan, advanced to Gura and fortified a position in the neighbourhood. Although reinforced by Walad Michael, who had now quarrelled with John, the Egyptians were a second time (25th March 1876) heavily beaten by the Abyssinians, and retired, losing an enormous quantity of both men and rifles. Colonel C. G. Gordon, governor-general of the Sudan, was now ordered to go and make peace with John, but the king had moved south with his army, intending to punish Menelek for having raided Gondar whilst he, John, was engaged with the Egyptians.

King John attains supreme power.

(23) Menelek's kingdom was meanwhile torn in twain by serious dissensions, which had been instigated by his concubine Bafana. This lady, to whom he was much attached, had been endeavouring to secure the succession of one of her own sons to the throne of Shoa, and had almost succeeded in getting rid of Mashashä, son of Siefu and cousin of Menelek, who was the apparent heir. On the approach of John, the Shoans united for a time against their common enemy. But after a few skirmishes they melted away, and Menelek was obliged to submit and do obeisance to John. The latter behaved with much generosity, but at the same time imposed terms which effectually deprived Shoa of her independence (March 1878). In 1879 Gordon was sent on a fresh mission to John on behalf of Egypt; but he was treated with scant courtesy, and was obliged to leave the country without achieving anything permanent.

Beginning of Italian influence.

The Italians now come on the scene. Assab, a port near the southern entrance of the Red Sea, had been bought from the local sultan in March 1870 by an Italian company, which, after acquiring more land in 1879 and 1880, was bought out by the Italian government in 1882. In this year Count Pietro Antonelli was despatched to Shoa in order to improve the prospects of the colony by treaties with Menelek and the sultan of Aussa. Several missions followed upon this one, with more or less successful results; but both John and Menelek became uneasy when Beilul, a port to the north of Assab Bay, was occupied by the Italians in January 1885, and Massawa taken over by them from Egypt in the following month. This latter act was greatly resented by the Abyssinians, for by a treaty concluded with a British and Egyptian mission under Admiral Hewett and Mason Pasha[1] in the previous year, free transit of goods was to be allowed through this port. Matters came to a head in January 1887, when the Abyssinians, in consequence of a refusal from General Gené to withdraw his troops, surrounded and attacked a detachment of 500 Italian troops at Dogali, killing more than 400 of them. Reinforcements were sent from Italy, whilst in the autumn the British government stepped in and tried to mediate by means of a mission under Mr (afterwards Sir Gerald) Portal. His mission, however proved abortive, and after many difficulties and dangers he returned to Egypt at the end of the year. In April 1888 the Italian forces, numbering over 20,000 men, came into touch with the Abyssinian army; but negotiations took the place of fighting, with the result that both forces retired, the Italians only leaving some 5000 troops in Eritrea, as their colony was now called. Meanwhile John had not been idle with regard to the dervishes, who had in the meantime become masters of the Egyptian Sudan. Although he had set his troops in motion too late to relieve Kassala, Ras Alula, his chief general, had succeeded in inflicting a handsome defeat on Osman Digna at Kufit in September 1885. Fighting between the dervishes and the Abyssinians continued, and in August 1887 the dervishes entered and sacked Gondar. After some delay, King John took the field in force against the enemy, who were still harassing the north-west of his territory. A great battle ensued at Gallabat, in which the dervishes, under Zeki Tumal, were beaten. But a stray bullet struck the king, and the Abyssinians decided to retire. The king died during the night, and his body fell into the hands of the enemy (9th March 1889).

Menelek emperor.

(24) Immediately the news of John's death reached Menelek, he proclaimed himself emperor, and received the submission of Gondar, Gojam and several other provinces. In common with other northern princes, Mangasha, reputed son and heir of King John, with the yellow-eyed Ras Alula,[2] refused to acknowledge the sovereignty of Menelek; but, on the latter marching against them in the following January with a large army, they submitted. As it happened, Count Antonelli was with Menelek when he claimed

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[1] A title variously translated. A *dejasmach* (*dejaj*) is a high official, ranking immediately below a *ras*.

[1] The main object of this mission was to seek John's assistance in evacuating the Egyptian garrisons in the Sudan, which were threatened by the dervishes.

[2] Ras Alula died February 1897, aged about 52. He had raised himself by his military talents from being a groom and private soldier to the position of generalissimo of the army.

the throne, and promptly concluded (2nd of May 1889) with him on behalf of Italy a friendly treaty, to be known hereafter as the famous Uccialli treaty. In consequence of this the Italians occupied Asmara, made friends with Mangasha and received Ras Makonnen,[1] Menelek's nephew, as his plenipotentiary in Italy. Thus it seemed as though hostilities between the two countries had come to a definite end, and that peace was assured in the land. For the next three years the land was fairly quiet, the chief political events being the convention (6th February 1891) between Italy and Abyssinia, protocols between Italy and Great Britain (24th March and 15th April 1891) and a proclamation by Menelek (10th April 1891), all on the subject of boundaries. As, however, the Italians became more and more friendly with Mangasha and Tigré the apprehensions of Menelek increased, till at last, in February 1893, he wrote denouncing the Uccialli treaty, which differed in the Italian and Amharic versions. According to the former, the negūs was bound to make use of Italy as a channel for communicating with other powers, whereas the Amharic version left it optional. Meanwhile the dervishes were threatening Eritrea. A fine action by Colonel Arimondi gained Agordat for Italy (21st December 1893), and a brilliant march by Colonel Baratieri resulted in the acquisition of Kassala (17th July 1894).

On his return Baratieri found that Mangasha was intriguing with the dervishes, and had actually crossed the frontier with a large army. At Koatit and Senafé (13th to 15th January 1895) Mangasha was met and heavily defeated by Baratieri, who occupied Adrigat in March. But as the year wore on the Italian commander pushed his forces unsupported too far to the south. Menelek was advancing with a large army in national support of Mangasha, and the subsequent reverses at Amba Alagi (7th December 1895) and Macalle (23rd January 1896) forced the Italians to fall back.

Battle of Adowa.

Reinforcements of many thousands were meanwhile arriving at Massawa, and in February Baratieri took the field at the head of over 13,000 men. Menelek's army, amounting to about 90,000, had during this time advanced, and was occupying a strong position at Abba Garima, near Adua (or Adowa). Here Baratieri attacked him on the 1st of March, but the difficulties of the country were great, and one of the four Italian brigades had pushed too far forward. This brigade was attacked by overwhelming numbers, and on the remaining brigades advancing in support, they were successively cut to pieces by the encircling masses of the enemy. The Italians lost over 4500 white and 2000 native troops killed and wounded, and over 2500 prisoners, of which 1600 were white, whilst the Abyssinians owned to a loss of over 3000. General Baldissera advanced with a large body of reinforcements to avenge this defeat, but the Abyssinians, desperately short of supplies, had already retired, and beyond the peaceful relief of Adrigat no further operations took place. It may here be remarked that the white prisoners taken by Menelek were exceedingly well treated by him, and that he behaved throughout the struggle with Italy with the greatest humanity and dignity. On the 26th of October following a provisional treaty of peace was concluded at Adis Ababa, annulling the treaty of Uccialli and recognizing the absolute independence of Abyssinia. This treaty was ratified, and followed by other treaties and agreements defining the Eritrean-Abyssinian and the Abyssinian-Italian Somaliland frontiers (see ITALY, *History*, and SOMALILAND, *Italian*).

Menelek as independent monarch.

(25) The war, so disastrous to Italy, attracted the attention of all Europe to Abyssinia and its monarch, and numerous missions, two Russian, three French and one British, were despatched to the country, and hospitably received by Menelek. The British one, under Mr (afterwards Sir) Rennell Rodd, concluded a friendly treaty with Abyssinia (15th of May 1897), but did not, except in the direction of Somaliland, touch on frontier questions, which for several years continued a subject of discussion. During the same year (1897) a small French expedition under Messrs Clochette and de Bonchamps endeavoured to reach the Nile, but, after surmounting many difficulties, stuck in the marshes of the Upper Sobat, and was obliged to return. Another expedition of Abyssinians, under Dejaj Tasamma and accompanied by three Europeans—Faivre (French), Potter (Swiss) and Artomonov (Russian)—started early in 1898, and reached the Nile at the Sobat mouth in June, a few days only before Major Marchand and his gallant companions arrived on the scene. But no contact was made, and the expedition returned to Abyssinia.

In the same year Menelek proceeded northwards with a large army for the purpose of chastising Mangasha, who was again rebelling against his authority. After some trifling fighting Mangasha submitted, and Ras Makonnen despatched a force to subdue Beni Shangul, the chief of which gold country, Wad Tur el Guri, was showing signs of disaffection. This effected, the Abyssinians almost came into contact with the Egyptian troops sent up the Blue Nile (after the occupation of Khartum) to Famaka and towards Gallabat; but as both sides were anxious to avoid a collision over this latter town, no hostile results ensued. An excellent understanding was, in fact, established between these two contiguous countries, in spite of occasional disturbances by bandits on the frontier. On this frontier question, a treaty was concluded on the 15th of May 1902 between England and Abyssinia for the delimitation of the Sudan-Abyssinian frontier. Menelek, in addition, agreed not to obstruct the waters of Lake Tsana, the Blue Nile or the Sobat, so as not to interfere with the Nile irrigation question, and he also agreed to give a concession, if such should be required, for the construction of a British railway through his dominions, to connect the Sudan with Uganda. A combined British-Abyssinian expedition (Mr A. E. Butter's) was despatched in 1901 to propose and survey a boundary between Abyssinia on the one side and British East Africa and Uganda on the other; and the report of the expedition was made public by the British government in November 1904. It was followed in 1908 by an agreement defining the frontiers concerned.

Co-operation with Britain against the Somali mullah.

(26) In 1899 the rebellion of the so-called "mad" mullah (Hajji Mahommed Abdullah) began on the borders of British Somaliland. An Abyssinian expedition was, at Great Britain's request, sent against the mullah, but without much effect. In the spring and summer of 1901 a fresh expedition from Harrar was undertaken against the mullah, who was laying waste the Ogaden country. Two British officers accompanied this force, which was to co-operate with British troops advancing from Somaliland; but little was achieved by the Abyssinians, and after undergoing considerable privations and losses, and harassing the country generally, including that of some friendly tribes, it returned to Harrar. During the 1902–3 campaign of General (Sir) W. H. Manning, Menelek provided a force of 5000 to co-operate with the British and to occupy the Webi Shebeli and south-western parts of the Haud. This time the Abyssinians were more successful, and beat the rebels in a pitched fight; but the difficulties of the country again precluded effective co-operation. During General Egerton's campaign (1903–4) yet another force of 5000 Abyssinians was despatched towards Somaliland. Accompanied by a few British officers, it worked its way southward, but did not contribute much towards the final solution. In any case, however, it is significant that the Abyssinians have repeatedly been willing to co-operate with the British away from their own country.

Growth of European influence.

Regarding the question of railways, the first concession for a railway from the coast at Jibuti (French Somaliland) to the interior was granted by Menelek to a French company in 1894. The company having met with numberless difficulties and financial troubles, the French government, on the extinction of the company's funds, came to the rescue and provided money for the construction. (In the alternative British capitalists interested in the company would have obtained control of the line.) The French government's help enabled the railway to be completed to Dire Dawa, 28 m. from Harrar, by the last day of 1902. Difficulties arose over the continuation of the railway to Adis Ababa and beyond, and the proposed internationalization of the line. These difficulties, which hindered the work of construction for years, were composed (so far as the European Powers interested were concerned) in 1906. By the terms of an Anglo-French-Italian agreement, signed in London on the 13th of December of that year, it was decided that the French company should build the railway as far as Adis Ababa, while railway construction west of that place should be under British auspices, with the stipulation that any railway connecting Italy's possessions on the Red Sea with its Somaliland protectorate should be built under Italian auspices. A British, an Italian and an Abyssinian representative were to be appointed to the board of the French company, and a French director to the board of any British or Italian company formed. Absolute equality of treatment on the railway and at Jibuti was guaranteed to the commerce of all the Powers.

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[1] Ras of Harrar, which province had been conquered and occupied by Menelek in January 1887.

Meanwhile the country slowly developed in parts and opened out cautiously to European influences. Most of the Powers appointed representatives at Menelek's capital—the British minister-plenipotentiary and consul-general, Lieut.-Colonel Sir J. L. Harrington, having been appointed shortly after the British mission in 1897. In December 1903 an American mission visited Adis Ababa, and a commercial treaty between the United States and Abyssinia was signed. A German mission visited the country early in 1905 and also concluded a treaty of commerce with the negūs. Later in the year a German minister was appointed to the court of the emperor.

After 1897 British influence in Abyssinia, owing largely no doubt to the conquest of the Sudan, the destruction of the dervish power and the result of the Fashoda incident, was sensibly on the increase. Of the remaining powers France occupied the most important position in the country. Ras Makonnen, the most capable and civilized of Menelek's probable successors, died in March 1906, and Mangasha died later in the same year; the question of the succession therefore opened up the possibility that, in spite of recent civilizing influences, Abyssinia might still relapse in the future into its old state of conflict. The Anglo-French-Italian agreement of December 1906 contained provisions in view of this contingency. The preamble of the document declared that it was the common interest of the three Powers "to maintain intact the integrity of Ethiopia," and Article I. provided for their co-operation in maintaining "the political and territorial *status quo* in Ethiopia." Should, however, the *status quo* be disturbed, the powers were to concert to safeguard their special interests. The terms of the agreement were settled in July 1906, and its text forthwith communicated to the negūs. After considerable hesitation Menelek sent, early in December, a note to the powers, in which, after thanking them for their intentions, he stipulated that the agreement should not in any way limit his own sovereign rights. In June 1908, by the nomination of his grandson, Lij Yasu (b. 1896), as his heir, the emperor endeavoured to end the rivalry between various princes claiming the succession to the throne. (See MENELEK.) A convention with Italy, concluded in the same year, settled the frontier questions outstanding with that country. (G.*)

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ABYSSINIAN CHURCH. As the chronicle of Axum relates, Christianity was adopted in Abyssinia in the 4th century. About A.D. 330 Frumentius was made first bishop of Ethiopia by Athanasius, patriarch of Alexandria. Cedrenus and Nicephorus err in dating Abyssinian Christianity from Justinian, *c.* 542. From Frumentius to the present day, with one break, the Metropolitan (*Abuna*) has always been appointed from Egypt, and, oddly enough, he is always a foreigner. Little is known of church history down to the period of Jesuit rule, which broke the connexion with Egypt from about 1500 to 1633. But the Abyssinians rejected the council of Chalcedon, and still remain monophysites. Union with the Coptic Church (*q.v.*) continued after the Arab conquest in Egypt. Abū Sālih records (12th century) that the patriarch used always to send letters twice a year to the kings of Abyssinia and Nubia, till Al Hākim stopped the practice. Cyril, 67th patriarch, sent Severus as bishop, with orders to put down polygamy and to enforce observance of canonical consecration for all churches. These examples show the close relations of the two churches in the Middle Ages. But early in the 16th century the church was brought under the influence of a Portuguese mission. In 1439, in the reign of Zara Yakub, a religious discussion between an Abyssinian, Abba Giorgis, and a Frank had led to the despatch of an embassy from Abyssinia to the Vatican; but the initiative in the Roman Catholic missions to Abyssinia was taken, not by Rome, but by Portugal, as an incident in the struggle with the Mussulmans for the command of the trade route to India by the

Red Sea. In 1507 Matthew, or Matheus, an Armenian, had been sent as Abyssinian envoy to Portugal to ask aid against the Mussulmans, and in 1520 an embassy under Dom Rodrigo de Lima landed in Abyssinia. An interesting account of this mission, which remained for several years, was written by Francisco Alvarez, the chaplain. Later, Ignatius Loyola wished to essay the task of conversion, but was forbidden. Instead, the pope sent out João Nunez Barreto as patriarch of the East Indies, with André de Oviedo as bishop; and from Goa envoys went to Abyssinia, followed by Oviedo himself, to secure the king's adherence to Rome. After repeated failures some measure of success was achieved, but not till 1604 did the king make formal submission to the pope. Then the people rebelled and the king was slain. Fresh Jesuit victories were followed sooner or later by fresh revolt, and Roman rule hardly triumphed when once for all it was overthrown. In 1633 the Jesuits were expelled and allegiance to Alexandria resumed.

There are many early rock-cut churches in Abyssinia, closely resembling the Coptic. After these, two main types of architecture are found—one basilican, the other native. The cathedral at Axum is basilican, though the early basilicas are nearly all in ruins—*e.g.* that at Adulis and that of Martula Mariam in Gojam, rebuilt in the 16th century on the ancient foundations. These examples show the influence of those architects who, in the 6th century, built the splendid basilicas at Sanaa and elsewhere in Arabia. Of native churches there are two forms—one square or oblong, found in Tigré; the other circular, found in Amhara and Shoa. In both, the sanctuary is square and stands clear in the centre. An outer court, circular or rectangular, surrounds the body of the church. The square type may be due to basilican influence, the circular is a mere adaptation of the native hut: in both, the arrangements are obviously based on Jewish tradition. Church and outer court are usually thatched, with wattled or mud-built walls adorned with rude frescoes. The altar is a board on four wooden pillars having upon it a small slab (tabût) of alabaster, marble, or shittim wood, which forms its essential part. At Martula Mariam, the wooden altar overlaid with gold had two slabs of solid gold, one 500, the other 800 ounces in weight. The ark kept at Axum is described as 2 feet high, covered with gold and gems. The liturgy was celebrated on it in the king's palace at Christmas, Epiphany, Easter and Feast of the Cross.

Generally the Abyssinians agree with the Copts in ritual and practice. The LXX. version was translated into Geez, the literary language, which is used for all services, though hardly understood. Saints and angels are highly revered, if not adored, but graven images are forbidden. Fasts are long and rigid. Confession and absolution, strictly enforced, give great power to the priesthood. The clergy must marry, but once only. Pilgrimage to Jerusalem is a religious duty and covers many sins.

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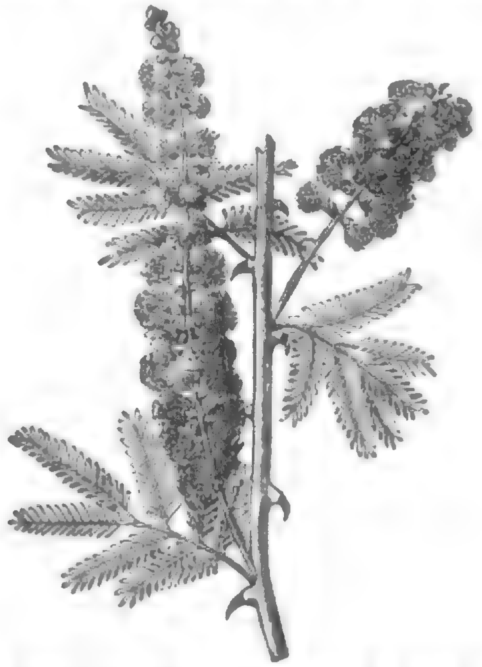
ACACIA, a genus of shrubs and trees belonging to the family Leguminosae and the sub-family Mimoseae. The small flowers are arranged in rounded or elongated clusters. The leaves are compound pinnate in general (see fig.). In some instances, however, more especially in the Australian species, the leaflets are suppressed and the leaf-stalks become vertically flattened, and serve the purpose of leaves. The vertical position protects the structure from the intense sunlight, as with their edges towards the sky and earth they do not intercept light so fully as ordinary horizontally placed leaves. There are about 450 species of acacia widely scattered over the warmer regions of the globe. They abound in Australia and Africa. Various species yield gum. True gum-arabic is the product of *Acacia Senegal*, abundant in both east and west tropical Africa. *Acacia arabica* is the gum-arabic tree of India, but yields a gum inferior to the true gum-arabic. An astringent medicine, called catechu (*q.v.*) or cutch, is procured from several species, but more especially from *Acacia catechu*, by boiling down the wood and evaporating the solution so as to get an extract. The bark of *Acacia arabica*, under the name of *babul* or *babool*, is used in Scinde for tanning. The bark of various Australian species, known as wattles, is also very rich in tannin and forms an important article of export. Such are *Acacia pycnantha*, golden wattle, *A. decurrens*, tan wattle, and *A. dealbata*, silver wattle. The pods of *Acacia nilotica*, under the name of neb-neb, and of other African species are also rich in tannin and used by tanners. The seeds of *Acacia niopo* are roasted and used as snuff in South America. Some species afford valuable timber; such are *Acacia melanoxylon*, black wood of Australia, which attains a great size; its wood is used for furniture, and takes a high polish; and *Acacia homalophylla* (also Australian), myall wood, which yields a fragrant timber, used for ornamental purposes. *Acacia formosa* supplies the valuable Cuba timber called sabicu. *Acacia seyal* is supposed to be the shittah tree of the Bible, which supplied shittim-wood. *Acacia heterophylla*, from Mauritius and Bourbon, and *Acacia koa* from the Sandwich Islands are also good timber trees. The plants often bear spines, especially those growing in arid districts in Australia or tropical and South Africa. These sometimes represent branches which have become short, hard and pungent, or sometimes leaf-stipules. *Acacia armata* is the kangaroo-thorn of Australia, *A. giraffae*, the African camel-thorn. In the Central American *Acacia sphaerocephala* (bull-thorn acacia) and *A. spadicigera*, the large thorn-like stipules are hollow and afford shelter for ants, which feed on a secretion of honey on the leaf-stalk and curious food-bodies at the tips of the leaflets; in return they protect the plant against leaf-cutting insects. In common language the term Acacia is often applied to species of the genus Robinia (*q.v.*) which belongs also to the



Acacia Senegal, flowering branch, natural size (after A. Meyer and Schumann).

From Strasburger's *Lehrbuch der Botanik*.

Leguminous family, but is placed in a different section. *Robinia Pseud-acacia*, or false acacia, is cultivated in the milder parts of Britain, and forms a large tree, with beautiful pea-like blossoms. The tree is sometimes called the locust tree.

ACADEMIES. The word "academy" is derived from "the olive grove of Academe, Plato's retirement," the birthplace of the Academic school of philosophy (see under ACADEMY, GREEK). The schools of Athens after the model of the Academy continued to flourish almost without a break for nine centuries till they were abolished by a decree of Justinian. It was not without significance in tracing the history of the word that Cicero gave the name to his villa near Puteoli. It was there that he entertained his cultured friends and held the symposia which he afterwards elaborated in *Academic Questions* and other philosophic and moral dialogues.

"Academy," in its modern acceptation, may be defined as a society or corporate body having for its object the cultivation and promotion of literature, of science and of art, either severally or in combination, undertaken for the pure love of these pursuits, with no interested motive. Modern academies, moreover, have, almost without exception, some form of public recognition; they are either founded or endowed, or subsidized, or at least patronized, by the sovereign of the state. The term "academy" is very loosely used in modern times; and, in essentials, other bodies with the title of "society" or "college," or even "school," often embody the same idea; we are only concerned here, however, with those which, bearing the title of academy, are of historical importance in their various spheres.

Early History.—The first academy, as thus defined, though it might with equal justice claim to be the first of universities, was the museum of Alexandria founded at the beginning of the 3rd century B.C. by the first of the Ptolemies. There all the sciences then known were pursued, and the most learned men of Greece and of the East gathered beneath its spacious porticos. Here, too, was the nucleus of the famous library of Alexandria.

Passing over the state institute for the promotion of science founded at Constantinople by Caesar Bardas in the 9th century, and the various academies established by the Moors at Granada, at Corduba and as far east as Samarkand, we come to the academy over which Alcuin presided, a branch of the School of the Palace established by Charlemagne in 782. This academy was the prototype of the learned coteries of Paris which Molière afterwards satirized. It took all knowledge for its province; it included the learned priest and the prince who could not write his own name, and it sought to solve all problems by witty definitions.

The David of Alcuin's academy (such was the name that the emperor assumed) found no successors or imitators, and the tradition of an Oxford academy of Alfred the Great has been proved to rest on a forgery. The academy of arts founded at Florence in 1270 by Brunetto Latini was short-lived and has left no memories, and modern literary academies may be said to trace their lineage in direct descent from the troubadours of the early 14th century. The first Floral Games were held at Toulouse in May 1324, at the summons of a gild of troubadours, who invited "honourable lords, friends and companions who possess the science whence spring joy, pleasure, good sense, merit and politeness" to assemble in their garden of the "gay science" and recite their works. The prize, a golden violet, was awarded to Vidal de Castelnaudary for a poem to the glory of the Virgin. In spite of the English invasion and other adversities the Floral Games survived till, about the year 1500, their permanence was secured by the munificent bequest of Clémence Isaure, a rich lady of Toulouse. In 1694 the *Académie des Jeux Floraux* was constituted an academy by letters patent of Louis XIV.; its statutes were reformed and the number of members raised to 36. Suppressed during the Revolution it was revived in 1806, and still continues to award amaranths of gold and silver lilies, for which there is keen competition.

Provence led the way, but Italy of the Renaissance is the soil in which academies most grew and flourished. The *Accademia Pontaniana*, to give it its subsequent title, was founded at Florence in 1433 by Antonio Beccadelli of Palermo and fostered by Laurentius Valla. Far more famous was the *Accademia Platonica*, founded *c.* 1442 by Cosimo de' Medici, which numbered among its members Marsilio Ficino, Pico della Mirandola, Machiavelli and Angelo Poliziano. It was, as the name implies, chiefly occupied with Plato, but it added to its objects the study of Dante and the purification of the Italian language, and though it lived for barely half a century, yet its influence as a model for similar learned societies was great and lasting.

Modern Academies.—Academies have played an important part in the revival of learning and in the birth of scientific inquiry. They mark an age of aristocracies when letters were the distinction of the few and when science had not been differentiated into distinct branches, each with its own specialists. Their interest is mainly historical, and it cannot be maintained that at the present day they have much direct influence on the advancement of learning either by way of research or of publication. For example, the standard dictionaries of France, Germany and England are the work, not of academies, but of individual scholars, of Littré, Grimm and Murray. Matthew Arnold's plea for an English academy of letters to save his countrymen from the note of vulgarity and provinciality has met with no response. Academies have been supplanted, socially by the modern club, and intellectually by societies devoted to special branches of science. Those that survive from the past serve, like the Heralds' College, to set an official stamp on literary and scientific merit. The principal academies of Europe, past and present, may be dealt with in various classes, according to the subjects to which they are devoted.

I. SCIENTIFIC ACADEMIES

Austria.—The *Kaiserliche Akademie der Wissenschaften* at Vienna, originally projected by Leibnitz, was founded by the emperor Ferdinand I. in 1846, and has two classes—mathematics and natural science, and history and philology.

Belgium and the Netherlands.—A literary society was founded at Brussels in 1769 by Count Cobenzl, the prime minister of Maria Theresa, which after various changes of name and constitution became in 1816 the *Académie impériale et royale des sciences et belles-lettres*, under the patronage of William I. of the Netherlands. It has devoted itself principally to natural history and antiquities. The Royal Institute of the Low Countries was founded in 1808 by King Louis Bonaparte. It was replaced in 1851 by the Royal Academy of Sciences at Amsterdam, to which in 1856 a literary section was added.

Denmark.—The *Kongelige danske videnskabernes selskab* (Royal Academy of Sciences) at Copenhagen owes its origin to Christian VI., who in 1742 invited six Danish numismatists to arrange his cabinet of medals. Historians and antiquaries were called in to assist at the sittings, and the commission developed into a sort of learned club. The king took it under his protection, enlarged its scope by the addition of natural history, physics and mathematics, and in 1743 constituted it a royal academy with an endowment fund.

France.—The old *Académie des sciences* had the same origin as the more celebrated *Académie française*. A number of men of science had for some thirty years met together, first at the house of P. Marsenne, then at that of Montmort, a member of the Council of State, afterwards at that of Melchisédec Thévenot, the learned traveller. It included Descartes, Gassendi, Blaise and Etienne Pascal. Hobbes, the author of *Leviathan*, was presented to it during his visit to Paris in 1640. Colbert conceived the idea of giving an official status to this learned club. A number of chemists, physicians, anatomists and eminent mathematicians, among whom were Christian Huyghens and Bernard Frenicle de Bessy (1605–1675), the author of a famous treatise on magic squares, were chosen to form the nucleus of the new society. Pensions were granted by Louis XIV. to each of the members, and a fund for instruments and experiment was placed at their disposal. They began their session on the 22nd of December 1666 in the Royal Library, meeting twice a week—the mathematicians on Wednesdays, the physicists on Saturdays. Duhamel was appointed permanent secretary, a post he owed more to his polished Latinity than to his scientific attainments, all the proceedings of the society being recorded in Latin, and C. A. Couplet was made treasurer. At first the academy was rather a laboratory and observatory than an academy proper. Experiments were undertaken in common and results discussed. Several foreign *savants*, in particular the Danish astronomer Roemer, joined the society, attracted by the liberality of the Grand Monarque; and the German physician and geometer Tschirnhausen and Sir Isaac Newton were made foreign associates. The death of Colbert, who was succeeded by Louvois, exercised a disastrous effect on the fortunes of the academy. The labours of the academicians were diverted from the pursuit of pure science to such works as the construction of fountains and cascades at Versailles, and the mathematicians were employed to calculate the odds of the games of lansquenet and basset. In 1699 the academy was reconstituted by Louis Phelypeaux, comte de Pontchartrain, under whose department as secretary of state the academies came. By its new constitution it consisted of twenty-five members, ten honorary, men of high rank interested in science, and fifteen pensionaries, who were the working members. Of these three were geometricians, three astronomers, three mechanicians, three anatomists, and three chemists. Each of these three had two associates, and, besides, each pensionary had the privilege of naming a pupil. There were eight foreign and four free associates. The officers were, a president and a vice-president, named by the king from among the honorary members, and a secretary and treasurer chosen from the pensionaries, who held office for life. Fontenelle, a man of wit, and rather a popularizer of science than an original investigator, succeeded Duhamel as secretary. The constitution was purely aristocratical, differing in that respect from that of the French Academy, in which the principle of equality among the members was never violated. Science was not yet strong enough to dispense with the patronage of the great. The two leading spirits of the academy at this period were Clairault and Réaumur. To trace the subsequent fortunes of this academy would be to write the history of the rise and progress of science in France. It has reckoned among its members Laplace, Buffon, Lagrange, D'Alembert, Lavoisier, and Jussieu, the father of modern botany. On the 21st of December 1792 it met for the last time, and it was suppressed with its sister academies by the act of the Convention on the 8th of April 1793. Some of its members were guillotined, some were imprisoned, more were reduced to poverty. The aristocracy of talent was almost as much detested and persecuted by the Revolution as that of rank.

In 1795 the Convention decided on founding an *Institut National* which was to replace all the academies, and its first class corresponded closely to the old academy of sciences. In 1816 the *Académie des sciences* was reconstituted as a branch of the Institute. The new academy has reckoned among its members, besides many other brilliant men, Carnot the engineer, the physicists Fresnel, Ampère, Arago, Biot, the chemists Gay-Lussac and Thénard, the zoologists G. Cuvier and the two Geoffroy Saint-Hilaires. In France there were also considerable academies in most of the large towns. Montpellier, for example, had a royal academy of sciences, founded in 1706 by Louis XIV., on nearly the same footing as that of Paris, of which, indeed, it was in some measure the counterpart. It was reconstituted in 1847, and organized under three sections—medicine, science and letters. Toulouse also has an academy, founded in 1640, under the name of *Société de lanternistes*; and there were analogous institutions at Nîmes, Arles, Lyons, Dijon, Bordeaux and elsewhere.

Germany.—The *Collegium Curiosum* was a scientific society, founded by J. C. Sturm, professor of mathematics and natural philosophy in the university of Altorf, in Franconia, in 1672, on the plan of the *Accademia del Cimento*. It originally consisted of twenty members, and continued to flourish long after the death of its founder. The early labours of the society were devoted to the repetition (under varied conditions) of the most notable experiments of the day, or to the discussion of the results. Two volumes (1676–1685) of proceedings were published by Sturm. The former, *Collegium Experimentale sive Curiosum*, begins with an account of the diving-bell, "a new invention"; next follow chapters on the camera obscura, the Torricellian experiment, the air-pump, microscope, telescope, &c.

The *Akademie der Wissenschaften zu Berlin*, if judged by the work it has produced, holds the first place in Germany. Its origin was the *Societas Regia Scientiarum*, constituted in 1700 by Frederick I. on the comprehensive plan of Leibnitz, who was its first president. Hampered and restricted under Frederick William I., it was reorganized under Frederick II. on the French model furnished by Maupertuis, and received its present constitution in 1812. It is divided into two classes and four sections—physical and mathematical, philosophical and historical. Each section has a permanent secretary with a salary of 1200 marks, and each of the 50 regular members is paid 600 marks a year. Among the contributors to its transactions (first volume published in 1710), to name only the dead, we find Immanuel Bekker, Böckling, Bernoulli, F. Bopp, P. Buttmann, Encke (of comet fame), L. Euler, the brothers Grimm, the two Humboldts, Lachmann, Lagrange, Leibnitz, T. Mommsen, J. Müller, G. Niebuhr, C. Ritter (the geographer), Savigny and Zumpt. Frederick II. presented in 1768 *A Dissertation on Ennui*. To the *Berlin Academy* we owe the *Corpus Inscriptionum Graecarum*, the *Corpus Inscriptionum Latinarum*, and the *Monumenta Germaniae Historica*.

The *Akademie der Wissenschaften zu Mannheim* was founded by the elector Palatine in 1755. Since 1780 it has devoted itself specially to meteorology, and has published valuable observations under the title of *Ephemerides Societatis Meteorologicae Theodoro-Palatinae*.

The Bavarian *Akademie der Wissenschaften zu München* was founded in 1759. It is distinguished from other academies by the part it has played in national education. Maximilian Joseph, the enlightened elector (afterwards king) of Bavaria, induced the government to hand over to it the organization and superintendence of public instruction, and this work was carried out by Privy-councillor Jacobi, the president of the academy. In recent years the academy has specially occupied itself with natural history.

The *Königliche Akademie der Wissenschaften*, at Erfurt, which dates from 1754 and devotes itself to applied science, and the Hessian academy of sciences at Giessen, which publishes medical transactions, also deserve mention.

Great Britain and Ireland.— In 1616 a scheme for founding a royal academy was started by Edmund Bolton, an eminent scholar and antiquary, who in his petition to King James I., which was supported by George Villiers, marquis of Buckingham, proposed that the title of the academy should be "King James, his Academe or College of honour." A list of the proposed original members is still extant, and includes the names of George Chapman, Michael Drayton, Ben Jonson, John Selden, Sir Kenelm Digby and Sir Henry Wotton. The constitution is of interest as reflecting the mind of the learned king. The academy was to consist of three classes,—tutelaries, who were to be Knights of the Garter, auxiliaries, all noblemen or ministers of state, and the essentials, "called from out of the most famous lay gentlemen of England, and either living in the light of things, or without any title of profession or art of life for lucre." Among other duties to be assigned to this academy was the licensing of all books other than theological. The death of King James put an end to the undertaking. In 1635 a second attempt to found an academy was made under the patronage of Charles I., with the title of "Minerva's Museum," for the instruction of young noblemen in the liberal arts and sciences, but the project was soon dropped. (For the "British Academy" see III. below.) About 1645 the more ardent followers of Bacon used to meet, some in London, some at Oxford, for the discussion of subjects connected with experimental science. This was the original of the Royal Society (*q.v.*), which received its charter in 1662.

A society was formed in Dublin, similar to the Royal Society in London, as early as 1683; but the distracted state of the country proved unpropitious to the cultivation of philosophy and literature. The Royal Irish Academy grew from a society established in Dublin about 1782 by a number of gentlemen, most of whom belonged to the university. They held weekly meetings, and read, in turn, essays on various subjects. They professed to unite the advancement of science with the history of mankind and polite literature. The first volume of transactions appeared in 1788.

Hungary.—The *Magyar Tudományos Akadémia* (Hungarian Academy of Sciences) was founded in 1825 by Count Stephen Széchenyi for the encouragement of the study of the Hungarian language and the various sciences. It has about 300 members and a fine building in Budapest containing a picture gallery and housing various national collections.

Italy.—The *Academia Secretorum Naturae* was founded at Naples in 1560 by Giambattista della Porta. It arose like the French Academy from a little club of friends who met at della Porta's house and called themselves the *Otiosi*. The condition of membership was to have made some discovery in natural science. Della Porta was suspected of practising the black arts and summoned to Rome to justify himself before the papal court. He was acquitted by Paul V., but commanded to close his academy.

The *Accademia dei Lincei*, to which della Porta was admitted when at Rome, and of which he became the chief ornament, had been founded in 1603 by Federigo Cesi, the marchese di Monticelli. Galileo and Colonna were among its earliest members. Its device was a lynx with upturned eyes, tearing a Cerberus with its claws. As a monument the Lincei have left the magnificent edition of Fernandez de Oviedo's *Natural History of Mexico* (Rome, 1651, fol.), printed at the expense of the founder and elaborately annotated by the members. This academy was resuscitated in 1870 under the title of *Reale Accademia dei Lincei*, with a literary as well as a scientific side, endowed in 1878 by King Humbert; and in 1883 it received official recognition from the Italian government, being lodged in the Corsini palace, whose owner made over to it his library and collections.

The *Accademia del Cimento* was founded at Florence in 1657 by Leopold de' Medici, brother of the grand duke Ferdinand II., at the instigation of Vincenzo Viviani, the geometrician. It was an academy of experiment, a deliberate protest against the deductive science of the quadrivium. Its founder left it when he was made a cardinal, and it lasted only ten years, but the grand folio published in Italian (afterwards translated into Latin) in 1667 is a landmark in the history of science. It contains experiments on the pressure of the air (Torricelli and Borelli were among its members), on the incompressibility of water and on universal gravity.

Science in Italy is now represented by the *Reale Accademia delle Scienze* (Royal Academy of Sciences), founded in 1757 as a private society, and incorporated under its present name by royal warrant in 1783. It consists of 40 full members, who must be residents of Turin, 20 non-resident, and 20 foreign members. It publishes a yearly volume of proceedings and awards prizes to learned works. There are, besides, royal academies of science at Naples, Lucca and Palermo.

Portugal.—The *Academia Real das Sciencias* (Royal Academy of Sciences) at Lisbon dates from 1779. It was reorganized in 1851 and since then has been chiefly occupied in the publication of *Portugaliae Monumenta Historica*.

Russia.—The *Académie Impériale des sciences de Saint-Petersbourg, Imperatorskaya Akademiya naük*, was projected by Peter the Great. The advice of Wolff and Leibnitz was sought, and several learned foreigners were invited to become members. Peter himself drew the plan, and signed it on the 10th of February 1724; but his sudden death delayed its fulfilment. On the 21st of December 1725, however, Catherine I. established it according to his plan, and on the 27th the society met for the first time. On the 1st of August 1726, Catherine honoured the meeting with her presence, when Professor G. B. Bilfinger, a German scientist, delivered an oration upon the determination of magnetic variations and longitude. Shortly afterwards the empress settled a fund of £4982 per annum for the support of the academy; and 15 eminent members were admitted and pensioned, under the title of professors in the various branches of science and literature. The most distinguished of these were Nicholas and Daniel Bernouilli, the two Delisles, Bilfinger, and Wolff.

During the short reign of Peter II. the salaries of members were discontinued, and the academy neglected by the Court; but it was again patronized by the empress Anne, who added a seminary under the superintendence of the professors. Both institutions flourished for some time under the direction of Baron Johann Albrecht Korff (1697–1766). At the accession of Elizabeth the original plan was enlarged and improved; learned foreigners were drawn to St Petersburg; and, what was considered a good omen for the literature of Russia, two natives, Lomonosov and Rumovsky, men of genius who had prosecuted their studies in foreign universities, were enrolled among its members. The annual income was increased to £10,659, and sundry other advantages were conferred upon the institution. Catherine II. utilized the academy for the advancement of national culture. She altered the court of directors greatly to the advantage of the whole body, corrected many of its abuses, added to its means, and infused a new vigour and spirit into its researches. By her recommendation the most intelligent professors visited all the provinces of her vast dominions, with most minute and ample instructions to investigate the natural resources, conditions and requirements, and report on the real state of the empire. The result was that no country at that time could boast, within so few years, such a number of excellent official publications on its internal state, its natural productions, its topography, geography and history, and on the manners, customs and languages of the different tribes that inhabited it, as came from the press of this academy. In its researches in Asiatic languages, oriental customs and religions, it proved itself the worthy rival of the Royal Asiatic Society in England. The first transactions, *Commentarii Academiae Scientiarum Imperialis Petropolitanae ad annum* 1726, with a dedication to Peter II., were published in 1728. This was continued until 1747, when the transactions were called *Novi Commentarii Academiae*, &c.; and in 1777, *Acta Academiae Scientiarum Imperialis Petropolitanae*, with some alteration in the arrangements and plan of the work. The papers, hitherto in Latin only, were now written indifferently in Latin or in French, and a preface added, *Partie Historique*, which contains an account of the society's meetings. Of the *Commentaries*, fourteen volumes were published: of the *New Commentaries* (1750–1776) twenty. Of the *Acta Academiae* two volumes are printed every year. In 1872 there was published at St Petersburg in 2 vols., *Tableau général des matières contenues dans les publications de l'Académie Impériale des Sciences de St Petersbourg*. The academy is composed, as at first, of fifteen professors, besides the president and director. Each of the professors has a house and an annual stipend of from £200 to £600. Besides the professors, there are four pensioned adjuncts, who are present at the meetings of the society, and succeed to the first vacancies. The buildings and apparatus of this academy are on a vast scale. There is a fine library, of 36,000 books and manuscripts; and an extensive museum, considerably augmented by the collections made by Pallas, Gmelin, Guldenstädt and other professors, during their expeditions through the Russian empire. The motto of the society is *Paulatim*.

Spain.—The *Real Academia Española* at Madrid (see below) had a predecessor in the *Academia Naturae curiosorum* (dating from 1657) modelled on that of Naples. It was reconstituted in 1847 after the model of the French academy.

Sweden.—The *Kongliga Svenska Vetenskaps Akademien* owes its institution to six persons of distinguished learning, among whom was Linnaeus. They met on the 2nd of June 1739, and formed a private society, the *Collegium Curiosorum*; and at the end of the year their first publication made its appearance.

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As the meetings continued and the members increased the society attracted the notice of the king; and on the 31st of March 1741 it was incorporated as the Royal Swedish Academy. Though under royal patronage and largely endowed, it is, like the Royal Society in England, entirely self-governed. Each of the members resident at Stockholm becomes in turn president, and continues in office for three months. The dissertations read at each meeting are published in the Swedish language, quarterly, and make an annual volume. The first forty volumes, octavo, completed in 1779, are called the *Old Transactions*.

United States of America.—The oldest scientific association in the United States is the American Philosophical Society Held at Philadelphia for Promoting Useful Knowledge. It owed its origin to Benjamin Franklin, who in 1743 published "A Proposal for Promoting Useful Knowledge among the British Plantations in America," which was so favourably received that in the same year the society was organized, with Thomas Hopkinson (1709–1751) as president and Franklin as secretary. In 1769 it united with another scientific society founded by Franklin, called the American Society Held at Philadelphia for Promoting Useful Knowledge, and adopted its present name, adding the descriptive phrase from the title of the American Society, and elected Franklin president, an office which he held until his death (1790). The American Philosophical Society is national in scope and is exclusively scientific; its Transactions date from 1771, and its Proceedings from 1838. It has a hall in Philadelphia, with meeting-rooms and a valuable library and collection of interesting portraits and relics. David Rittenhouse was its second and Thomas Jefferson was its third president. In 1786 John Hyacinth de Magellan, of London, presented a fund, the income of which was to supply a gold medal for the author of the most important discovery "relating to navigation, astronomy or natural philosophy (mere natural history excepted)." An annual general meeting is held.

The American Academy of Arts and Sciences (Boston), the second oldest scientific organization in the United States, was chartered in Massachusetts in 1780 by some of the most prominent men of that time. James Bowdoin was its first president, John Adams its second. The Academy published Memoirs beginning in 1785, and Proceedings from 1846. The Rumford Premium awarded through it for the most "important discovery or useful improvement on Heat, or on Light" is the income of $5000 given to the Academy by Count Rumford.

The National Academy of Sciences (1863) was incorporated by Congress with the object that it "shall, whenever called upon by any department of the Government, investigate, examine, experiment and report upon any subject of science or art." Its membership was first limited to 50; after the amendment of the act of incorporation in 1870 the limit was placed at 100; and in 1907 it was prescribed that the resident membership should not exceed 150 in number, that not more than 10 members be elected in any one year, and that the number of foreign associates be restricted to 50. The Academy is divided into six committees: mathematics and astronomy; physics and engineering; chemistry; geology and palaeontology; biology; and anthropology. It gives several gold medals for meritorious researches and discoveries. It publishes scientific monographs (at the expense of the Federal Government). Its presidents have been Alexander D. Bache, Joseph Henry, Wm. B. Rogers, Othniel C. Marsh, Wolcott Gibbs, Alexander Agassiz and Ira Remsen.

The Academy of Natural Sciences of Philadelphia was organized in 1812. It has a large library, very rich in natural history, and its museum, with nearly half a million specimens, is particularly strong in conchology and ornithology. The society has published Journals since 1817, and Proceedings since 1841; it also has published the *American Journal of Conchology*. The American Entomological Society (in 1859–1867 the Entomological Society of Philadelphia, and since 1876 part of this academy) has published *Proceedings* since 1861, and the *Entomological News* (a monthly).

There are also other scientific organizations like the American Association for the Advancement of Science (chartered in 1874, as a continuation of the American Association of Geologists, founded in 1840 and becoming in 1842 the American Association of Geologists and Naturalists), which publishes its Proceedings annually; the American Geographical Society (1852), with headquarters in New York; the National Geographic Society (1888), with headquarters in Washington, D.C.; the Geological Society of America (1888), the American Ornithologists' Union (1883), the American Society of Naturalists (1883), the Botanical Society of America (1893), the American Academy of Medicine (1876); and local academies of science, or of special sciences, in many of the larger cities. The Smithsonian Institution at Washington is treated in a separate article.

II. ACADEMIES OF BELLES LETTRES

Belgium.—Belgium has always been famous for its literary societies. The little town of Diest boasts that it possessed a society of poets in 1302, and the Catherinists of Alost date from 1107. It is at least certain that numerous Chambers of Rhetoric (so academies were then called) existed in the first years of the rule of the house of Burgundy.

France.—The French Academy (*l'Académie française*) was established by order of the king in the year 1635, but in its original form existed four or five years earlier. About the year 1629 certain literary friends in Paris agreed to meet informally each week at the house of Valentin Courart, the king's secretary. The conversation turned mostly on literary topics; and when one of the number had finished some literary work, he read it to the rest, and they gave their opinions upon it. The fame of these meetings, though the members were bound to secrecy, reached the ears of Cardinal Richelieu, who promised his protection and offered to incorporate the society by letters patent. Nearly all the members would have preferred the charms of privacy, but, considering the risk they would run in incurring the cardinal's displeasure, and that by the letter of the law all meetings of any sort were prohibited, they expressed their gratitude for the high honour the cardinal thought fit to confer on them, proceeded at once to organize their body, settle their laws and constitution, appoint officers and choose a name. Letters patent were granted by the king on the 29th of January 1635. The officers consisted of a director and a chancellor, chosen by lot, and a permanent secretary, chosen by vote. They elected also a publisher, not a member of the body. The director presided at the meetings, being considered as *primus inter pares*. The chancellor kept the seals and sealed all the official documents of the academy. The cardinal was *ex officio* protector. The meetings were held weekly as before.

The object for which the academy was founded, as set forth in its statutes, was the purification of the French language. "The principal function of the academy shall be to labour with all care and diligence to give certain rules to our language, and to render it pure, eloquent and capable of treating the arts and sciences" (Art. 24). They proposed "to cleanse the language from the impurities it has contracted in the mouths of the common people, from the jargon of the lawyers, from the misusages of ignorant courtiers, and the abuses of the pulpit" (*Letter of Academy to Cardinal Richelieu*).

The number of members was fixed at forty. The original members formed a nucleus of eight, and it was not till 1639 that the full number was completed. Their first undertaking consisted of essays written by the members in rotation. To judge by the titles and specimens which have come down to us, these possessed no special originality or merit, but resembled the ἐπιδείξεις of the Greek rhetoricians. Next, at the instance of Cardinal Richelieu, they undertook a criticism of Corneille's *Cid*, the most popular work of the day. It was a rule of the academy that no work could be criticized except at the author's request, and fear of incurring the cardinal's displeasure wrung from Corneille an unwilling consent. The critique of the academy was re-written several times before it met with the cardinal's approbation. After six months of elaboration, it was published under the title, *Sentiments de l'académie française sur le Cid.* This judgment did not satisfy Corneille, as a saying attributed to him on the occasion shows. "*Horatius,*" he said, referring to his last play, "was condemned by the Duumviri, but he was absolved by the people." But the crowning labour of the academy, begun in 1639, was a dictionary of the French language. By the twenty-sixth article of their statutes, they were pledged to compose a dictionary, a grammar, a treatise on rhetoric and one on poetry. Jean Chapelain, one of the original members and leading spirits of the academy, pointed out that the dictionary would naturally be the first of these works to be undertaken, and drew up a plan of the work, which was to a great extent carried out. A catalogue was to be made of all the most approved authors, prose and verse: these were to be distributed among the members, and all approved words and phrases were to be marked for incorporation in the dictionary. For this they resolved themselves into two committees, which sat on other than the regular days. C. F. de Vaugelas was appointed editor in chief. To remunerate him for his labours, he received from the cardinal a pension of 2000 francs. The first edition of this dictionary appeared in 1694, the sixth and last in 1835, since when *compléments* have been added.

This old *Académie française* perished with the other pre-revolutionary academies in 1793, and it has little but the name in common with the present academy, a section of the Institute. That Jean Baptiste Suard, the first perpetual secretary of the new, had been a member of the old academy, is the one connecting link.

The chronicles of the Institute down to the end of 1895 have been given in full by the count de Franqueville in *Le premier siècle de l'Institut de France*, and from it we extract a few leading facts and dates. Before the Revolution there were in existence the following institutions:—(1) the *Académie de poésie et de musique*, founded by Charles IX. in 1570 at the instigation of Baïf, which counted among its members Ronsard and most of the Pléiade; (2) the *Académie des inscriptions et medailles*, founded in 1701; (3) the *Académie des inscriptions et belles-lettres*; (4) the old *Académie des sciences*; (5) the *Académie de peinture et de sculpture*, a school as well as an academy; (6) the *Académie d'architecture*.

The object of the Convention in 1795 was to rebuild all the institutions that the Revolution had shattered and to combine them in an organic whole; in the words of the preamble:—"*Il y a pour toute la République un Institut national chargé de recueiller les découvertes, de perfectionner les arts et les sciences.*" As Renan has remarked, the Institute embodied two ideas, one disputable, the other of undisputed truth:—That science and art are a state concern, and that there is a solidarity between all branches of knowledge and human activities. The Institute was at first composed of 184 members resident in Paris and an equal number living in other parts of France, with 24 foreign members, divided into three classes, (1) physical and mathematical science, (2) moral and political science, (3) literature and the fine arts. It held its first sitting on the 4th of April 1796. Napoleon as first consul suppressed the second class, as subversive of government, and reconstituted the other classes as follows: (1) as before, (2) French language and literature, (3) ancient history and literature, (4) fine arts. The class of moral and political science was restored on the proposal of M. Guizot in 1832, and the present Institute consists of the five classes named above. Each class or academy has its own special jurisdiction and work, with special funds; but there is a general fund and a common library, which, with other common affairs, are managed by a committee of the Institute—two chosen from each academy, with the secretaries. Each member of the Institute receives an annual allowance of 1200 francs, and the secretaries of the different academies have a salary of 6000 francs.

The class of the Institute which deals with the language and literature takes precedence, and is known as the *Académie française.* There was at first no perpetual secretary, each secretary of sections presiding in turn. Shortly afterwards J. B. Suard was elected to the post, and ever since the history of the academy has been determined by the reigns of its successive perpetual secretaries. The secretary, to borrow an epigram of Sainte-Beuve, both reigns and governs. There have been in order: Suard (13 years), François Juste Raynouard (9 years), Louis Simon Auger, François Andrieux, Arnault, Villemain (34 years), Henri Joseph Patin, Charles Camille Doucet (19 years), Gaston Boissier. Under Raynouard the academy ran a tilt against the abbé Delille and his followers. Under Auger it did battle with romanticism, "a new literary schism." Auger did not live to see the election of Lamartine in 1829, and it needed ten more years for Victor Hugo after many vain assaults to enter by the breach. The academy is professedly non-political. It accepted and even welcomed in succession the empire, the restoration and the reign of Louis Philippe, and it tolerated the republic of 1848; but to the second empire it offered a passive resistance, and no politician of the second empire, whatever his gifts as an orator or a writer, obtained an armchair. The one seeming exception, Emile Ollivier, confirms the rule. He was elected on the eve of the Franco-German war, but his *discours de réception*, a eulogy of the emperor, was deferred and never delivered. The Institute appears in the annual budget for a grant of about 700,000 fr. It has also large vested funds in property, including the magnificent estate and library of Chantilly bequeathed to it by the duc d'Aumale. It awards various prizes, of which the most considerable are the Montyon prizes, each of 20,000 fr., one for the poor Frenchman who has performed the most virtuous action during the year, and one for the French author who has published the book of most service to morality. The conditions are liberally interpreted; the first prize is divided among a number of the deserving poor, and the second has been assigned for lexicons to Molière, Corneille and Madame de Sévigné.

One alteration in the methods of the French Academy has to be chronicled: in 1859 it became the custom to discuss the claims of the candidates at a preliminary meeting of the members. In 1880, on the instance of the philosopher Caro, supported by A. Dumas *fils*, and by the aged Désiré Nisard, it was decided to abandon this method.

A point of considerable interest is the degree in which, since its foundation, the French Academy has or has not represented the best literary life of France. It appears from an examination of the lists of members that a surprising number of authors of the highest excellence have, from one cause or another, escaped the honour of academic "immortality." When the academy was founded in 1634, the moment was not a very brilliant one in French letters. Among the forty original members we find only ten who are remembered in literary history; of these four may reasonably be considered famous still—Balzac, Chapelain, Racan and Voiture. In that generation Scarron was never one of the forty, nor do the names of Descartes, Malebranche or Pascal occur; Descartes lived in Holland, Scarron was paralytic, Pascal was best known as a mathematician—(his *Lettres provinciales* was published anonymously)—and when his fame was rising he retired to Port Royal, where he lived the life of a recluse. The duc de la Rochefoucauld declined the honour from a proud modesty, and Rotrou died too soon to be elected. The one astounding omission of the 17th century, however, is the name of Molière, who was excluded by his profession as an actor.[1] On the other hand, the French Academy was never more thoroughly representative of letters than when Boileau, Corneille, La Fontaine, Racine, and Quinault were all members. Of the great theologians of that and the subsequent age, the Academy contained Bossuet, Fléchier, Fénelon, and Massillon, but not Bourdaloue. La Bruyère and Fontenelle were among the forty, but not Saint-Simon, whose claims as a man of letters were unknown to his contemporaries. Early in the 18th century almost every literary personage of eminence found his place naturally in the Academy. The only exceptions of importance were Vauvenargues, who died too early for the honour, and two men of genius but of dubious social position, Le Sage and the abbé Prévost d'Exiles. The approach of the Revolution affected gravely the *personnel* of the Academy. Montesquieu and Voltaire belonged to it, but not Rousseau or Beaumarchais. Of the Encyclopaedists, the French Academy opened its doors to D'Alembert, Condorcet, Volney, Marmontel and La Harpe, but not to Diderot, Rollin, Condillac, Helvétius or the Baron d'Holbach. Apparently the claims of Turgot and of Quesnay did not appear to the Academy sufficient, since neither was elected. In the transitional period, when the social life of Paris was distracted and the French Academy provisionally closed, neither André Chénier nor Benjamin Constant nor Joseph de Maistre became a member. In the early years of the 19th century considerations of various kinds excluded from the ranks of the forty the dissimilar names of Lamennais, Prudhon, Comte and Béranger. Critics of the French Academy are fond of pointing out that neither Stendhal, nor Balzac, nor Théophile Gautier, nor Flaubert, nor Zola penetrated into the Mazarine Palace. It is not so often remembered that writers so academic as Thierry and Michelet and Quinet suffered the same exclusion. In later times neither Alphonse Daudet nor Edmond de Goncourt, neither Guy de Maupassant nor Ferdinand Fabre, has been among the forty immortals. The non-election, after a long life of distinction, of the scholar Fustel de Coulanges is less easy to account for. Verlaine, although a poet of genius, was of the kind that no academy can ever be expected to recognize.

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[1] The Academy has made the *amende honorable* by placing in the *Salle des séances* a bust of Molière, with the inscription "*Rien ne manque à sa gloire, il manquait à la notre.*"

Concerning the influence of the French Academy on the language and literature, the most opposite opinions have been advanced. On the one hand, it has been asserted that it has corrected the judgment, purified the taste and formed the language of French writers, and that to it we owe the most striking characteristics of French literature, its purity, delicacy and flexibility. Thus Matthew Arnold, in his *Essay on the Literary Influence of Academies*, has pronounced a glowing panegyric on the French Academy as a high court of letters, and a rallying-point for educated opinion, as asserting the authority of a master in matters of tone and taste. To it he attributes in a great measure that thoroughness, that openness of mind, that absence of vulgarity which he finds everywhere in French literature; and to the want of a similar institution in England he traces that eccentricity, that provincial spirit, that coarseness which, as he thinks, are barely compensated by English genius. Thus, too, Renan, one of its most distinguished members, says that it is owing to the academy "*qu'on peut tout dire sans appareil scholastique avec la langue des gens du monde.*" "*Ah ne dites,*" he exclaims, "*qu'ils n'ont rien fait, ces obscures beaux esprits dont la vie se passe à instruire le procès des mots, à peser les syllables. Ils ont fait un chef-d'œuvre—la langue française.*" On the other hand, its inherent defects have been well summed up by P. Lanfrey in his *Histoire de Napoléon*: "This institution had never shown itself the enemy of despotism. Founded by the monarchy and for the monarchy, eminently favourable to the spirit of intrigue and favouritism, incapable of any sustained or combined labour, a stranger to those great works pursued in common which legitimize and glorify the existence of scientific bodies, occupied exclusively with learned trifles, fatal to emulation, which it pretends to stimulate, by the compromises and calculations to which it subjects it, directed in everything by petty considerations, and wasting all its energy in childish tournaments, in which the flatteries that it showers on others are only a foretaste of the compliments it expects in return for itself, the French Academy seems to have received from its founders the special mission to transform genius into *bel esprit*, and it would be hard to produce a man of talent whom it has not demoralized. Drawn in spite of itself towards politics, it alternately pursues and avoids them; but it is specially attracted by the gossip of politics, and whenever it has so far emancipated itself as to go into opposition, it does so as the champion of ancient prejudices. If we examine its influence on the national genius, we shall see that it has given it a flexibility, a brilliance, a polish, which it never possessed before; but it has done so at the expense of its masculine qualities, its originality, its spontaneity, its vigour, its natural grace. It has disciplined it, but it has emasculated, impoverished and rigidified it. It sees in taste, not a sense of the beautiful, but a certain type of correctness, an elegant form of mediocrity. It has substituted pomp for grandeur, school routine for individual inspiration, elaborateness for simplicity, *fadeur* and the monotony of literary orthodoxy for variety, the source and spring of intellectual life; and in the works produced under its auspices we discover the rhetorician and the writer, never the man. By all its traditions the academy was made to be the natural ornament of a monarchical society. Richelieu conceived and created it as a sort of superior centralization applied to intellect, as a high literary court to maintain intellectual unity and protest against innovation. Bonaparte, aware of all this, had thought of re-establishing its ancient privileges; but it had in his eyes one fatal defect—*esprit*. Kings of France could condone a witticism even against themselves, a *parvenu* could not."

On the whole the influence of the French Academy has been conservative rather than creative. It has done much by its example for style, but its attempts to impose its laws on language have, from the nature of the case, failed. For, however perfectly a dictionary or a grammar may represent the existing language of a nation, an original genius is certain to arise—a Victor Hugo or an Alfred de Musset—who will set at defiance all dictionaries and academic rules.

Germany.—Of the German literary academies the most celebrated was *Die Fruchtbringende Gesellschaft* (the Fruitful Society), established at Weimar in 1617. Five princes were among the original members. The object was to purify the mother tongue. The German academies copied those of Italy in their quaint titles and petty ceremonials, and exercised little permanent influence on the language or literature of the country.

Italy.—Italy in the 16th century was remarkable for the number of its literary academies. Tiraboschi, in his *History of Italian Literature*, has given a list of 171; and Jarkius, in his *Specimen Historiae Academiarum Conditarum*, enumerates nearly 700. Many of these, with a sort of Socratic irony, gave themselves ludicrous names, or names expressive of ignorance. Such were the *Lunatici* of Naples, the *Estravaganti*, the *Fulminales*, the *Trapessati*, the *Drowsy*, the *Sleepers*, the *Anxious*, the *Confused*, the *Unstable*, the *Fantastic*, the *Transformed*, the *Ethereal*. "The first academies of Italy chiefly directed their attention to classical literature; they compared manuscripts; they suggested new readings or new interpretations; they deciphered inscriptions or coins, they sat in judgment on a Latin ode or debated the propriety of a phrase. Their own poetry had, perhaps, never been neglected; but it was not till the writings of Bembo furnished a new code of criticism in the Italian language that they began to study it with the same minuteness as modern Latin." "They were encouragers of a numismatic and lapidary erudition, elegant in itself, and throwing for ever little specks of light on the still ocean of the past, but not very favourable to comprehensive observation, and tending to bestow on an unprofitable pedantry the honours of real learning."[1] The Italian nobility, excluded as they mostly were from politics, and living in cities, found in literature a consolation and a career. Such academies were oligarchical in their constitution; they encouraged culture, but tended to hamper genius and extinguish originality. Far the most celebrated was the *Accademia della Crusca* or *Furfuratorum*; that is, of bran, or of the sifted, founded in 1582. The title was borrowed from a previous society at Perugia, the *Accademia degli Scossi*, of the well-shaken. Its device was a sieve; its motto, "Il più bel fior ne coglie" (it collects the finest flower); its principal object the purification of the language. Its great work was the *Vocabulario della Crusca*, printed at Venice in 1612. It was composed avowedly on Tuscan principles, and regarded the 14th century as the Augustan period of the language. Paul Beni assailed it in his *Anti-Crusca*, and this exclusive Tuscan purism has disappeared in subsequent editions. The *Accademia della Crusca* is now incorporated with two older societies—the *Accademia degli Apatici* (the Impartials) and the *Accademia Florentina*.

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[1] Hallam's *Int. to Lit. of Europe*, vol. i. p. 654. and vol. ii. p. 502.

Among the numerous other literary academies of Italy we may mention the academy of Naples, founded about 1440 by Alphonso, the king; the Academy of Florence, founded 1540, to illustrate and perfect the Tuscan tongue, especially by the close study of Petrarch; the *Intronati* of Siena, 1525; the *Infiammati* of Padua, 1534; the *Rozzi* of Siena, suppressed by Cosimo, 1568.

The Academy of Humorists arose from a casual meeting of witty noblemen at the marriage of Lorenzo Marcini, a Roman gentleman. It was carnival time, and to give the ladies some diversion they recited verses, sonnets and speeches, first impromptus and afterwards set compositions. This gave them the name, Belli Humori, which, after they resolved to form an academy of belles lettres, they changed to *Humoristi*.

In 1690 the *Accademia degli Arcadi* was founded at Rome, for the purpose of reviving the study of poetry, by Crescimbeni, the author of a history of Italian poetry. Among its members were princes, cardinals and other ecclesiastics; and, to avoid disputes about pre-eminence, all came to its meetings masked and dressed like Arcadian shepherds. Within ten years from its establishment the number of academicians was 600.

The Royal Academy of Savoy dates from 1719, and was made a royal academy by Charles Albert in 1848. Its emblem is a gold orange tree full of flowers and fruit; its motto "Flores fructusque perennes," the same as that of the famous Florimentane Academy, founded at Annecy by St Francis de Sales. It has published valuable memoirs on the history and antiquities of Savoy.

Spain.—The *Real Academia Española* at Madrid held its first meeting in July 1713, in the palace of its founder, the duke d'Escalona. It consisted at first of 8 academicians, including the duke; to which number 14 others were afterwards added, the founder being chosen president or director. In 1714 the king granted them the royal confirmation and protection. Their device is a crucible in the middle of the fire, with this motto, *Limpia, fixa, y da esplendor*—"It purifies, fixes, and gives brightness." The number of its members was limited to 24; the duke d'Escalona was chosen director for life, but his successors were elected yearly, and the secretary for life. Their object, as marked out by the royal declaration, was to cultivate and improve the national language. They were to begin with choosing carefully such words and phrases as have been used by the best Spanish writers; noting the low, barbarous or obsolete ones; and composing a dictionary wherein these might be distinguished from the former.

Sweden.—The *Svenska Akademien* was founded in 1786, for the purpose of purifying and perfecting the Swedish language. A medal is struck by its direction every year in honour of some illustrious Swede. This academy does not publish its transactions.

III. ACADEMIES OF ARCHAEOLOGY AND HISTORY

France.—The old *Académie des inscriptions et belles-lettres* (or "*Petite Académie*," founded in 1663) was an offshoot of the French Academy, which then at least contained the *élite* of French learning. Louis XIV. was of all French kings the one most occupied with his own aggrandisement. Literature, and even science, he only encouraged so far as they redounded to his own glory. Nor were literary men inclined to assert their independence. Boileau well represented the spirit of the age when, in dedicating his tragedy *Berenice* to Colbert, he wrote: "The least things become important if in any degree they can serve the glory and pleasure of the king." Thus it was that the Academy of Inscriptions arose. At the suggestion of Colbert a company (a committee we should now call it) had been appointed by the king, chosen from the French Academy, charged with the office of furnishing inscriptions, devices and legends for medals. It consisted of four academicians: Chapelain, then considered the poet laureate of France, one of the authors of the critique on the *Cid*; the abbé Amable de Bourzeis (1606–1671); François Charpentier (1620–1702), an antiquary of high repute among his contemporaries; and the abbé Jacques de Cassagnes (1636–1679), who owed his appointment more to the fulsome flattery of his odes than to his really learned translations of Cicero and Sallust. This company used to meet in Colbert's library in the winter, at his country-house at Sceaux in the summer, generally on Wednesdays, to serve the convenience of the minister, who was always present. Their meetings were principally occupied with discussing the inscriptions, statues and pictures intended for the decoration of Versailles; but Colbert, a really learned man and an enthusiastic collector of manuscripts, was often pleased to converse with them on matters of art, history and antiquities. Their first published work was a collection of engravings, accompanied by descriptions, designed for some of the tapestries at Versailles. Louvois, who succeeded Colbert as a superintendent of buildings, revived the company, which had begun to relax its labours. Félibien, the learned architect, and the two great poets Racine and Boileau, were added to their number. A series of medals was commenced, entitled *Médailles de la Grande Histoire*, or, in other words, the history of the Grand Monarque.

But it was to M. de Pontchartrain, comptroller-general of finance and secretary of state, that the academy owed its institution. He added to the company Renaudot and Jacques Tourreil, both men of vast learning, the latter tutor to his son, and put at its head his nephew, the abbé Jean Paul Bignon, librarian to the king. By a new regulation, dated the 16th of July 1701, the *Académie royale des inscriptions et médailles* was instituted, being composed of ten honorary members, ten pensioners, ten associates, and ten pupils. Its constitution was an almost exact copy of that of the Academy of Sciences. Among the regulations we find the following, which indicates clearly the transition from a staff of learned officials to a learned body: "The academy shall concern itself with all that can contribute to the perfection of inscriptions and legends, of designs for such monuments and decorations as may be submitted to its judgment; also with the description of all artistic works, present and future, and the historical explanation of the subject of such works; and as the knowledge of Greek and Latin antiquities, and of these two languages, is the best guarantee for success in labours of this class, the academicians shall apply themselves to all that this division of learning includes, as one of the most worthy objects of their pursuit."

Among the first honorary members we find the indefatigable Mabillon (excluded from the pensioners by reason of his orders), Père La Chaise, the king's confessor, and Cardinal Rohan; among the associates Fontenelle and Rollin, whose *Ancient History* was submitted to the academy for revision. In 1711 they completed *L'Histoire métallique du roi*, of which Saint-Simon was asked to write the preface. In 1716 the regent changed its title to that of the *Académie des inscriptions et belles-lettres*, a title which better suited its new character.

In the great battle between the Ancients and the Moderns which divided the learned world in the first half of the 18th century, the Academy of Inscriptions naturally espoused the cause of the Ancients, as the Academy of Sciences did that of the Moderns. During the earlier years of the French Revolution the academy continued its labours uninterruptedly; and on the 22nd of January 1793, the day after the death of Louis XVI., we find in the *Proceedings* that M. Bréquigny read a paper on the projects of marriage between Queen Elizabeth and the dukes of Anjou and Alençon. In the same year were published the 45th and 46th vols. of the *Mémoires de l'académie*. On the 2nd of August of the same year the last *séance* of the old academy was held. More fortunate than its sister Academy of Sciences, it lost only three of its members by the guillotine. One of these was the astronomer Sylvain Bailly. Three others sat as members of the Convention; but for the honour of the academy, it should be added that all three were distinguished by their moderation.

In the first draft of the new Institute, October 25, 1705, no class corresponded exactly to the old Academy of Inscriptions; but most of the members who survived found themselves re-elected either in the class of moral and political science, under which history and geography were included as sections, or more generally under the class of literature and fine arts, which embraced ancient languages, antiquities and monuments.

In 1816 the academy received again its old name. The *Proceedings* of the society embrace a vast field, and are of very various merits. Perhaps the subjects on which it has shown most originality are comparative mythology, the history of science among the ancients, and the geography and antiquities of France. The old academy has reckoned among its members De Sacy the orientalist, Dansse de Villoison (1750–1805) the philologist, Anquetil du Perron the traveller, Guillaume J. de C. L. Sainte-Croix and du Theil the antiquaries, and Le Beau, who has been named the last of the Romans. The new academy has inscribed on its lists the names of Champollion, A. Rémusat, Raynouard, Burnouf and Augustin Thierry.

In consequence of the attention of several literary men in Paris having been directed to Celtic antiquities, a *Celtic Academy* was established in that city in 1805. Its objects were, first, the elucidation of the history, customs, antiquities, manners and monuments of the Celts, particularly in France; secondly, the etymology of all the European languages, by the aid of the Celto-British, Welsh and Erse; and, thirdly, researches relating to Druidism. The attention of the members was also particularly called to the history and settlements of the Galatae in Asia. Lenoir, the keeper of the museum of French monuments, was appointed president. The academy still exists as *La société nationale des antiquaires de France.*

Great Britain.—The British Academy was the outcome of a meeting of the principal European and American academies, held at Wiesbaden in October 1899. A scheme was drawn up for an international association of the academies of the world under the two sections of natural science and literary science, but while the Royal Society adequately represented England in science there was then no existing institution that could claim to represent England in literature, and at the first meeting of the federated academies this chair was vacant. A plan was proposed by Professor H. Sidgwick to add a new section to the Royal Society, but after long deliberation this was rejected by the president and council. The promoters of the plan thereupon determined to form a separate society, and invited certain persons to become the first members of a new body, to be called "The British Academy for the promotion of historical, philosophical and philological studies." The unincorporated body thus formed petitioned for a charter, and on the 8th of August 1902 the royal charter was granted and the by-laws were allowed by order in council. The objects of the academy are therein defined—"the promotion of the study of the moral and political sciences, including history, philosophy, law, politics and economics, archaeology and philology." The number of ordinary fellows (so all members are entitled) is restricted to one hundred, and the academy is governed by a president (the first being Lord Reay) and a council of fifteen elected annually by the fellows.

Italy.—Under this class the *Accademia Ercolanese* (*Academy of Herculaneum*) properly ranks. It was established at Naples about 1755, at which period a museum was formed of the antiquities found at Herculaneum, Pompeii and other places, by the marquis Tanucci, who was then minister of state. Its object was to explain the paintings, &c., discovered at those places. For this purpose the members met every fortnight, and at each meeting three paintings were submitted to three academicians, who made their report at their next sitting. The first volume of their labours appeared in 1775, and they have been continued under the title of *Antichità di Ercolano.* They contain engravings of the principal paintings, statues, bronzes, marble figures, medals, utensils, &c., with explanations. In the year 1807 an academy of history and antiquities, on a new plan, was established at Naples by Joseph Bonaparte. The number of members was limited to forty, twenty of whom were to be appointed by the king; and these twenty were to present to him, for his choice, three names for each of those needed to complete the full number. Eight thousand ducats were to be annually allotted for the current expenses, and two thousand for prizes to the authors of four works which should be deemed by the academy most deserving of such a reward. A grand meeting was to be held every year, when the prizes were to be distributed and analyses of the works read. The first meeting took place on the 25th of April 1807; but the subsequent changes in the political state of Naples prevented the full and permanent establishment of this institution. In the same year an academy was established at Florence for the illustration of Tuscan antiquities, which published some volumes of memoirs.

IV. ACADEMIES OF MEDICINE AND SURGERY

Austria.—The defunct Academy of Surgery at Vienna was instituted in 1784 by the emperor Joseph II. under the direction of the distinguished surgeon, Giovanni Alessandro Brambilla (1728–1800). For many years it did important work, and though closed in 1848 was reconstituted by the emperor Francis Joseph in 1854. In 1874 it ceased to exist; its functions had become mainly military, and were transferred to newer schools.

France.—Académie de Médecine. Medicine is a science which has always engaged the attention of the kings of France. Charlemagne established a school of medicine in the Louvre, and various societies have been founded, and privileges granted to the faculty by his successors. The *Académie de médecine* succeeded to the old *Académie royale de chirurgie et société royale de médecine.* It was erected by a royal ordinance, dated December 20, 1820. It was divided into three sections—medicine, surgery and pharmacy. In its constitution it closely resembled the *Académie des sciences.* Its function was to preserve or propagate vaccine matter, and answer inquiries addressed to it by the government on the subject of epidemics, sanitary reform and public health generally. It has maintained an enormous correspondence in all quarters of the globe and published extensive minutes.

Germany.—The *Academia Naturae Curiosi*, afterwards called the *Academia Caesaraea Leopoldina*, was founded in 1662 by J. L. Bausch, a physician of Leipzig, who published a general invitation to medical men to communicate all extraordinary cases that occurred in the course of their practice. The works of the *Naturae Curiosi* were at first published separately; but in 1770 a new arrangement was planned for publishing a volume of observations annually. From some cause, however, the first volume did not make its appearance until 1784, when it was published under the title of *Ephemerides.* In 1687 the emperor Leopold took the society under his protection, and its name was changed in his honour. This academy has no fixed abode, but follows the home of its president. Its library remains at Dresden. By its constitution the Leopoldine Academy consists of a president, two adjuncts or secretaries and unlimited colleagues or members. At their admission the last come under a twofold obligation—first, to choose some subject for discussion out of the animal, vegetable or mineral kingdoms, not previously treated by any colleague of the academy; and, secondly, to apply themselves to furnish materials for the annual *Ephemerides.*

V. ACADEMIES OF THE FINE ARTS

France.—The *Académie royale de peinture et de sculpture* at Paris was founded by Louis XIV. in 1648, under the title of *Académie royale des beaux arts*, to which was afterwards united the *Académie d'architecture*, founded 1671. It is composed of painters, sculptors, architects, engravers and musical composers. From among the members of the society who are painters, is chosen the director of the French *Académie des beaux arts* at Berne, also instituted by Louis XIV. in 1677. The director's province is to superintend the studies of the painters, sculptors, &c., who, chosen by competition, are sent to Italy at the expense of the government, to complete their studies in that country. Most of the celebrated French painters have begun their career in this way.

The *Académie nationale de musique* is the official and administrative name given in France to the grand opera. In 1570 the poet Baïf established in his house a school of music, at which ballets and masquerades were given. In 1645 Mazarin brought from Italy a troupe of actors, and established them in the rue du Petit Bourbon, where they gave Jules Strozzi's *Achille in Sciro*, the first opera performed in France. After Molière's death in 1673, his theatre in the Palais Royal was given to Sulli, and there were performed all Gluck's great operas; there Vestris danced, and there was produced Jean Jacques Rousseau's *Devin du Village*.

Great Britain.—The Royal Academy of Arts in London, founded in 1768, is described in a separate article. (See Academy, Royal.)

The Academy of Ancient Music was established in London in 1710, with the view of promoting the study and practice of vocal and instrumental harmony. This institution had a fine musical library, and was aided by the performances of the gentlemen of the Chapel Royal and the choir of St Paul's, with the boys belonging to each, and continued to flourish for many years. About 1734 the academy became a seminary for the instruction of youth in the principles of music and the laws of harmony. The Royal Academy of Music was formed for the performance of operas, composed by Handel, and conducted by him at the theatre in the Haymarket. The subscription amounted to £50,000, and the king, besides subscribing £1000, allowed the society to assume the title Royal. It consisted of a governor, deputy-governor and twenty directors. A contest between Handel and Senesino, one of the performers, in which the directors took the part of the latter, occasioned the dissolution of the academy after it had existed with honour for more than nine years. The present Royal Academy of Music dates from 1822, and was incorporated in 1830. It instructs pupils of both sexes in music. (See also the article Conservatoire for colleges of music.)

Italy.—In 1778 an academy of painting and sculpture was established at Turin. The meetings were held in the palace of the king, who distributed prizes among the most successful members. In Milan an academy of architecture was established so early as 1380, by Gian Galeazzo Visconti. About the middle of the 18th century an academy of the arts was established there, after the example of those at Paris and Rome. The pupils were furnished with originals and models, and prizes were distributed by competent judges annually. The prize for painting was a gold medal. Before the effects of the French Revolution reached Italy this was one of the best establishments of the kind in that kingdom. In the hall of the academy were some admirable examples of Correggio, as well as several statues of great merit, particularly a small bust of Vitellius, and a torso of Agrippina, of most exquisite beauty. The academy of the arts, which had been long established at Florence, fell into decay, but was restored in the end of the 18th century. In it there are halls for nude and plaster figures, for the use of the sculptor and the painter, with models of all the finest statues in Italy. But the treasures of this and the other institutions for the fine arts were greatly diminished during the occupancy of Italy by the French. The academy of the arts at Modena, after being plundered by the French, dwindled into a petty school for drawing from living models. There is also an academy of the fine arts in Mantua, and another at Venice.

Russia.—The academy of St Petersburg was established in 1757 by the empress Elizabeth, at the suggestion of Count Shuvalov, and annexed to the academy of sciences. The fund for its support was £4000 per annum, and the foundation admitted forty scholars. Catherine II. formed it into a separate institution, augmented the annual revenue to £12,000, and increased the number of scholars to three hundred; she built for it a large circular building, which fronts the Neva. The scholars are admitted at the age of six, and continue until they have attained that of eighteen. They are clothed, fed and lodged at the expense of the crown; and are instructed in reading, writing, arithmetic, French, German and drawing. At the age of fourteen they are at liberty to choose any of the following arts; first, painting in all its branches, architecture, mosaic, enamelling, &c.; second, engraving on copper-plates, seal-cutting, &c.; third, carving on wood, ivory and amber; fourth, watch-making, turning, instrument-making, casting statues in bronze and other metals, imitating gems and medals in paste and other compositions, gilding and varnishing. Prizes are annually distributed, and from those who have obtained four prizes, twelve are selected, who are sent abroad at the charge of the crown. A certain sum is paid to defray their travelling expenses; and when they are settled in any town, they receive during four years an annual salary of £60. The academy has a small gallery of paintings for the use of the scholars; and those who have made great progress are permitted to copy the pictures in the imperial collection. For the purpose of design, there are full-size models of the best antique statues in Italy.

South America.—There are several small academies in the various towns of South America, the only one of note being that of Rio de Janeiro, founded by John VI. of Portugal in 1816 and now known as the *Escola Nacional de Bellas Artes*.

Spain.—In Madrid an academy for painting, sculpture and architecture, the *Academia de Bellas Artes de San Fernando*, was founded by Philip V. The minister for foreign affairs is president. Prizes are distributed every three years. In Cadiz a few students are supplied by government with the means of drawing and modelling from figures; and such as are not able to purchase the requisite instruments are provided with them.

Sweden.—An academy of the fine arts was founded at Stockholm in the year 1733 by Count Tessin. In its hall are the ancient figures of plaster presented by Louis XIV. to Charles XI. The works of the students are publicly exhibited, and prizes are distributed annually. Such of them as display distinguished ability obtain pensions from government, to enable them to reside in Italy for some years, for the purposes of investigation and improvement. In this academy there are nine professors and generally about four hundred students.

Austria.—In the year 1705 an academy of painting, sculpture and architecture was established at Vienna, with the view of encouraging and promoting the fine arts.

United States of America.—In America the institution similar to the Royal Academy of Arts in London is the National Academy of Design (1826), which in 1906 absorbed the Society of American Artists, the members of the society becoming members of the academy.

The volume of excerpts from the general catalogue of books in the British Museum, "Academies," 5 parts and index, furnishes a complete bibliography. (F. S.)

ACADEMY, GREEK or Academe (Gr. ἀκαδήμεια or ἑκαδημία), the name given to the philosophic successors of Plato. The name is derived from a pleasure-garden or gymnasium situated in the suburb of the Ceramicus on the river Cephissus about a mile to the north-west of Athens from the gate called Dipylum. It was said to have belonged to the ancient Attic hero Academus, who, when the Dioscuri invaded Attica to recover their sister Helen, carried off by Theseus, revealed the place where she was hidden. Out of gratitude the Lacedaemonians, who reverenced the Dioscuri, always spared the Academy during their invasions of the country. It was walled in by Hipparchus and was adorned with walks, groves and fountains by Cimon (Plut. *Cim.* 13), who bequeathed it as a public pleasure-ground to his fellow-citizens. Subsequently the garden became the resort of Plato (*q.v.*), who had a small estate in the neighbourhood. Here he taught for nearly fifty years till his death in 348 B.C., and his followers continued to make it their headquarters. It was closed for teaching by Justinian in A.D. 529 along with the other pagan schools. Cicero borrowed the name for his villa near Puteoli, where he composed his dialogue *The Academic Questions*.

The Platonic Academy (proper) lasted from the days of Plato to those of Cicero, and during its whole course there is traceable a distinct continuity of thought which justifies its examination as a real intellectual unit. On the other hand, this continuity of thought is by no means an identity. The Platonic doctrine was so far modified in the hands of successive scholarchs that the Academy has been divided into either two, three or five main sections (Sext. Empir. *Pyrrh. Hyp.* i. 220). Finally, in the days of Philo, Antiochus and Cicero, the metaphysical dogmatism class, and up to 1855 they were admitted to the associateship only, the number, six, being in addition to the other associates; now the maximum is four, of whom not more than two may be academicians. A class of honorary retired academicians was established in 1862, and of honorary retired associates in 1884. The first honorary foreign academicians were elected in 1869. The honorary members consist of a chaplain, an antiquary, a secretary for foreign correspondence, and professors of ancient history and ancient literature. These posts, which date from the foundation of the Academy, have always been held by distinguished men.

Academy Schools.—One of the most important functions of the Royal Academy, and one which for nearly a century it discharged alone, was the instruction of students in art. The first act, as has been shown, of the newly founded Academy was to establish schools—"an Antique Academy," and a "School for the Living Model" for painters, sculptors and architects. In the first year, 1769, no fewer than seventy-seven students entered. A school of painting was added in 1815, and special schools of sculpture and architecture in 1871. It would occupy too much space to follow the various changes that have been made in the schools since their establishment. In one important respect, however, they remain the same, viz. in the instruction being gratuitous—no fees have ever been charged. Up to the removal of the Academy to its present quarters the schools could not be kept permanently open, as the rooms occupied by them were wanted for the exhibition. They are now open all the year round with the exception of a fortnight at Christmas, and the months of August and September. They consist of an antique school, upper and lower schools of painting, a school of drawing from the life, a school of modelling from the life and an architectural school. Admission is gained by submitting certain specimens of drawing or modelling, and the successful candidates, called probationers, have then to undergo a further test in the schools, on passing which they are admitted as students for three years. At the end of that time they are again examined, and if qualified admitted for a further term of two years. These examinations are held twice a year, in January and July. Female students were first admitted in 1860. There are many scholarships, money prizes and medals to be gained by the various classes of students during the time of studentship, including travelling studentships of the value of £200 for one year, gold and silver medals, and prizes varying from £50 to £10. There are permanent curators and teachers in all the schools, but the principal teaching is done by the visitors, academicians and associates, elected to serve in each school. The average cost of maintaining these schools, including salaries, fees, cost of models, prizes, books, maintenance of building, &c., is from £5000 to £6000 a year, apart from certain scholarships and prizes derived from moneys given or bequeathed for this purpose, such as the Landseer scholarships, the Creswick prize, the Armitage prizes and the Turner scholarship and gold medal.

Charities.—Another of the principal objects to which the profits of the Royal Academy have been devoted has been the relief of distressed artists and their families. From the commencement of the institution a fund was set apart for this purpose, and subsequently a further sum was allotted to provide pensions for necessitous members of the Academy and their widows. Both these funds were afterwards merged in the general fund, and various changes have from time to time been made in the conditions under which pensions and donations have been granted and in their amount. At the present time pensions not exceeding a certain fixed amount may be given to academicians and associates, sixty years of age, who have retired and whose circumstances show them to be in need, provided the sum given does not make their total annual income exceed a certain limit, and the same amounts can be given to their widows subject to the same conditions. No pensions are granted without very strict inquiry into the circumstances of the applicant, who is obliged to make a yearly declaration as to his or her income. The average annual amount of these pensions has been latterly about £2000. Pensions are also given according to the civil service scale to certain officers on retirement. It may be stated here that with the exception of these pensions and of salaries and fees for official services, no member of the Academy derives any pecuniary benefit from the funds of the institution. Donations to distressed artists who are or have been exhibitors at the Royal Academy, their widows and children under twenty-one years of age, are made twice a year in February and August. The maximum amount that can be granted to any one applicant in one donation is £100, and no one can receive a grant more than once a year. The average yearly amount thus expended is from £1200 to £1500. In addition to these charities from its general funds, the Academy administers for the benefit of artists, not members of the Academy, certain other funds which have been bequeathed to it for charitable purposes, viz. the Turner fund, the Cousins fund, the Cooke fund, the Newton bequest and the Edwards fund (see below).

Exhibitions.—The source from which have been derived the funds for carrying on the varied work of the Royal Academy, its schools, its charities and general cost of administration, and which has enabled it to spend large sums on building, and provided it with the means of maintaining the buildings, has been the annual exhibitions. With the exception of the money left by John Gibson, R.A., some of which was spent in building the gallery containing the statues and bas-reliefs bequeathed by him, these exhibitions have provided the sole source of revenue, all other moneys that have come to the Academy having been either left in trust, or been constituted trusts, for certain specific purposes. The first exhibition in 1769 contained 136 works, of which more than one-half were contributed by members, and brought in £699: 17: 6. In 1780, the first year in which the receipts exceeded the expenditure, the number of works was 489, of which nearly one-third were by members, and the sum received was £3069: 1s. This increase continued gradually with fluctuations, and in 1836, the last year at Somerset House, the number of works was 1154, and the receipts were £5179: 19s. No great addition to the number of works exhibited took place at Trafalgar Square, but the receipts steadily grew, and their careful management enabled the Academy, when the time came for moving, to erect its own buildings and become no longer dependent on the government for a home. The greater space afforded by the galleries at Burlington House rendered it possible to increase the number of works exhibited, which of late years has reached a total of over 2000, while the receipts have also been such as to provide the means for further building, and for a largely increased expenditure of all kinds. It may be noted that the number of works sent for exhibition soon began to exceed the space available. In 1868, the last year at Trafalgar Square, the number sent was 3011. This went on increasing, with occasional fluctuations, at Burlington House, and in the year 1900 it reached the number of 13,462. The annual winter exhibition of works by old masters and deceased British artists was begun in 1870. It was never intended to be a source of revenue, but appreciation by the public has so far prevented it from being a cause of loss. The summer exhibition of works by living artists opens on the first Monday in May, and closes on the first Monday in August. The winter exhibition of works by deceased artists opens on the first Monday in January, and closes on the second Saturday in March. The galleries containing the diploma works, the Gibson statuary and other works of art are open daily, free.

Presidents of the Royal Academy.—Sir Joshua Reynolds, 1768–1792; Benjamin West (resigned), 1792–1805; James Wyatt (president-elect), 1805; Benjamin West (re-elected), 1806–1820; Sir Thomas Lawrence, 1820–1830; Sir Martin Archer Shee, 1830–1850; Sir Charles Lock Eastlake, 1850–1865; Sir Francis Grant, 1866–1878; Frederick, Lord Leighton of Stretton, 1878–1896; Sir John Everett Millais, 1896; Sir Edward John Poynter, 1896.

The library contains about 7000 volumes, dealing with the history, the theory and the practice of the various branches of the fine arts, some of them of great rarity and value. It is open daily to the students and members, and to other persons on a proper introduction.

The trust funds administered by the Royal Academy are:—

The *Turner fund* (J. M. W. Turner, R.A.), which provides sixteen annuities of £50 each, for artists of repute not members of the Academy, also a biennial scholarship of £50 and a gold medal for a landscape painting.

The *Chantrey fund* (Sir Francis Chantrey, R.A.), the income of which, paid over by the Chantrey trustees, is spent on pictures and sculpture. (See CHANTREY.)

The *Creswick fund* (Thomas Creswick, R.A.), which provides an annual prize of £30 for a landscape painting in oil.

The *Cooke fund* (E. W. Cooke, R.A.), which provides two annuities of £35 each for painters not members of the Academy, over sixty years of age and in need.

The *Landseer fund* (Charles Landseer, R.A.), which provides four scholarships of £40 each, two in painting and two in sculpture, tenable for two years, open to students at the end of the first two years of studentship, and given for the best work done during the second year.

The *Armitage fund* (E. Armitage, R.A.), which provides two annual prizes of £30 and £10, for a design in monochrome for a figure picture.

The *Cousins fund* (S. Cousins, R.A.), which provides seven annuities of £80 each for deserving artists, not members of the Academy, in need of assistance.

The *Newton bequest* (H. C. Newton), which provides an annual sum of £60 for the indigent widow of a painter.

The *Bizo fund* (John Bizo), to be used in the scientific investigation into the nature of pigments and varnishes, &c.

The *Edwards fund* (W. J. Edwards), producing £40 a year for the benefit of poor artists or artistic engravers.

The *Leighton bequest* (Lord Leighton, P.R.A.), received from Mrs Orr and Mrs Matthews in memory of their brother, the income from which, about £300, is expended on the decoration of public places and buildings.

The literature concerning the Royal Academy consists chiefly of pamphlets and articles of more or less ephemeral value. More serious works are: William Sandby, *The History of the Royal Academy of Arts* (London, 1862) (withdrawn from circulation on a question of copyright); *Report from the Select Committee on Arts and their Connexion with Manufactures, with the Minutes of Evidence and Appendix* (London, 1836); *Report of the Royal Commission on the Royal Academy, with Minutes of Evidence and Appendix* (London, 1863); Martin

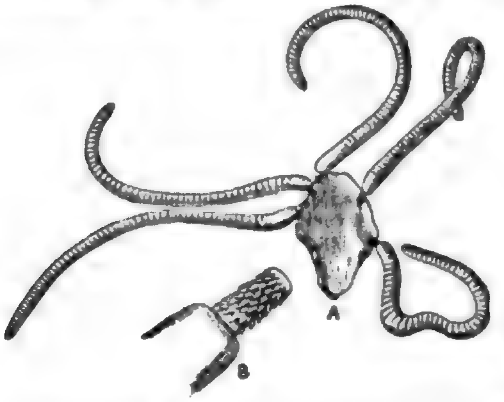
Archer Shee, *The Life of Sir M. A. Shee, P.R.A.* (London, 1860); C. R. Leslie, R.A., and Tom Taylor, *Life and Times of Sir Joshua Reynolds, P.R.A.* (London, 1865); J. E. Hodgson, R.A. (the late), and Fred. A. Eaton, Sec. R.A., "The Royal Academy in the Last Century," *Art Journal*, 1889–1891. But the chief sources of information on the subject are the minute-books of the council and of the general assembly, and the annual reports, which, however, only date from 1859. (F. A. E.)

ACADIAN, in geology, the name given by Sir J. W. Dawson in 1867 to a series of black, red and green shales and slates, with dark grey limestones, which are well developed at St John, New Brunswick; Avalon in E. Newfoundland, and Braintree in E. Massachusetts. These rocks are of Middle Cambrian age and possess a *Paradoxides* fauna. They have been correlated with limestone beds in Tennessee, Alabama, Central Nevada and British Columbia (St Stephen).

See CAMBRIAN SYSTEM; also C. D. Walcott, *Bull. U.S. Geol. Survey*, No. 81, 1891; and Sir J. W. Dawson, *Acadian Geology*, 1st ed. 1855, 3rd ed. 1878.

ACADIE, or ACADIA, a name given by the French in 1603 to that part of the mainland of North America lying between the latitudes 40° and 46°. In the treaty of Utrecht (1713) the words used in transferring the French possessions to Britain were "Nova Scotia or Acadia." See NOVA SCOTIA for the limits included at that date under the term.

ACANTHOCEPHALA, a compact group of cylindrical, parasitic worms, with no near allies in the animal kingdom. Its members are quite devoid of any mouth or alimentary canal, but have a well-developed body cavity into which the eggs are dehisced and which communicates with the exterior by means of an oviduct. The size of the animals varies greatly, from forms a few millimetres in length to *Gigantorhynchus gigas*, which measures from 10 to 65 cms. The adults live in great numbers in the alimentary canal of some vertebrate, usually fish, the larvae are as a rule encysted in the body cavity of some invertebrate, most often an insect or crustacean, more rarely a small fish. The body is divisible into a proboscis and a trunk with sometimes an intervening neck region. The proboscis bears rings of recurved hooks arranged in horizontal rows, and it is by means of these hooks that the animal attaches itself to the tissues of its host. The hooks may be of two or three shapes. Like the body, the proboscis is hollow, and its cavity is separated from the body cavity by a septum or proboscis sheath. Traversing the cavity of the proboscis are muscle-strands inserted into the tip of the proboscis at one end and into the septum at the other. Their contraction causes the proboscis to be invaginated into its cavity (fig. 2). But the whole proboscis apparatus can also be, at least partially, withdrawn into the body cavity, and this is effected by two retractor muscles which run from the posterior aspect of the septum to the body wall (fig. 3).

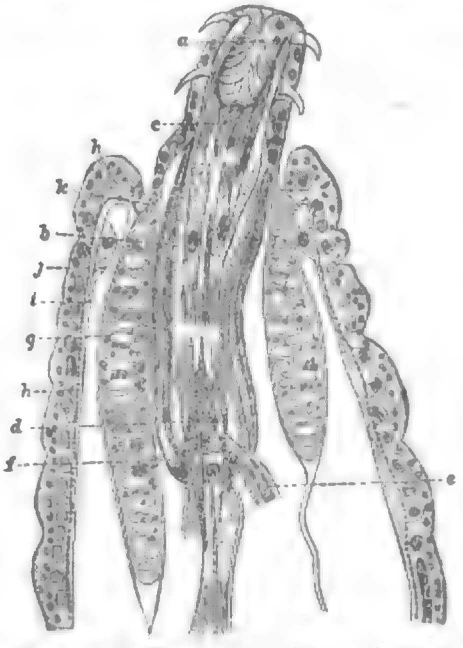


From *Cambridge Natural History*, vol. ii., "Worms, &c.," by permission of Macmillan & Co., Ltd.

FIG. 1.

A, Five specimens of *Echinorhynchus acus*, Rud., attached to a piece of intestinal wall, × 4.
B, The proboscis of one still more highly magnified.

The skin is peculiar. Externally is a thin cuticle; this covers the epidermis, which consists of a syncytium with no cell limits. The syncytium is traversed by a series of branching tubules containing fluid and is controlled by a few wandering, amoeboid nuclei (fig. 2). Inside the syncytium is a not very regular layer of circular muscle fibres, and within this again some rather scattered longitudinal fibres; there is no endothelium. In their minute structure the muscular fibres resemble those of Nematodes. Except for the absence of the longitudinal fibres the skin of the proboscis resembles that of the body, but the fluid-containing tubules of the latter are shut off from those of the body. The canals of the proboscis open ultimately into a circular vessel which runs round its base. From the circular canal two sac-like diverticula called the "lemnisci" depend into the cavity of the body (fig. 2). Each consists of a prolongation of the syncytial material of the proboscis skin, penetrated by canals and sheathed with a scanty muscular coat. They seem to act as reservoirs into which the fluid of the tense, extended proboscis can withdraw when it is retracted, and from which the fluid can be driven out when it is wished to expand the proboscis.



From *Cambridge Natural History*, vol. ii., "Worms, &c.," by permission of Macmillan & Co., Ltd.

FIG. 2.—A longitudinal section through the anterior end of *Echinorhynchus haeruca*, Rud. (from Hamann).

a, The proboscis not fully expanded.
b, Proboscis-sheath.
c, Retractor muscles of the proboscis.
d, Cerebral ganglion.
e, Retinaculum enclosing a nerve.
f, One of the retractors of the sheath.
g, A lemniscus.
h, One of the spaces in the sub-cuticular tissue.
i, Longitudinal muscular layer.
j, Circular muscular layer.
k, Line of division between the sub-cuticular tissue of the trunk and that of the proboscis with the lemnisci.

There are no alimentary canal or specialized organs for circulation or for respiration. Food is imbibed through the skin from the digestive juices of the host in which the Acanthocephala live.

J. Kaiser has described as kidneys two organs something like minute shrubs situated dorsally to the generative ducts into which they open. At the end of each twig is a membrane pierced by pores, and a number of cilia depend into the lumen of the tube; these cilia maintain a constant motion.

The central ganglion of the nervous system lies in the proboscis-sheath or -septum. It supplies the proboscis with nerves and gives off behind two stout trunks which supply the body (fig. 2). Each of these trunks is surrounded by muscles, and the complex retains the old name of "retinaculum." In the male at in Lithuanian, the language still spoken by some two millions of people on the frontier between Prussia and Russia in the neighbourhood of Königsberg and Vilna. Swedish also has a well-marked musical accent. Modern Greek has changed from pitch to stress, the stress being generally laid upon the same syllable in modern as bore the pitch accent in ancient Greek.

In the majority of European languages, however, stress is more conspicuous than pitch, and there is plenty of evidence to show that the original language from which Greek, Latin, Celtic, Teutonic, Slavonic and other languages of Europe are descended, possessed stress accent also in a marked degree. To the existence of this accent must be attributed a large part of the phenomena known as Ablaut or Gradation (see INDO-EUROPEAN LANGUAGES). In modern languages we can see the same principle at work making *Acton* out of the O. Eng. (Anglo-Saxon) *āc-tūn* (oak-town), and in more recent times producing the contrast between *New Town* and *Newton*. In French, stress is less marked than it is in English, but here also there is evidence to show that in the development from Latin to French a very strong stress accent must have existed. The natural result of producing one syllable of a word with greater energy than the others is that the other syllables have a less proportion of breath assigned to them and therefore tend to become indistinct or altogether inaudible. Thus the strong stress accent existing in the transition period between Latin and French led to the curtailing of long Latin words like *latrocīnium* or *hospitāle* into the words which we have borrowed from French into English as *larceny* and *hotel*. It will be observed that the first syllable and that which bears the accent are the two which best withstand change, though the strong tendency in English to stress heavily the first syllable bids fair ultimately to oust the *e* in the pronunciation of *larceny*. No such changes arise when a strong pitch accent is accompanied by a weaker stress accent, and hence languages like ancient Sanskrit and ancient Greek, where such conditions existed, preserve fuller forms than their sister languages or than even their own descendants, when stress takes the place of pitch as the more important element in accent.

In both pitch and stress accent different gradations may be observed. In pitch, the accent may be uniform, rising or falling. Or there may be combinations of rising and falling or of falling and rising accents upon the same syllable. In ancient Greek, as is well known, three accents are distinguished—(1) the acute (´), a rising accent; (2) the grave (`), apparently merely the indication that in particular positions in the sentence the acute accent is not used where it would occur in the isolated word; and (3) the circumflex, which, as its form (^) shows, and as the ancient grammarians inform us, is a combination of the rising and the falling accent upon the same syllable, this syllable being always long. Different Greek dialects, however, varied the syllables of the word on which the accent occurred, Aeolic Greek, for example, never putting the acute on the last syllable of a word, while Attic Greek had many words so accented.

The pitch accent of the Indo-European languages was originally free, *i.e.* might occur on any syllable of a word, and this condition of things is still found in the earliest Sanskrit literature. But in Greek before historical times the accent had become limited to the last three syllables of a word, so that a long word like the Homeric genitive φερομένοιο could in no circumstances be accented on either of its first two syllables, while if the final syllable was long, as in the accusative plural φερομένους, the accent could go back only to the second syllable from the end. As every vowel has its own natural pitch, and a frequent interchange between *e* (a high vowel) and *o* (a low vowel) occurs in the Indo-European languages, it has been suggested that *e* originally went with the highest pitch accent, while *o* appeared in syllables of a lower pitch. But if there is any foundation for the theory, which is by no means certain, its effects have been distorted and modified by all manner of analogical processes. Thus ποιμήν with acute accent and δαίμων with the acute accent on the preceding syllable would correspond to the rule, so would ἀληθής and ἔτος, but there are many exceptions like ὁδός where the acute accent accompanies an *o* vowel. Somewhat similar distinctions characterize syllables which are stressed. The strength of the expiration may be greatest either at the beginning, the end or the middle of the syllable, and, according as it is so, the accent is a falling, a rising, or a rising and falling one. Syllables in which the stress is produced continuously whether increasing or decreasing are called single-pointed syllables, those in which a variation in the stress occurs without being strong enough to break the syllable into two are called double-pointed syllables. These last occur in some English dialects, but are commonest in languages like Swedish and Lithuanian, which have a "sing-song" pronunciation. It is often not easy to decide whether a syllable is double-pointed or whether what we hear is really two-single-pointed syllables. There is no separate notation for stress accent, but the acute (′) is used for the increasing, the grave (`) for the decreasing stress, and the circumflex (˜) for the rising and falling (increasing and decreasing) and (ˇ) for the opposite. A separate notation is much to be desired, as the nature of the two accents is so different, and could easily be devised by using ʃ for the falling, (ʃ) for the rising stress, and ∽ for the combination of the two in one syllable. This would be clearer than the upright stroke ( ) preceding the stressed syllable, which is used in some phonetic works.

The relation between the two accents in the same language at the same time is a subject which requires further investigation. It is generally assumed that the chief stress and the chief pitch in a word coincide, but this is by no means certain for all cases, though the incidence of the chief stress accent in modern Greek upon the same syllable as had the chief pitch accent in ancient times suggests that the two did frequently fall upon the same syllable. On the other hand, in words like the Sanskrit *saptá*, the Gr. ἑπτά, the pitch accent which those languages indicate is upon a syllable which certainly, in the earliest times at least, did not possess the principal stress. For forms in other languages, like the Lat. *septem* or the Gothic *sibun*, show that the *a* of the final syllables in Sanskrit and Greek is the representative of a reduced syllable in which, even in the earliest times, the nasal alone existed (see under N for the history of these so-called sonant nasals). It is possible that sporadic changes of accent, as in the Gr. μήτηρ compared with the Sanskrit *matá*, is owing to the shifting of the pitch accent to the same syllable as the stress occupied.

There is no lack of evidence to show that the stress accent also may shift its position in the history of a language from one syllable to another. In prehistoric times the stress in Latin must have rested upon the first syllable in all cases. Only on this hypothesis can be explained forms like *peperci* (perfect of *parco*) and *collido* (a compound of *laedo*). In historical times, when the stress in Latin was on the second syllable from the end of the word if that syllable was long, or on the third syllable from the end if the second from the end was short, we should have expected to find **peparci* and **collaedo*, for throughout the historical period the stress rested in these words upon the second syllable from the end. The causes for the change of position are not always easy to ascertain. In words of four syllables with a long penult and words of five syllables with a short penult there probably developed a secondary accent which in course of time replaced the earlier accent upon the first syllable. But the number of such long words in Latin is comparatively small. It is no less possible that relations between the stress and pitch accents were concerned. For unless we are to regard the testimony of the ancient Latin grammarians as altogether untrustworthy there was at least in classical Latin a well-marked pitch as well as a stress accent. This question, which had long slumbered, has been revived by Dr J. Vendryes in his treatise entitled *Recherches sur l'histoire et les effets de l'intensité initiale en latin* (Paris, 1902).

In English there is a tendency to throw the stress on to the first syllable, which leads in time to the modification of borrowed words. Thus throughout the 18th century there was a struggle going on over the word *balcony*, which earlier was pronounced *balcóny*. Swift is the first author quoted for the pronunciation *bálcony*, and Cowper's *balcóny* in "John Gilpin" is among the latest instances of the old pronunciation. Disregarding the Latin quantity of *orātor* and *senātor*, English by throwing the stress on the first syllable has converted them into *órātor* and *sénātor*, while Scots lawyers speak also of a *cúrātor*. How far French influence plays a part here is not easy to say.

Besides the accent of the syllable and of the word, which have been already discussed, there remains the accent of the sentence. Here the problem is much more complicated. The accent of a word, whether pitch or stress, may be considerably modified in the sentence. From earliest times some words have become parasitic or enclitic upon other words. Pronouns more than most words are modified from this cause, but conjunctions like the Gr. τε ("and"), the Lat. *que*, have throughout their whole history been enclitic upon the preceding word. A very important word may be enclitic, as in English *don't*, *shan't*. It is to be remembered that the unit of language is rather the sentence than the word, and that the form which is given to the word in the dictionary is very often not the form which it takes in actual speech. The divisions of words in speech are quite different from the divisions on the printed page. Sanskrit alone amongst languages has consistently recognized this, and preserves in writing the exact combinations that are spoken.

Accent, whether pitch or stress, can be utilized in the sentence to express a great variety of meanings. Thus in English a sentence like *You rode to Newmarket yesterday*, which contains five words, may be made to express five different statements by putting the stress upon each of the words in turn. By putting the stress on *you* the person addressed is marked out as distinct from certain others, by putting it upon *rode* other means of locomotion to Newmarket are excluded, and so on. With the same order of words five interrogative sentences may also be expressed, and a third series of exclamatory sentences expressing anger, incredulity, &c., may be obtained from the same words. It is to be noticed that for these two series a different intonation, a different musical (pitch) accent appears from that which is found in the same words when employed to make a matter-of-fact statement.

In languages like Chinese, which have neither compound words nor inflection, accent plays a very important part. As the words are all monosyllabic, stress could obviously not be so important as pitch as a help to distinguish different senses attached to the same vocable, and in no other language is variety of pitch so well developed as in Chinese. In languages which, like English, show comparatively little pitch accent it is to be noticed that the sentence tends to develop a more musical character under the influence of emotion. The voice is raised and at the same time greater stress is generally employed when the speaker is carried away by emotion, though the connexion is not essential and strong emotion may be expressed by a lowering as well as by a raising of the voice. In either case, however, the stress will be greater than the normal.

Bibliography.—H. Sweet, *Primer of Phonetics* (1890, now in 3rd edition), § 96 ff., *History of English Sounds* (1888), § 110 ff., and other works; E. Sievers, *Grundzuge der Phonetik* (1893), § 532 ff.; O. Jespersen, *Lehrbuch der Phonetik* (1904), an abbreviated German translation of the author's larger work in Danish, § 216 ff. The books of Sievers and Jespersen give (especially Sievers) full references to the literature of the subject. For the accent system of the Indo-European languages see "Betonung" in Brugmann's *Grundriss der vergleichenden Grammatik der indogermanischen Sprachen*, vol. i. (1897), or, with considerable modifications, his *Kurze vergleichende Grammatik der idg. Sprachen* (1902), §§ 32-65 and 343-350. (P. Gi.)

ACCEPTANCE (Lat. *acceptare*, frequentative form of *accipere*, to receive), generally, a receiving or acknowledgment of receipt; in law, the act by which a person binds himself to comply with the request contained in a *bill of exchange* (*q.v.*), addressed to him by the drawer. In all cases it is understood to be a promise to pay the bill in money, the law not recognizing an acceptance in which the promise is to pay in some other way, *e.g.* partly in money and partly by another bill. Acceptance may be either general or qualified. A *general* acceptance is an engagement to pay the bill strictly according to its tenor, and is made by the drawee subscribing his name, with or without the word "accepted," at the bottom of the bill, or across the face of it. *Qualified* acceptance may be a promise to pay on a contingency occurring, *e.g.* on the sale of certain goods consigned by the drawer to the acceptor. No contingency is allowed to be mentioned in the body of the bill, but a qualified acceptance is quite legal, and equally binding with a general acceptance upon the acceptor when the contingency has occurred. It is also qualified acceptance where the promise is to pay only part of the sum mentioned in the bill, or to pay at a different time or place from those specified. As a qualified acceptance is so far a disregard of the drawer's order, the holder is not obliged to take it; and if he chooses to take it he must give notice to antecedent parties, acting at his own risk if they dissent. In all cases acceptance involves the signature of the acceptor either by himself or by some person duly authorized on his behalf. A bill can be accepted in the first instance only by the person or persons to whom it is addressed; but if he or they fail to do so, it may, after being protested for non-acceptance, be accepted by some one else "*supra* protest," for the sake of the honour of one or more of the parties concerned in it, and he thereupon acquires a claim against the drawer and all those to whom he could have resorted.

ACCEPTILATION (from Lat. *acceptilatio*), in Roman and Scots law, a verbal release of a verbal obligation. This formal mode of extinguishing an obligation contracted verbally received its name from the book-keeping term *acceptilatio*, entering a receipt, *i.e.* carrying it to credit. The words conveying the release had to correspond to, or strictly cover, the expressed obligation. Figuratively, in theology, the word acceptilation means free remission or forgiveness of sins.

ACCESS (Lat. *accessus*), approach, or the means of approaching. In law, the word is used in various connexions. The presumption of a child's legitimacy is negatived if it be proved that a husband has not had access to his wife within such a period of time as would admit of his being the father. (See Legitimacy.) In the law of easements, every person who has land adjoining a public road or a public navigable river has a right of access to it from his land. So, also, every person has a right of access to air and light from an ancient window. For the right of access of parents to children under the guardianship of the court, see Infant.

ACCESSION (from Lat. *accedere*, to go to, to approach), in law, a method of acquiring property adopted from Roman law, by which, in things that have a close connexion with or dependence on one another, the property of the principal draws after it the property of the accessory, according to the principle, *accessio cedet principali*. Accession may take place either in a natural way, such as the growth of fruit or the pregnancy of animals, or in an artificial way. The various methods may be classified as (1) land to land by accretion or alluvion; (2) moveables to land (see Fixtures); (3) moveables to moveables; (4) moveables added to by the art or industry of man; this may be by specification, as when wine is made out of grapes, or by confusion, or commixture, which is the mixing together of liquids or solids, respectively. In the case of industrial accession ownership is determined according as the natural or manufactured substance is of the more importance, and, in general, compensation is payable to the person who has been dispossessed of his property.

In a historical or constitutional sense, the term "accession" is applied to the coming to the throne of a dynasty or line of sovereigns or of a single sovereign.

"Accession" sometimes likewise signifies consent or acquiescence. Thus, in the bankruptcy law of Scotland, where there is a settlement by a trust-deed, it is accepted on the part of each creditor by a "deed of accession."

ACCESSORY, a person guilty of a felonious offence, not as principal, but by participation; as by advice, command, aid or concealment. In certain crimes, there can be no accessories; all concerned being principals, whether present or absent at the time of their commission. These are treason, and all offences below the degree of felony, as specified in the Offences against the Person Act 1861.

There are two kinds of accessories—*before* the fact, and *after* it. The first is he who commands or procures another to commit felony, and is not present himself; for if he be present, he is a principal. The second is he who receives, harbours, assists, or comforts any man that has done murder or felony, whereof he has knowledge. An accessory before the fact is liable to the same punishment as the principal; and there is now indeed no practical difference between such an accessory and a principal in regard either to indictment, trial or punishment. Accessories after the fact are in general punishable with imprisonment (with or without hard labour) for a period not exceeding two years, but in the case of murder punishable by penal servitude for life, or not less than three years, or by imprisonment (with or without hard labour) to the extent of two years.

The law of Scotland makes no distinction between the accessory to any crime and the principal (see ART AND PART). Except in the case of treason, accession after the fact is not noticed by the law of Scotland, unless as an element of evidence to prove previous accession.

ACCIAJUOLI, DONATO (1428–1478), Italian scholar, was born at Florence in 1428. He was famous for his learning, especially in Greek and mathematics, and for his services to his native state. Having previously been entrusted with several important embassies, he became Gonfalonier of Florence in 1473. He died at Milan in 1478, when on his way to Paris to ask the aid of Louis XI. on behalf of the Florentines against Pope Sixtus IV. His body was taken back to Florence, and buried in the church of the Carthusians at the public expense, and his daughters were portioned by his fellow-citizens, the fortune he left being, owing to his probity and disinterestedness, very small. He wrote a Latin translation of some of Plutarch's *Lives* (Florence, 1478); Commentaries on Aristotle's *Ethics* and *Politics*; and the lives of Hannibal, Scipio and Charlemagne. In the work on Aristotle he had the co-operation of his master Argyropulus.

ACCIDENCE (a mis-spelling of "accidents," from the Latin neuter plural *accidentia*, casual events), the term for the grammatical changes to which words are subject in their inflections as to gender, number, tense and case. It is also used to denote a book containing the first principles of grammar, and so of the rudiments of any subject or art.

ACCIDENT (from Lat. *accidere*, to happen), a word of widely variant meanings, usually something fortuitous and unexpected; a happening out of the ordinary course of things. In the law of tort, it is defined as "an occurrence which is due neither to design nor to negligence"; in equity, as "such an unforeseen event, misfortune, loss, act or omission, as is not the result of any negligence or misconduct." So, in criminal law, "an effect is said to be accidental when the act by which it is caused is not done with the intention of causing it, and when its occurrence as a consequence of such act is not so probable that a person of ordinary prudence ought, under the circumstances, to take reasonable precaution against it" (Stephen, *Digest of Criminal Law*, art. 210). The word may also have in law the more extended meaning of an unexpected occurrence, whether caused by any one's negligence or not, as in the Fatal Accidents Act 1846, Notice of Accidents Act 1894. See also CONTRACT, CRIMINAL LAW, EMPLOYERS' LIABILITY, INSURANCE, TORT, &c.

In logic an "accident" is a quality which belongs to a subject but not as part of its essence (in Aristotelian language *κατὰ συμβεβηκός*, the scholastic *per accidens*). Essential attributes are necessarily, or causally, connected with the subject, *e.g.* the sum of the angles of a triangle; accidents are not deducible from the nature, or are not part of the necessary connotation, of the subject, *e.g.* the area of a triangle. It follows that increased knowledge, *e.g.* in chemistry, may show that what was thought to be an accident is really an essential attribute, or vice versa. It is very generally held that, in reality, there is no such thing as an accident, inasmuch as complete knowledge would establish a causal connexion for all attributes. An accident is thus merely an unexplained attribute. Accidents have been classed as (1) "inseparable," *i.e.* universally present, though no causal connexion is established, and (2) "separable," where the connexion is neither causally explained nor universal. Propositions expressing a relation between a subject and an accident are classed as "accidental," "real" or "ampliative," as opposed to "verbal" or "analytical," which merely express a known connexion, *e.g.* between a subject and its connotation (*q.v.*).

ACCIDENTALISM, a term used (1) in philosopy for any system of thought which denies the causal nexus and maintains that events succeed one another haphazard or by chance (not in the mathematical but in the popular sense). In metaphysics, accidentalism denies the doctrine that everything occurs or results from a definite cause. In this connexion it is synonymous with Tychism (τύχη, chance), a term used by C. S. Peirce for the theories which make chance an objective factor in the process of the Universe. Opponents of this accidentalism maintain that what seems to be the result of chance is in reality due to a cause or causes which, owing to the lack of imagination, knowledge or scientific instruments, we are unable to detect. In ethics the term is used, like indeterminism, to denote the theory that mental change cannot always be ascribed to previously ascertained psychological states, and that volition is not causally related to the motives involved. An example of this theory is the doctrine of the *liberum arbitrium indifferentiae* ("liberty of indifference"), according to which the choice of two or more alternative possibilities is affected neither by contemporaneous data of an ethical or prudential kind nor by crystallized habit (character). (2) In painting, the term is used for the effect produced by accidental lights (Ruskin, *Modern Painters*, I. ii. 4, iii. § 4, 287). (3) In medicine, it stands for the hypothesis that disease is only an accidental modification of the healthy condition, and can, therefore, be avoided by modifying external conditions.

ACCIUS, a Latin poet of the 16th century, to whom is attributed a paraphrase of Aesop's Fables, of which Julius Scaliger speaks with great praise.

ACCIUS, LUCIUS, Roman tragic poet, the son of a freedman, was born at Pisaurum in Umbria, in 170 B.C. The year of his death is unknown, but he must have lived to a great age, since Cicero (*Brutus*, 28) speaks of having conversed with him on literary matters. He was a prolific writer and enjoyed a very high reputation (Horace, *Epistles*, ii. 1, 56; Cicero, *Pro Plancio*, 24). The titles and considerable fragments (about 700 lines) of some fifty plays have been preserved. Most of these were free translations from the Greek, his favourite subjects being the legends of the Trojan war and the house of Pelops. The national history, however, furnished the theme of the *Brutus* and *Decius*,—the expulsion of the Tarquins and the self-sacrifice of Publius Decius Mus the younger. The fragments are written in vigorous language and show a lively power of description.

Accius wrote other works of a literary character: *Didascalicōn* and *Pragmaticōn libri*, treatises in verse on the history of Greek and Roman poetry, and dramatic art in particular; *Parerga* and *Praxidica* (perhaps identical) on agriculture; and an *Annales*. He also introduced innovations in orthography and grammar.

See Boissier, *Le Poète Accius*, 1856; L. Müller, *De Accii fabulis Disputatio* (1890); Ribbeck, *Geschichte der römischen Dichtung* (1892); editions of the tragic fragments by Ribbeck (1897), of the others by Bährens (1886); Plessis, *Poésie latine* (1909).

ACCLAMATION (Lat. *acclamatio*, a shouting at), in deliberative or electoral assemblies, a spontaneous shout of approval or praise. Acclamation is thus the adoption of a resolution or the passing of a vote of confidence or choice unanimously, in direct distinction from a formal ballot or division. In the Roman senate opinions were expressed and votes passed by acclamation in such forms as *Omnes, omnes, Aequum est, Justum est*, &c.; and the praises of the emperor were celebrated in certain pre-arranged sentences, which seem to have been chanted by the whole body of senators. In ecclesiastical councils vote by acclamation is very common, the question being usually put in the form, *placet* or *non placet*. The Sacred College has sometimes elected popes by acclamation, when the cardinals simultaneously and without any previous consultation "acclaimed" one of their number as pontiff. A further ecclesiastical use of the word is in its application to set forms of praise or thanksgiving in church services, the stereotyped responses of the congregation. In modern parliamentary usage a motion is carried by acclamation when, no amendment being proposed, approval is expressed by shouting such words as *Aye* or *Agreed*.

ACCLIMATIZATION, the process of adaptation by which animals and plants are gradually rendered capable of surviving and flourishing in countries remote from their original habitats, or under meteorological conditions different from those which they have usually to endure, and at first injurious to them.

The subject of acclimatization is very little understood, and some writers have even denied that it can ever take place. It is often confounded with *domestication* or with *naturalisation*; but these are both very different phenomena. A *domesticated* animal or a cultivated plant need not necessarily be *acclimatised*; that is, it need not be capable of enduring the severity of the seasons without protection. The canary bird is *domesticated* but not *acclimatized*, and many of our most extensively cultivated plants are in the same category. A *naturalized* animal or plant, on the other hand, must be able to withstand all the vicissitudes of the seasons in its new home, and it may therefore be thought that it must have become acclimatized. But in many, perhaps most cases of *naturalization* (see Appendix below) there is no evidence of a gradual adaptation to new conditions which were at first injurious, and this is essential to the idea of *acclimatization*. On the contrary, many species, in a new country and under somewhat different climatic conditions, seem to find a more congenial abode than in their native land, and at once flourish and increase in it to such an extent as often to exterminate the indigenous inhabitants. Thus L. Agassiz (in his work on Lake Superior) tells us that the roadside weeds of the north-eastern United States, to the number of 130 species, are all European, the native weeds having disappeared westwards; while in New Zealand there are, according to T. Kirk (*Transactions of the New Zealand Institute*, vol. ii. p. 131), no less than 250 species of naturalized plants, more than 100 of which spread widely over the country and often displace the native vegetation. Among animals, the European rat, goat and pig are naturalized in New Zealand, where they multiply to such an extent as to injure and probably exterminate many native productions. In none of these cases is there any indication that *acclimatisation* was necessary or ever took place.

On the other hand, the fact that an animal or plant cannot be *naturalized* is no proof that it is not *acclimatised*. It has been shown by C. Darwin that, in the case of most animals and plants in a state of nature, the competition of other organisms is a far more efficient agency in limiting their distribution than the mere influence of climate. We have a proof of this in the fact that so few, comparatively, of our perfectly hardy garden plants ever run wild; and even the most persevering attempts to naturalize them usually fail. Alphonse de Candolle (*Géographie botanique*, p. 798) informs us that several botanists of Paris, Geneva, and especially of Montpellier, have sown the seeds of many hundreds of species of exotic hardy plants, in what appeared to be the most favourable situations, but that in hardly a single case has any one of them become naturalized. Attempts have also been made to naturalize continental insects in Britain, in places where the proper food-plants abound and the conditions seem generally favourable, but in no case do they seem to have succeeded. Even a plant like the potato, so largely cultivated and so perfectly hardy, has not established itself in a wild state in any part of Europe.

Different Degrees of Climatal Adaptation in Animals and Plants.—Plants differ greatly from animals in the closeness of their adaptation to meteorological conditions. Not only will most tropical plants refuse to live in a temperate climate, but many species are seriously injured by removal a few degrees of latitude beyond their natural limits. This is probably due to the fact, established by the experiments of A. C. Becquerel, that plants possess no proper temperature, but are wholly dependent on that of the surrounding medium.

Animals, expecially the higher forms, are much less sensitive to change of temperature, as shown by the extensive range from north to south of many species. Thus, the tiger ranges from the equator to northern Asia as far as the river Amur, and to the isothermal of 32° Fahr. The mountain sparrow (*Passer montana*) is abundant in Java and Singapore in a uniform equatorial climate, and also inhabits Britain and a considerable portion of northern Europe. It is true that most terrestrial animals are restricted to countries not possessing a great range of temperature or very diversified climates, but there is reason to believe that this is due to quite a different set of causes, such as the presence of enemies or deficiency of appropriate food. When supplied with food and partially protected from enemies, they often show a wonderful capacity of enduring climates very different from that in which they originally flourished. Thus, the horse and the domestic fowl, both natives of very warm countries, flourish without special protection in almost every inhabited portion of the globe. The parrot tribe form one of the most pre-eminently tropical groups of birds, only a few species extending into the warmer temperate regions; yet even the most exclusively tropical genera are by no means delicate birds as regards climate. In the *Annals and Magazine of Natural History* for 1868 (p. 381) is a most interesting account, by Charles Buxton, of the naturalization of parrots at Northreps Hall, Norfolk. A considerable number of African and Amazonian parrots, Bengal parroquets, four species of white and rose crested cockatoos, and two species of crimson lories, remained at large for many years. Several of these birds bred, and they almost all lived in the woods the whole year through, refusing to take shelter in a house constructed for their use. Even when the thermometer fell 6° below zero, all appeared in good spirits and vigorous health. Some of these birds have lived thus exposed for many years, enduring the English cold easterly winds, rain, hail and snow, all through the winter—a marvellous contrast to the equable equatorial temperature (hardly ever less than 70°) to which many of them had been accustomed for the first year or years of their existence. Similarly the recent experience of zoological gardens, particularly in the case of parrots and monkeys, shows that, excluding draughts, exposure to changes of temperature without artificial heat is markedly beneficial as compared with the older method of strict protection from cold.

Hardly any group of Mammalia is more exclusively tropical than the Quadrumana, yet, if other conditions are favourable, some of them can withstand a considerable degree of cold. *Semnopithecus schistaceus* was found by Captain Hutton at an elevation of 11,000 feet in the Himalayas, leaping actively among fir-trees whose branches were laden with snow-wreaths. In Abyssinia a troop of dog-faced baboons was observed by W. T. Blanford at 9000 feet above the sea. We may therefore conclude that the restriction of the monkey tribe to warm latitudes is probably determined by other causes than temperature alone.

Similar indications are given by the fact of closely allied species inhabiting very extreme climates. The recently extinct Siberian mammoth and woolly rhinoceros were closely allied to species now inhabiting tropical regions exclusively. Wolves and foxes are found alike in the coldest and hottest parts of the earth, as are closely allied species of falcons, owls, sparrows and numerous genera of waders and aquatic birds.

A consideration of these and many analogous facts might induce us to suppose that, among the higher animals at least, there is little constitutional adaptation to climate, and that in their case acclimatization is not required. But there are numerous examples of domestic animals which show that such adaptation does exist in other cases. The yak of Thibet cannot long survive in the plains of India, or even on the hills below a certain altitude; and that this is due to climate, and not to the increased density of the atmosphere, is shown by the fact that the same animal appears to thrive well in Europe, and even breeds there readily. The Newfoundland dog will not live in India, and the Spanish breed of fowls in this country suffer more from frost than most others. When we get lower in the scale the adaptation is often more marked. Snakes, which are so abundant in warm countries, diminish rapidly as we go north, and wholly cease at lat. 62°. Most insects are also very susceptible to cold, and seem to be adapted to very narrow limits of temperature.

From the foregoing facts and observations we may conclude, firstly, that some plants and many animals are not constitutionally adapted to the climate of their native country only, but are capable of enduring and flourishing under a more or less extensive range of temperature and other climatic conditions; and, secondly, that most plants and some animals are, more or less closely, adapted to climates similar to those of their native habitats. In order to domesticate or naturalize the former the same local diseases as other unacclimatized individuals. He well remarked that the debility and sickening of Europeans in many tropical countries are wrongly ascribed to the climate, but are rather the consequences of indolence, sensual gratification and an irregular mode of life. Thus the English, who cannot give up animal food and spirituous liquors, are less able to sustain the heat of the tropics than the more sober Spaniards and Portuguese. The excessive mortality of European troops in India, and the delicacy of the children of European parents, do not affect the real question of acclimatization under proper conditions. They only show that acclimatization is in most cases necessary, not that it cannot take place. The best examples of partial or complete acclimatization are to be found where European races have permanently settled in the tropics, and have maintained themselves for several generations. There are, however, two sources of inaccuracy to be guarded against, and these are made the most of by the writers above referred to, and are supposed altogether to invalidate results which are otherwise opposed to their views. In the first place, we have the possibility of a mixture of native blood having occurred; in the second, there have almost always been a succession of immigrants from the parent country, who continually intermingle with the families of the early settlers. It is maintained that one or other of these mixtures is absolutely necessary to enable Europeans to continue long to flourish in the tropics.

There are, however, certain cases in which the sources of error above mentioned are reduced to a minimum, and cannot seriously affect the results; such as those of the Jews, the Dutch at the Cape of Good Hope and in the Moluccas, and the Spaniards in South America.

The Jews are a good example of acclimatization, because they have been established for many centuries in climates very different from that of their native land; they keep themselves almost wholly free from intermixture with the people around them; and they are often so populous in a country that the intermixture with Jewish immigrants from other lands cannot seriously affect the local purity of the race. They have, for instance, attained a population of millions in such severe climates as Poland and Russia; in the towns of Algeria they have succeeded so conspicuously as to bring about an outburst of anti-semitism; and in Cochin-China and Aden they succeed in rearing children and forming permanent communities.

In some of the hottest parts of South America Europeans are perfectly acclimatized, and where the race is kept pure it seems to be even improved. Some very valuable notes on this subject were furnished to the present writer by the well-known botanist, Richard Spruce, who resided many years in South America, but who was prevented by ill-health from publishing his researches (see A. R. Wallace, *Notes of a Botanist*, 1908). As a careful, judicious and accurate observer, both of man and nature, he had few superiors. He says:

> The white inhabitants of Guayaquil (lat. 2° 13′ S.) are kept pure by careful selection. The slightest tincture of red or black blood bars entry into any of the old families who are descendants of Spaniards from the Provincias Vascongadas or those bordering the Bay of Biscay, where the morals are perhaps the purest (as regards the intercourse of the sexes) of any in Europe, and where for a girl, even of the poorest class, to have a child before marriage is the rarest thing possible. The consequence of this careful breeding is, that the women of Guayaquil are considered (and justly) the finest along the whole Pacific coast. They are often tall, sometimes very handsome, decidedly healthy, although pale, and assuredly prolific enough. Their sons are big, stout men, but when they lead inactive lives are apt to become fat and sluggish. Those of them, however, who have farms in the savannahs and are accustomed to take long rides in all weathers, and those whose trade obliges them to take frequent journeys in the mountainous interior, or even to Europe and North America, are often as active and as little burdened with superfluous flesh as a Scotch farmer.
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> The oldest Christian town in Peru is Piura (lat. 5° S.), which was founded by Pizarro himself. The climate is very hot, especially in the three or four months following the southern solstice. In March 1843 the temperature only once fell as low as 83° during the whole month, the usual lowest night temperature being 85°. Yet people of all colours find it very healthy, and the whites are very prolific. I resided in the town itself nine months, and in the neighbourhood seven months more. The population (in 1863–1864) was about 10,000, of which not only a considerable proportion was white, but was mostly descended from the first emigrants after the conquest. Purity of descent was not, however, quite so strictly maintained as at Guayaquil. The military adventurers, who have often risen to high or even supreme rank in Peru, have not seldom been of mixed race, and fear or favour has often availed to procure them an alliance with the oldest and purest-blooded families.

These instances, so well stated by Spruce, seem to demonstrate the complete acclimatization of Spaniards in some of the hottest parts of South America. Although we have here nothing to do with mixed races, yet the want of fertility in these has been often taken to be a fact inherent in the mongrel race, and has been also sometimes held to prove that neither the European nor his half-bred offspring can maintain themselves in the tropics. The following observation is therefore of interest:—

> At Guayaquil for a lady of good family—married or unmarried—to be of loose morals is so uncommon, that when it does happen it is felt as a calamity by the whole community. But here, and perhaps in most other towns in South America, a poor girl of mixed race—especially if good-looking—rarely thinks of marrying one of her own class until she has—as the Brazilians say—"approveitada de sua mocidade" (made the most of her youth) in *receiving presents from gentlemen*. If she thus bring a good dowry to her husband, he does not care to inquire, or is not sensitive, about the mode in which it was acquired. The consequence of this indiscriminate sexual intercourse, especially if much prolonged, is to diminish, in some cases to paralyse, the fertility of the female. And as among people of mixed race it is almost universal, the population of these must fall off both in numbers and quality.

The following example of divergent acclimatization of the same race to hot and cold zones is very interesting, and will conclude our extracts from Spruce's valuable notes:—

> One of the most singular cases connected with this subject that have fallen under my own observation, is the difficulty, or apparent impossibility, of acclimatizing the Red Indian in a certain zone of the Andes. Any person who has compared the physical characters of the native races of South America must be convinced that these have all originated in a common stirps. Many local differences exist, but none capable of invalidating this conclusion. The warmth yet shade-loving Indian of the Amazon; the Indian of the hot, dry and treeless coasts of Peru and Guayaquil, who exposes his bare head to the sun with as much zest as an African negro; the Indian of the Andes, for whom no cold seems too great, who goes constantly bare-legged and often bare-headed, through whose rude straw hut the piercing wind of the paramos sweeps and chills the white man to the very bones;—all these, in the colour and texture of the skin, the hair and other important features, are plainly of one and the same race.
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> Now there is a zone of the equatorial Andes, ranging between about 4000 and 6000 feet altitude, where the very best flavoured coffee is grown, where cane is less luxuriant but more saccharine than in the plains, and which is therefore very desirable to cultivate, but where the red man sickens and dies. Indians taken down from the sierra get ague and dysentery. Those of the plains find the temperature chilly, and are stricken down with influenza and pains in the limbs. I have seen the difficulty experienced in getting farms cultivated in this zone, on both sides of the Cordillera. The permanent residents are generally limited to the major-domo and his family; and in the dry season labourers are hired, of any colour that can be obtained—some from the low country, others from the highlands—for three, four, or five months, who gather in and grind the cane, and plant for the harvest of the following year; but the staff of resident Indian labourers, such as exists in the farms of the sierra, cannot be kept up in the *Yungas*, as these half-warm valleys are called. White men, who take proper precautions, and are not chronically soaked with cane-spirit, stand the climate perfectly, but the creole whites are still too much *caballeros* to devote themselves to agricultural work.
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> In what is now the republic of Ecuador, the only peopled portions are the central valley, between the two ridges of the Andes—height 7000 to 12,000 feet—and the hot plain at their western base; nor do the wooded slopes appear to have been inhabited, except by scattered savage hordes, even in the time of the Incas. The Indians of the highlands are the descendants of others who have inhabited that region exclusively for untold ages; and a similar affirmation may be made of the Indians of the plain. Now, there is little doubt that the progenitors of both these sections came from a temperate region (in North America); so that here we have one moiety acclimatized to endure extreme heat, and the other extreme cold; and at this day exposure of either to the opposite extreme (or even, as we have seen, to the climate of an intermediate zone) is always pernicious and often fatal. But if this great difference has been brought about in the red man, might not the same have happened to the white man? Plainly it might, time being given; for one cannot doubt that the inherent adaptability is the same in both, or (if not) that the white man possesses it in a higher degree.

distinct from that of the same or closely allied species of adjacent islands; and, lastly, numerous species which have tailed wings in India and the western islands of the Archipelago, gradually lose the tail as we proceed eastward to New Guinea and the Pacific.

Many of these curious modifications may, it is true, be due to other causes than climate only, but they serve to show how powerfully and mysteriously local conditions affect the form and structure of both plants and animals; and they render it probable that changes of constitution are also continually produced, although we have, in the majority of cases, no means of detecting them. It is also impossible to determine how far the effects described are produced by spontaneous favourable variations or by the direct action of local conditions; but it is probable that in every case both causes are concerned, although in constantly varying proportions.

Selection and Survival of the Fittest as Agents in Naturalization.—We may now take it as an established fact that varieties of animals and plants occur, both in domesticity and in a state of nature, which are better or worse adapted to special climates. There is no positive evidence that the influence of new climatal conditions on the parents has any tendency to produce variations in the offspring better adapted to such conditions. Neither does it appear that this class of variations are very frequent. It is, however, certain that whenever any animal or plant is largely propagated constitutional variations will arise, and some of these will be better adapted than others to the climatal and other conditions of the locality. In a state of nature, every recurring severe winter or otherwise unfavourable season weeds out those individuals of tender constitution or imperfect structure which may have got on very well during favourable years, and it is thus that the adaptation of the species to the climate in which it has to exist is kept up. Under domestication the same thing occurs by what C. Darwin has termed "unconscious selection." Each cultivator seeks out the kinds of plants best suited to his soil and climate and rejects those which are tender or otherwise unsuitable. The farmer breeds from such of his stock as he finds to thrive best with him, and gets rid of those which suffer from cold, damp or disease. A more or less close adaptation to local conditions is thus brought about, and breeds or races are produced which are sometimes liable to deterioration on removal even to a short distance in the same country, as in numerous cases quoted by C. Darwin (*Animals and Plants under Domestication*).

The Method of Acclimatization.—Taking into consideration the foregoing facts and illustrations, it may be considered as proved—*1st*, That habit has little (though it appears to have some) definite effect in adapting the constitution of animals to a new climate; but that it has a decided, though still slight, influence in plants when, by the process of propagation by buds, shoots or grafts, the individual can be kept under its influence for long periods; *2nd*, That great and sudden changes of climate often check reproduction even when the health of the individuals does not appear to suffer. In order, therefore, to have the best chance of acclimatizing any animal or plant in a climate very dissimilar from that of its native country, and in which it has been proved that the species in question cannot live and maintain itself without acclimatization, we must adopt some such plan as the following:—

1. We must transport as large a number as possible of adult healthy individuals to some intermediate station, and increase them as much as possible for some years. Favourable variations of constitution will soon show themselves, and these should be carefully selected to breed from, the tender and unhealthy individuals being rigidly eliminated.

2. As soon as the stock has been kept a sufficient time to pass through all the ordinary extremes of climate, a number of the hardiest may be removed to the more remote station, and the same process gone through, giving protection if necessary while the stock is being increased, but as soon as a large number of healthy individuals are produced, subjecting them to all the vicissitudes of the climate.

It can hardly be doubted that in most cases this plan would succeed. It has been recommended by C. Darwin, and at one of the early meetings of the *Société Zoologique d' Acclimatation*, at Paris, Isodore Geoffroy St Hilaire insisted that it was the only method by which acclimatization was possible. But in looking through the long series of volumes of Reports published by this society, there is no sign that any systematic attempt at acclimatization has even once been made. A number of foreign animals have been introduced, and more or less domesticated, and some useful exotics have been cultivated for the purpose of testing their applicability to French agriculture or horticulture; but neither in the case of animals nor of plants has there been any systematic effort to modify the constitution of the species, *by breeding largely and selecting the favourable variations that appeared*.

Take the case of the *Eucalyptus globulus* as an example. This is a Tasmanian gum-tree of very rapid growth and great beauty, which will thrive in the extreme south of France. In the *Bulletin* of the society a large number of attempts to introduce this tree into general cultivation in other parts of France are recorded in detail, with the failure of almost all of them. But no precautions such as those above indicated appear to have been taken in any of these experiments; and we have no intimation that either the society or any of its members are making systematic efforts to acclimatize the tree. The first step would be, to obtain seed from healthy trees growing in the coldest climate and at the greatest altitude in its native country, sowing these very largely, and in a variety of soils and situations, in a part of France where the climate is somewhat but not much more extreme. It is almost a certainty that a number of trees would be found to be quite hardy. As soon as these produced seed, it should be sown in the same district and farther north in a climate a little more severe. After an exceptionally cold season, seed should be collected from the trees that suffered least, and should be sown in various districts all over France. By such a process there can be hardly any doubt that the tree would be thoroughly acclimatized in any part of France, and in many other countries of central Europe; and more good would be effected by one well-directed effort of this kind than by hundreds of experiments with individual animals and plants, which only serve to show us which are the species that *do not require to be acclimatized*.

Acclimatization of Man.—On this subject we have, unfortunately, very little direct or accurate information. The general laws of heredity and variation have been proved to apply to man as well as to animals and plants; and numerous facts in the distribution of races show that man must, in remote ages at least, have been capable of constitutional adaptation to climate. If the human race constitutes a single species, then the mere fact that man now inhabits every region, and is in each case constitutionally adapted to the climate, proves that acclimatization has occurred. But we have the same phenomenon in single varieties of man, such as the American, which inhabits alike the frozen wastes of Hudson's Bay and Tierra del Fuego, and the hottest regions of the tropics,—the low equatorial valleys and the lofty plateaux of the Andes. No doubt a sudden transference to an extreme climate is often prejudicial to man, as it is to most animals and plants; but there is every reason to believe that, if the migration occurs step by step, man can be acclimatized to almost any part of the earth's surface in comparatively few generations. Some eminent writers have denied this. Sir Ranald Martin, from a consideration of the effects of the climate of India on Europeans and their offspring, believed that there is no such thing as acclimatization. Dr Hunt, in a report to the British Association in 1861, argued that "time is no agent," and—"if there is no sign of acclimatization in one generation, there is no such process." But he entirely ignored the effect of favourable variations, as well as the direct influence of climate acting on the organization from infancy.

Professor Theodor Waitz, in his *Introduction to Anthropology*, adduced many examples of the comparatively rapid constitutional adaptation of man to new climatic conditions. Negroes, for example, who have been for three or four generations acclimatized in North America, on returning to Africa become subject to

The golden pheasant (*Chrysolophus pictus*) is locally established in the United States, as appear to be other pheasants of less common species. The Reeves' pheasant (*P. reevesi*) is at large on some English estates. Of the partridges, the continental red-leg (*Caccabis rufa*) is established in England, and its ally, the Asiatic chukore (*C. chukar*), in St Helena, as is the Californian quail (*Lophortyx californica*) in New Zealand and Hawaii. The latter, however, though thriving as an aviary bird, has failed at large in England, as did the bob-white (*Ortyx virginianus*) both there and in New Zealand.

The desirable character of the grouse as game-birds has led to many attempts at their acclimatization, but usually these have been unsuccessful; the red grouse (*Lagopus scoticus*), however, the only endemic British bird, is naturalized in some parts of Europe.

Of waterfowl, the Canada goose (*Branta canadensis*) is naturalized to a small extent in Britain, and also, to a less degree, the Egyptian goose (*Chenalopex aegyptiacus*); the latter bird also occurs wild in New Zealand. The modern presence of the black swan of Australia (*Chenopis atrata*) in New Zealand appears to be due to a natural irruption of the species about half a century ago as much as to acclimatization by man, if not more so.

Birds of prey are, unjustly enough, regarded with so little favour that few attempts have been made to naturalize them; the continental little owl (*Athene noctua*), however, has for some time been well established in England, where it has hardly, if ever, appeared naturally.

Pigeons have been very little naturalized; the tame bird has become feral locally in various countries, and the Chinese turtle-dove (*Turtur chinensis*) is established in Hawaii, as is the small East Indian zebra dove (*Geopelia striata*) in the Seychelles, and the allied Australian (*G. tranquilla*) in St Helena. There has also been very little naturalization of parrots, but the rosella parrakeet of Australia (*Platycercus eximius*) is being propagated by escaped captives in the north island of New Zealand, and its ally the mealy rosella (*P. pallidiceps*) is locally wild in Hawaii, the stock in this case having descended from a single pair intentionally liberated. Attempts to naturalize that well-known Australian grass-parrakeet the budgerigar (*Melopsittacus undulatus*) in England have so far proved abortive, and none of the species experimented with in Norfolk and Bedfordshire effected a settlement. The greyheaded love-bird (*Agapornis cana*) of Madagascar is established in the Seychelles. Some of the passerine birds have been the most widely distributed, especially the house-sparrow (*Passer domesticus*), which is now an integral, and very troublesome, part of the fauna in the Australasian States and in North America. It is, in fact, as notorious an example of over-successful acclimatization as the rabbit, but in Hutton and Drummond's recent work on the New Zealand animals (London, 1905) it is not regarded in this light, considering that some very common exotic birds were needed to keep down the insects, which it certainly did. Even in the United States also, it has been found a useful destroyer of weed-seeds. The house-sparrow is also feral in Argentina, some of the West Indian islands, Hawaii and the Andamans.

The allied tree-sparrow (*P. montanus*) has been locally naturalized in the United States; it is a more desirable bird, being less prolific and pugnacious, but it is expelled from towns by the house-sparrow.

The so-called Java sparrow (*Munia oryzivora*), although a destructive bird to rice, has been widely distributed by accident or design, and is now found in several East Indian islands besides Java, in south China, St Helena, India, Zanzibar and the east African coast. An allied but much smaller weaver-finch, a form of the spice-bird (*Munia nisoria punctata*), is introduced and well distributed over the Hawaiian islands. The little rooibek of South Africa (*Estrilda astrild*) has been so long and well established in St Helena that it is known in the bird trade as the St Helena waxbill, and the brilliant scarlet weaver of Madagascar (*Foudia madagascariensis*) inhabits as an imported bird Mauritius, the Seychelles and even the remote Chagos Islands.

Returning to the true finches, the only one which can compete with the house-sparrow in the extent of its distribution by man is the goldfinch (*Carduelis carduelis*), now established all over New Zealand, as well as in Australia, the United States and Jamaica. It bears a good character, and is one of the marked successes of naturalization. The redpoll (*Acanthis linaria*), chaffinch (*Fringilla coelebs*) and greenfinch (*Chloris chloris*) are established in New Zealand, the last named being a pest there, as is also the cirl-bunting (*Emberiza cirlus*)—the yellow-hammer (*E. citrinella*) being perhaps confused with this also.

Among starlings, the Indian mynah (generally the house mynah, *Acridotheres tristis*, but some other species seem to have been confused with this) has been naturalized in the Andamans, Seychelles, Réunion, Australia, Hawaii and parts of New Zealand. Its alleged destructiveness to the Hawaiian avifauna seems open to doubt.

The European starling (*Sturnus vulgaris*) is naturalized in New Zealand, Australia and to some extent in the United States. Thrushes have not been widely introduced, but the song-thrush and blackbird (*Turdus musicus* and *Merula merula*) are common in New Zealand; attempts were made, but unsuccessfully, to establish the latter in the United States. The so-called hedge-sparrow (*Accentor modularis*), really a member of this group, is one of the successful introductions into New Zealand. The robin (*Erithacus rubecula*) failed there.

Rooks (*Corvus frugilegus*) and the Australian "magpie" or piping crow (*Gymnorhina*) are to be found in New Zealand, but only locally, especially the former.

Reptiles and Amphibians.—Very little naturalization has been effected, or indeed apparently attempted, in regard to these groups, but the occurrence of the edible frog of the continent of Europe (*Rana esculenta*) as an introduced animal in certain British localities is well known. An Australian tree-frog (*Hyla peronii*) is naturalized in many parts of the north island of New Zealand.

Fish.—The instances of naturalization in this class are few, but important. The common carp (*Cyprinus carpio*), originally a Chinese fish, has for centuries been acclimatized in Europe, where indeed it is in places a true domestic creature, with definite variations. It is, however, quite feral also, and has been introduced into North America.

The Prussian carp (*Carassius vulgaris*) is established in New Zealand, and the nearly-allied goldfish, a domestic form (*C. auratus*) of Chinese origin, has been widely distributed as a pet, and is feral in some places.

The gourami (*Osphromenus olfax*) of the East Indies has been established in Mauritius and Cayenne, being a valuable food-fish.

The most important case of naturalization of fish is, however, the establishment of some *Salmonidae* in Tasmania and New Zealand. These are the common trout and sea-trout (*Salmo fario* and *S. trutta*); they attain a great size. So far, attempts to establish the true salmon in alien localities have been unsuccessful, but the American rainbow trout (*S. irideus*) has thriven in New Zealand, and the brook char of the same continent (*S. fontinalis*) inhabits at least one stream there to the exclusion of the common trout.

Invertebrates.—Many insects and other invertebrates, mostly noxious, have been accidentally naturalized, and some have been deliberately introduced, like the honey-bee, now feral in Australasia and North America, and the humble-bee, imported into New Zealand to effect the fertilization of red clover.

The spread of the European house-fly has been deliberately encouraged in New Zealand, as wherever it penetrates the native flesh-fly, a more objectionable pest, disappears.

The wide distribution of three common cockroaches (*Periplaneta americana*, *Blatta orientalis* and *Ectobia germanica*) is well known, but these are chiefly house-insects.

The common small white butterfly of Europe (*Pontia* or *Pieris rapae*) is now established in North America; and the march of the jigger, or foot-infesting flea (*Sarcopsylla penetrans*) of tropical America, across Africa, has taken place in quite recent years.

The Romans are credited with having purposely introduced the edible snail (*Helix pomatia*) into England, and the common garden snail and slugs (*Helix aspersa*, *Limax agrestis* and *Arion hortensis*) have been unwittingly established in New Zealand. In that country, also, the earthworms of Europe are noticed to replace native forms as the ground is broken.

General Remarks.—A great deal has been said about the upsetting of the balance of nature by naturalization, and as to the ill-doing of exotic forms. But certain considerations should be borne in mind in this connexion. In the first place, naturalization experiments fail at least as often as they succeed, and often quite inexplicably. Thus, the linnet and partridge have failed to establish themselves in New Zealand. This may ultimately throw some light on the disappearance of native forms; for these have at times declined without any assignable cause.

Secondly, native forms often disappear with the clearing off of the original forest or other vegetation, in which case their recession is to a certain extent unavoidable, and the fauna which has established itself in the presence of cultivation is needed to replace them.

Thirdly, the ill effect of introduced forms on existing ones may often be due rather to the spread of disease and parasites than to actual attack; thus, in Hawaii the native birds have been found suffering from a disease which attacks poultry. And the recession of the New Zealand earthworms and flies before exotic forms probably falls under this category. As man cannot easily avoid introducing parasites, and must keep domestic animals and till the land, a certain disturbance in aboriginal faunas is absolutely unavoidable. Under certain circumstances, however, the native animals may recover, for in some cases they even profit by man's advent, and at times themselves become pests, like the Kea parrot (*Nestor notabilis*), which attacks sheep in New Zealand, and the bobolink or rice-bird (*Dolichonyx oryzivorus*) in North America. Finally, it should never be forgotten that the worst enemies of declining forms have been collectors who have not given these species the chance of recovering themselves. (F. Fn.)

ACCOLADE (from Ital. *accolata*, derived from Lat. *collum*, the neck), a ceremony anciently used in conferring knighthood; but whether it was an actual embrace (according to the use of the modern French word *accolade*), or a slight blow on the neck or cheek, is not agreed. Both these customs appear to be of great antiquity. Gregory of Tours writes that the early kings of France, in conferring the gilt shoulder-belt, kissed the knights on the left cheek; and William the Conqueror is said to have made use of the blow in conferring the honour of knighthood on his son Henry. At first it was given with the naked fist, a veritable box on the ear, but for this was substituted a gentle stroke with the flat of the sword on the side of the neck, or on either shoulder as well. In Great Britain the sovereign, in conferring knighthood, still employs this latter form of accolade.

"Accolade" is also a technical term in music-printing for a sort of brace joining separate staves; and in architecture it denotes a form of decoration on doors and windows.

ACCOLTI, BENEDETTO (1415–1466), Italian jurist and historian, was born at Arezzo, in Tuscany, of a noble family, several members of which were distinguished like himself for their attainments in law. He was for some time professor of jurisprudence in the university of Florence, and on the death of the celebrated Poggio, in 1459, became chancellor of the Florentine republic. He died at Florence. In conjunction with his brother Leonardo, he wrote in Latin a history of the first crusade, entitled *De Bello a Christianis contra Barbaros gesto pro Christi Sepulchro et Judaea recuperandis libri tres* (Venice, 1432, translated into Italian, 1543, and into French, 1620), which, though itself of little interest, is said to have furnished Tasso with the historic basis for his *Jerusalem Delivered*. Another work of Accolti's—*De Praestantia Virorum sui Aevi*—was published at Parma in 1689. His brother Francesco (1418–1483) was also a distinguished jurist, and was the author of *Consilia seu responsa* (Pisa, 1481); *Commentaria super lib. ii. decretalium* (Bologna, 1481); *Commentaria* (Pavia, 1493); *de Balneis Puteolanis* (1475).

ACCOLTI, BERNARDO (1465–1536), Italian poet, born at Arezzo, was the son of Benedetto Accolti. Known in his own day as *l' Unico Aretino*, he acquired great fame as a reciter of impromptu verse. He was listened to by large crowds, composed of the most learned men and the most distinguished prelates of the age. Among others, Cardinal Bembo has left on record a testimony to his extraordinary talent. His high reputation with his contemporaries seems scarcely justified by the poems he published, though they give evidence of brilliant fancy. It is probable that he succeeded better in his extemporary productions than in those which were the fruit of deliberation. His works, under the title *Virginia, Comedia, Capitoli e Strambotti di Messer Bernardo Accolti Aretino*, were published at Florence in 1513, and have been several times reprinted.

ACCOLTI, PIETRO (1455–1532), brother of the preceding, known as the cardinal of Ancona, was born in Florence on the 15th of March 1455, and died at Rome on the 12th of December 1532 (Cinconi, *Vitae Pontificum*, 1677, iii. 295). He was made bishop of Ancona, 1505, and cardinal on the 17th of March 1511, by Julius II. He was abbreviator under Leo X., and in that capacity drew up in 1520 the bull against Luther (L. Cardella, *Memorie Storiche de' Cardinali*, 1793, iii. 450). He held successively the suburban sees of Albano and Sabina, also the sees of Cadiz, Maillezais, Arras and Cremona, and was made archbishop of Ravenna, 1524, by Clement VII.

F. Cristofori (*Storia dei Cardinali*, 1888) and others have confused him with his nephew Benedetto (1497–1549), son of Michaele; who followed him in several of his preferments, was made cardinal, 1527, by Clement VII., and is known as a writer in behalf of papal claims and as a Latin poet.

ACCOMMODATION (Lat. *accommodare*, to make fit, from *ad*, to, *cum*, with, and *modus*, measure), the process of fitting, adapting, adjusting or supplying with what is needed (*e.g.* housing).

In theology the term "accommodation" is used rather loosely to describe the employment of a word, phrase, sentence or idea, in a context other than that in which it originally occurred; the actual wording of the quotation may be modified to a greater or lesser extent. Such accommodation, though sometimes purely literary or stylistic, generally has the definite purpose of instruction, and is frequently used both in the New Testament and in pulpit utterances in all periods as a means of producing a reasonably accurate impression of a complicated idea in the minds of those who are for various reasons unlikely to comprehend it otherwise. There are roughly three main kinds. (1) A later Biblical passage quotes from an earlier, partly as a literary device, but also with a view to demonstration. Sometimes it is plain that the writer deliberately "accommodates" a quotation (cf. John xviii. 8, 9 with xvii. 12). But New Testament quotations of Old Testament predictions are often for us accommodations—striking or forced as the case may be—while the New Testament writer, "following the exegetical methods current among the Jews of his time, Matthew ii. 15, 18, xxvi. 31, xxvii. 9" (S. R. Driver in *Zechariah* in *Century Bible*, pp. 259, 271), puts them forward as arguments. To say that he is merely "describing a New Testament fact in Old Testament phraseology" may be true of the result rather than of his design. (2) Much besides in the Bible—parable, metaphor, &c.—has been called an "accommodation," or divine condescension to human weakness. (3) German 18th-century rationalism (see Apologetics) held that the Biblical writers made great use of conscious accommodation—intending moral commonplaces when they seemed to be enunciating Christian dogmas. Another expression for this, used, *e.g.*, by J. S. Semler, is "economy," which also occurs in the kindred sense of "reserve" (or of *Disciplina Arcani*—a modern term for the supposed early Catholic habit of reserving esoteric truths). Isaac Williams on *Reserve in Religious Teaching*, No. 80 of *Tracts for the Times*, made a great sensation; see R. W. Church's comments in *The Oxford Movement*. Strictly, accommodation (2) or (3) modifies, in form or in substance, the content of religious belief; reserve, their business career. Corporations and companies were formed to carry out large operations previously either left to the state or not undertaken, and for the development of trades and manufactures which were becoming less profitable when carried on by hand labour and with limited capital; and, for these, the services of public accountants were necessarily required to devise systems of accounts and methods of control, and to enable the results of the various transactions carried on to be ascertained with the least waste of power or chance of loss by negligence or fraud. The large number of companies formed in 1843 and 1844, when a great amount of capital was invested in railways and extensive speculation resulted, also added to the demand for the services of professional accountants. The Companies' Clauses Consolidation Act 1845 made provision for the audit of the accounts of companies regulated by act of parliament, and gave some extensive powers to the auditors, who are now, to a very large extent, selected from among professional accountants. The Companies Act of 1862 led to a large extension of the business of accountants, both as auditors and liquidators of companies; and the acts relating to bankruptcy passed between the years 1831 and 1883 added to the work devolving on professional accountants. The Companies Act 1879, which affected banking companies, made provision for the audit of their accounts, and it has been found desirable, in most cases, to appoint professional accountants to this duty. The experience and professional knowledge of trained accountants have, in fact, been utilized by their appointment as auditors in the majority of joint-stock companies, whether manufacturing, banking, trading or created for any other purpose. Until the Companies Act 1900 was passed there was no general obligation upon limited companies to have auditors; this act not only requires that auditors shall be appointed in all cases, but provides for their remuneration, and to a limited extent defines their rights and duties. The legislature evidently did not find it easy to formulate at all clearly the duties of auditors, and it seems reasonable to suppose that any general definition will prove an impossibility, as the work which auditors undertake must vary very widely, and depends largely upon the scope of the operations the accounts of which are to be examined.

Duties.

The duties of practising accountants cover a very wide area: they act as trustees, liquidators, receivers and managers of businesses, the owners of which are in default or their affairs in liquidation, both under the direction of the courts and by appointment of creditors and others; they are largely engaged as arbitrators, umpires and referees in differences relating to matters of account or finance; they prepare the accounts of executors and trustees, and the necessary statements of affairs in cases of bankruptcy, both of firms and companies; they prepare accounts for prosecutions in cases of fraud and misconduct; and they are constantly called upon to unravel and properly state the accounts of complicated transactions. Their services are commonly required to certify the profits of businesses intended to be sold, either privately or to companies by means of a published prospectus; and, in cases of compulsory purchases of businesses by railway companies and public bodies, the statements of the profits of the businesses to be acquired are generally made by them. In a very large number of financial operations they are called upon to give advice and prepare accounts, and in few business matters requiring arithmetical calculations or involving the investigation of figures, and particularly where a considerable acquaintanceship with the principles of law is needed, are their services not utilized. One of the most important duties undertaken by accountants is the audit of accounts, and this duty has, of late years, been widely extended. Originally, auditors were appointed to examine and vouch statements of receipts and payments; but the provisions made in acts of parliament in relation to audit, and the requirements of most articles of association of limited companies, put much graver responsibilities on auditors, who are now generally required to certify to the accuracy of balance sheets and of revenue and other accounts, the performance of which duties involves far more knowledge of accounts than was once required. The efficiency, in most cases, of audits conducted by skilled accountants has led the public to attach exceptional value to their audit certificates, and to demand extensive knowledge and ability in the conduct of the audit of the accounts of public companies. One other requirement which is generally regarded as indispensable, is that the work of audit should be very expeditiously performed; for it is easy to understand that, were the presentation of the accounts of a company and the distribution of dividends materially delayed in consequence of the audit, much inconvenience would result, while the value of the criticism of the accounts of business operations would be much deteriorated if it could not be made very shortly after the accounts were closed. In these circumstances, in the cases of large concerns with wide ramifications and numerous transactions, it is necessary that auditors should have the help of trained assistants, and thus the personal examination of details by the auditor himself is, to a large extent, rendered unnecessary and the cost of audit materially reduced. This delegation of duty by auditors is generally well understood, and is in accordance with the requirements of those concerned; but there has been a tendency of late years to enlarge the responsibilities of auditors to an extent which, if persisted in, might render it dangerous for men of reputation and means to accept the duties.

Auditors.

Organization.

While the number of practising accountants has of late years been steadily increasing and their services are correspondingly appreciated, the necessity for controlling those exercising the profession and for improving its status has naturally become apparent. The first important steps in this direction were taken by the accountants in Scotland—the Society of Accountants in Edinburgh being incorporated by royal charter in 1854; similar societies in Glasgow and Aberdeen being also incorporated by charter in 1855 and 1867. The Institute of Accountants was formed in London in 1870, but did not receive a royal charter until the 11th May 1880, when all the then existing accountants' societies and institutes in England were incorporated as the Institute of Chartered Accountants in England and Wales, and means were provided by which all the then practising accountants in these countries could claim membership thereof. In the year 1885 the Society of Accountants and Auditors was incorporated, but has obtained no charter; this body, while numbering among its members a considerable number of practising accountants in the United Kingdom, also includes treasurers and accountants to cities and boroughs in England, as well as clerks to chartered and other accountants. A large proportion of its members also consists of accountants practising abroad. In 1888 an Institute of Chartered Accountants was formed in Ireland, and a great many institutes and societies have been formed in the British colonies and in the United States, some of which have local charters. It is curious to note, however, that, outside the United Kingdom, it was only in the British colonies that associations of practising accountants existed, until, in 1895, an Institute of Accountants (*Nederlands Instituut van Accountants*) was founded in Utrecht for Dutch accountants; when, although the principles of accountancy have been well understood and practised in Holland since the 16th century, and probably earlier, it was found necessary to borrow the words "accountant" and "accountancy" from the English language to convey to the Dutch an idea of the meaning of the terms. Three others have since been formed, the *Nederlandsche Academie van Accountants* (1902); the *Nationale Organisatie van Accountants* (1903); and the *Nederlandsche Bond van Accountants* (1902). Sweden has a society, *Svenska Revisorsamfundet*, formed in 1899; Belgium, the *Chambre Syndicale des Experts Comptables*, founded in 1903. In South America, accountants have acquired a certain status in Argentina, Uruguay and Peru.

In the United States the organization of professional accountants is of quite recent growth. The first society formed in America was "The New York State Society of Certified Public Accountants," and shortly afterwards (in 1896) the New York state legislature passed an act authorizing the State university to confer the degree of certified public accountant (C.P.A.) on the members of the society, while requiring all subsequent entrants to pass an examination. This degree, however, can be obtained, like other university degrees, without being a member of the society. Other states, notably Pennsylvania, Maryland, California, Illinois, Washington and New Jersey, have followed the example of New York. In 1903 the various state societies formed themselves into a federation. There is also an independent society of practising accountants, the American Association of Public Accountants, with objects similar to those of the federation, but steps have been taken to bring about an amalgamation between the two in order to form one central society to look after their common interests, without, however, interfering with the individual organization of the various state societies.

See R. Brown, *History of Accounting and Accountants* (Edinburgh), 1905, the most comprehensive book upon the subject; also G. W. Haskins, *Accountancy, its Past and Present* (U.S.A., 1900); S. S. Dawson, *Accountant's Compendium*; G. Lisle, *Accounting in Theory and Practice* (1899); F. W. Pixley, *Auditors and their Liabilities* (1901). The professional periodicals, *The Accountant* (vol. i., 1877); *Accountant's Journal* (vol. i., 1883–1884); *The Accountants' Magazine* (vol. i., 1897); *Incorporated Accountants' Journal* (vol. i., 1889–1890); *Accountics* (U.S.A., vol. i., 1897) may also be consulted, and also the Year-books of the Society of Accountants and Auditors, and of the Institute of Chartered Accountants. (J. G. Gr.)

ACCOUTREMENT (a French word, probably derived from *à* and *coustre* or *coutre*, an old word meaning one who has charge of the vestments in a church), clothing, apparel; a term used especially, in the plural, of the military equipment of a soldier other than his arms and clothing.

ACCRA, a port on the Gulf of Guinea in 5° 31′ N., 0° 12′ W., since 1876 capital of the British Gold Coast colony. Population about 20,000, including some 150 Europeans. Accra is about 80 m. E. of Cape Coast (*q.v.*), the former capital of the colony. The name is derived from the Fanti word *Nkran* (an ant), by which designation the tribe inhabiting the surrounding district was formerly known. The town grew up around three forts established in close proximity—St James (British), Crèvecœur (Dutch) and Christiansborg (Danish). The last named was ceded to Britain in 1850, Crèvecœur not till 1871. Fort St James is now used as a signal station, lighthouse and prison. Accra preserves the distinctions of James Town, Ussher Town and Christiansborg, indicative of its tripartite origin. Ussher Town represents Crèvecœur, the fort being renamed after H. T. Ussher, administrator of the Gold Coast (1867–1872). The sea frontage extends about three miles; there is, however, no harbour, and steamers have to lie about a mile out, goods and passengers being landed in surf boats. The streets formerly consisted largely of mud hovels, but since a great fire in 1894, which destroyed large parts of James Town and Ussher Town, more substantial buildings have been erected. Christiansborg, the finest of the three forts, is the official residence of the governor of the colony. Westwards of the landing-place, where is the customs house, lies James Town. Beyond the fort are various public buildings leading to Otoo Street, the main thoroughfare, which runs two miles in a straight line to Christiansborg. This street contains a fine stone church built in 1895 for the use of the Anglican community, a branch of the Bank of British West Africa, telegraph offices and the establishments of the principal trading firms. In Victoriaborg, a suburb of Ussher Town, are the residences of the principal officials, and here a racecourse has been laid out. (Accra is almost the only point along the Gold Coast where horses thrive.) Behind the town is rolling grass land, which gives place to the highlands of Aquapim and Akim. At Aburi in the Aquapim hills, 26 m. N. by E. of Accra, are the government sanatorium and botanical gardens.

Accra, the first town in the Gold Coast colony to be raised (July 1, 1896) to the rank of a municipality, is governed by a town council with power to raise and spend money. The council consists in equal proportions of nominated and elected members, no racial distinctions being made. Accra is connected by cable with Europe and South Africa, and is the sea terminus of a railway serving the districts N.E., where are flourishing cocoa plantations.

ACCRETION (from Lat. *ad*, to, and *crescere*, to grow), an addition to that which already exists; increase in any substance by the addition of particles from the outside. In law, the term is used for the increase of property caused by gradual natural additions, as on a river bank or seashore.

ACCRINGTON, a market town and municipal borough in the Accrington parliamentary division of Lancashire, England, 208 m. N.W. by N. from London, and 23 m. N. by W. from Manchester, on the Lancashire and Yorkshire railway. Pop. (1891) 38,603; (1901) 43,122. It lies in a deep valley on the Hindburn, a feeder of the Calder. Cotton spinning and printing works, cotton-mill machinery works, dye-works and chemical manufactures, and neighbouring collieries maintain the industrial population. The church of St James dates from 1763, and the other numerous places of worship and public buildings are all modern. The borough is under a mayor, 8 aldermen and 24 councillors. Area 3427 acres.

Accrington (Akerenton, Alkerington, Akerington) was granted by Henry de Lacy to Hugh son of Leofwine in Henry II.'s reign, but came again into the hands of the Lacys, and was given by them about 1200 to the monks of Kirkstall, who converted it into a grange. It again returned, however, to the Lacys in 1287, was granted in parcels, and like their other lands became merged in the duchy of Lancaster. In 1553 the commissioners of chantries sold the chapel to the inhabitants to be continued as a place of divine service. In 1836 Old and New Accrington were merely straggling villages with about 5000 inhabitants. By 1861 the population had grown to 17,688, chiefly owing to its position as an important railway junction. A charter of incorporation was granted in 1878. The date of the original chapel is unknown, but it was probably an oratory which was an offshoot of Kirkstall Abbey. Ecclesiastically the place was dependent on Altham till after the middle of the 19th century.

ACCUMULATION (from Lat. *accumulare*, to heap up), strictly a piling-up of anything; technically, in law, the continuous adding of the interest of a fund to the principal, for the benefit of some person or persons in the future. Previous to 1800, this accumulation of property was not forbidden by English law, provided the period during which it was to accumulate did not exceed that forbidden by the law against perpetuities, viz. the period of a life or lives in being, and twenty-one years afterwards. In 1800, however, the law was amended in consequence of the eccentric will of Peter Thellusson (1737–1797), an English merchant, who directed the income of his property, consisting of real estate of the annual value of about £5000 and personal estate amounting to over £600,000, to be accumulated during the lives of his children, grandchildren and great-grandchildren, living at the time of his death, and the survivor of them. The property so accumulated, which, it is estimated, would have amounted to over £14,000,000, was to be divided among such descendants as might be alive on the death of the survivor of those lives during which the accumulation was to continue. The bequest was held valid (*Thellusson v. Woodford*, 1798, 4 Vesey, 237). In 1856 there was a protracted lawsuit as to who were the actual heirs. It was decided by the House of Lords (June 9, 1859) in favour of Lord Rendlesham and Charles Sabine Augustus Thellusson. Owing, however, to the heavy expenses, the amount inherited was not much larger than that originally bequeathed.

To prevent such a disposition of property in the future, the Accumulations Act 1800 (known also as the "Thellusson Act") was passed, by which it was enacted that no property should be accumulated for any longer term than either (1) the life of the settlor; or (2) the term of twenty-one years from his death; or (3) during the minority of any person living or *en ventre sa mère* at the time of the death of the grantor; or (4) during the minority of any person who, if of full age, would be entitled to the income directed to be accumulated. The act, however, did not extend to any provision for payment of the debts of the grantor or of any other person, nor to any provision for raising portions for the children of the settlor, or any person interested under the settlement, nor to any direction touching the produce

Hatch cell.

red lead paste, an electrode of rolled sheet lead is placed on its surface, and over this again is placed a second porous tray filled with paste. The whole then looks like a thin earthenware box with the lug of the electrode projecting from one end. The negatives consist of sheet lead covered by active material. On assembling the plates, each negative is held between two positive "boxes," the outsides of which have projecting vertical ribs. These press against the active material on the negative plates, and help to keep it in position. At the same time, the clearance between the ribs allows room for acid to circulate freely between the negative plate and the outer face of the positive envelope. Diffusion of the acid through this envelope is easy, as it is very porous and not more than $\frac{1}{32}$ inch thick.

Traction Cells.—Attempts to run tramcars by accumulators have practically all failed, but traction cells are employed for electric broughams and light vehicles for use in towns. There are no large deviations in manufacture except those imposed by limited space, weight and vibration. The plates are generally thinner and placed closer together. The Planté positive is not used so much as in lighting types. The acid is generally a little stronger in order to get a higher electromotive force (E.M.F.). To prevent the active material from being shaken out of the grids, corrugated and perforated ebonite separators are placed between the plates. The "chloride" traction cell uses a special variety of wood separator: the "exide" type of plate is used for both positive and negative. Cells are now made to run 3000 or more miles before becoming useless. The specific output can be made as high as 10 or 11 watt-hours per pound of cell, but this involves a chance of shorter life. The average working requirement for heavy vehicles is about 50 watt-hours per 1000 lb per mile.

Ignition Cells for motor cars are made on the same lines as traction cells, though of smaller capacity. As a rule two cells are put up in ebonite or celluloid boxes and joined in series so as to give a 4-volt battery, the pressure for which sparking coils are generally designed. The capacity ranges from 20 to 100 ampere-hours, and the current for a single cylinder engine will average one to one and a half amperes during the running intervals.

General Features.—The tendency in stationary cells is to allow plenty of space below the plates, so that any active material which falls from the plates may collect there without risk of short-circuit, &c. More space is allowed between the plates, which means that (*a*) there is more acid within reach, and (*b*) a slight buckling is not so dangerous, and indeed is not so likely to occur. The plates are now generally made thicker than formerly, so as to secure greater mechanical rigidity. At the same time, the manufacturers aim at getting the active materials in as porous a state as possible.

The figures with regard to specific output are difficult to classify. It would be most interesting to give the data in the form of watt-hours per pound of active material, and then to compare them with the theoretical values, but such figures are impossible in the nature of the case except in very special instances. For many purposes, long life and trustworthiness are more important than specific output. Except in the case of traction cells, therefore, the makers have not striven to reduce weight to its lowest values. Table I. shows roughly the weight of given types of cells for a given output in ampere hours.

TABLE I.

Type of Cell.	Capacity in ampere-hours if discharged in				Weight of Cell.
	9 hrs.	6 hrs.	3 hrs.	1 hr.	
Ordinary lighting	200	182	153	101	100 pounds.
" "	420	380	300	210	200 "
" "	1200	1080	880	600	670 "
Central station and High Rate	3500	3100	2500	1700	2000 "
" "	6000	5400	4400	3000	3200 "
Traction . . .	220	185	155	125	40 "
" . . .	. .	440	. .	. .	90 "

Influence of Temperature on Capacity.—These figures are true only at ordinary temperatures. In winter the capacity is diminished, in summer it is increased. The differences are due partly to change of liquid resistance but more especially to the difference in the rate at which acid can diffuse into or out of the pores: obviously this is greater at higher temperatures. The increase in capacity on warming is appreciable, and may amount to as much as 3% per degree centigrade (Gladstone and Hibbert, *Journ. Inst. Elec. Eng.* xxi. 441; Heim, *Electrician*, Nov. 1901, p. 55; Liagre, *L'Éclairage électrique*, 1901, xxix. 150). Notwithstanding these results, it is not advisable to warm accumulators appreciably. At higher temperatures, local action is greatly increased and deterioration becomes more rapid. It is well, however, to avoid low winter temperatures.

Working of Accumulators.—Whatever the type of cell may be, it is important to attend to the following working requirements:—(1) The cells must be fully equal to the maximum demand, both in discharge rate and capacity. (2) All the cells in one series ought to be equal in discharge rate and capacity. This involves similarity of treatment. (3) The cells are erected on strong wooden stands. Where floor space is too expensive, they can be erected in tiers; but, if possible, this should be avoided. They ought to lie in rows, so arranged that it is easy to get to one side (at least) of every cell, for examination and testing, and if need be to detach and remove it or its plates. Where a second tier is placed over the first, sufficient clearance space must be allowed for the plates to be lifted out of the lower boxes. The cells are insulated by supporting them on glass or mushroom-shaped oil insulators. If the containing vessels are made of glass, it is desirable to put them in wooden trays which distribute the weight between the vessel and insulators. To prevent acid spray from filling the air of the room, a glass plate is arranged over each cell. The positive and negative sections are fixed in position with insulating forks or tubes, and the positive terminal of one cell is joined to the negative of the next by burning or bolting. If the latter method is adopted, the surfaces ought to be very clean and well pressed home. The joint ought to be covered by vaseline or varnish. When this has been done, examination ought to be made of each cell to see that the plates are evenly spaced, that the separators (glass tubes or ebonite forks between the plates) are in position and vertical, and that there are no scales or other adventitious matter connecting the plates. The floor of the cell ought to be quite clear; if anything lies there it must be removed. (4) To mix the solution a *gentle stream* of sulphuric acid must be poured into the water (not the other way, lest too great heating cause an accident). It is necessary to stir the whole as the mixing proceeds and to arrange that the density is about 1190, or according to the recommendation of the maker. About five volumes of water ought to be taken to one volume of acid. After mixing, allow to cool for two or three hours. The strong acid ought to be free from arsenic, copper and other similar impurities. The water ought to be as pure as can be obtained, distilled water being best; rain water is also good. If potable water be employed, it will generally be improved by boiling, which removes some of the lime held in solution. The impurity in ordinary drinking water is very slight; but as all cells lose by evaporation and require additions of water from time to time, there is a tendency for it to increase. The acid must not be put into the cells till everything is ready for charging. (5) A shunt-wound or separately-excited dynamo being ready and running so as to give at will 2·6 or 2·7 volts per cell, the acid is run into the cells. As soon as this is done, the dynamo must be switched on and charging commenced. The positive terminal of the dynamo must be joined to the positive terminal of the battery. If necessary, the + end of the machine must be found by a trial cell made of two plain lead sheets in dilute acid. It is important also to maintain this first charging operation for a long time without a break. Twelve hours is a minimum time, twenty-four not too much. The charging is not even then complete, though a short interval is not so injurious as in the earlier stage. The full charge required varies with the cells, but in all types a full and practically continuous first charge is imperatively necessary. During the early part of this charge the density of the acid may fall; but after a time ought to increase, and finally reach the value desired for permanent working. Towards the end of the "formation" vigilant observation must be exercised. It is important to notice whether any cells are appreciably behind the others in voltage, density or gassing. Such cells may be faulty, and in any case they must be charged and tended till their condition is like that of the others. They ought not to go on the discharge circuit till this is assured. The examination of the cells before passing them as ready for discharge includes:—(*a*) Density of acid as shown by the hydrometer. (*b*) Voltage. This may be taken when charging or when idle. In the first case it ought to be from 2·4 to 2·6 volts, according to conditions. In the second case it ought to be just over 2 volts, provided that the observation is not taken too soon after switching off the charging current. For about half an hour after that is done, the E.M.F. has a transient high value, so that, if it be desired to get the proper E.M.F. of the cell, the observation must be taken thirty minutes after the charging ceases.

Google

(*c*) Eye observations of the plates and the acid between them. The positive plates ought to show a rich dark brown colour, the negatives a dull slate-blue, and the space between ought to be quite clear and free from anything like solid matter. All the positives ought to be alike, and similarly all the negatives. If the cells show similarity in these respects they will probably be in good working order.

As to management, it is important to keep to certain simple rules, of which these are the chief:—(1) Never discharge below a potential difference of 1·85 (or in rapid discharge, 1·8) volt. (2) Never leave the cells discharged, if it be avoidable. (3) Give the cells a special full charging once a month. (4) Make a periodic examination of each cell, determining its E.M.F., density of acid, the condition of its plates and freedom from growth. Any incipient growth, however small, must be carefully watched. (5) If any cell shows signs of weakness, keep it off discharge till it has been brought back to full condition. See that it is free from any connexion between the plates which would cause short-circuiting; the frame or support which carries the plates sometimes gets covered by a conducting layer. To restore the cell, two methods can be adopted. In private installations it may be disconnected and charged by one or two cells reserved for the purpose; or, as is preferable, it may be left in circuit, and a cell in good order put in parallel with it. This acts as a "milking" cell, not only preventing the faulty one from discharging, but keeping it supplied with a charging current till its potential difference (P.D.) is normal. Every battery attendant should be provided with a hydrometer and a voltmeter. The former enables him to determine from time to time the density of the acid in the cells; instruments specially constructed for the purpose are now easily procurable, and it is desirable that one be provided for every 20 or 25 cells. The voltmeter should read up to about 3 volts and be fitted with a suitable connector to enable contacts to be made quickly with any desired cell. A portable glow lamp should also be available, so that a full light can be thrown into any cell; a frosted bulb is rather better than a clear one for this purpose. He must also have some form of wooden scraper to remove any growth from the plates. The scraping must be done gently, with as little other disturbance as possible. By the ordinary operations which go on in the cell, small portions of the plates become detached. It is important that these should fall below the plates, lest they short-circuit the cell, and therefore sufficient space ought to be left between the bottom of the plates and the floor of the cell for these "scalings" to accumulate without touching the plates. It is desirable that they be disturbed as little as possible till their increase seriously encroaches on the free space. It sometimes happens that brass nuts or bolts, &c., are dropped into a cell; these should be removed at once, as their partial solution would greatly endanger the negative plates. The level of the liquid must be kept above the top of the plates. Experience shows the advisability of using distilled water for this purpose. It may sometimes be necessary to replenish the solution with some dilute acid, but strong acid must never be added.

The chief faults are buckling, growth, sulphating and disintegration. Buckling of the plates generally follows excessive discharge, caused by abnormal load or by accidental short-circuiting. At such times asymmetry in the cell is apt to make some part of the plate take much more than its share of the current. That part then expands unduly, as explained later, and curvature is produced. The only remedy is to remove the plate, and press it back into shape as gently as possible. Growth arises generally from scales from one part falling on some other—say, on the negative. In the next charging the scale is reduced to a projecting bit of lead, which grows still further because other particles rest on it. The remedy is, gently to scrape off any incipient growth. Sulphating, the formation of a white hard surface on the active material, is due to neglect or excessive discharge. It often yields if a small quantity of sulphate of soda be added to the liquid in the cell. Disintegration is due to local action, and there is no ultimate remedy. The end can be deferred by care in working, and by avoiding strains and excessive discharge as much as possible.

Accumulators in Repose.—Accumulators contain only three active substances—spongy lead on the negative plate, spongy lead peroxide on the positive, and dilute sulphuric acid between them. Sulphate of lead is formed on both plates during discharge and brought back to lead and lead peroxide again during charge, and there is a consequent change in the strength of acid during every cycle. The chief properties of these substances are shown in Table II.

TABLE II.

Substance.	Colour.	Density.	Specific Resistance.
Lead	slate blue	11·3	0·0000195 ohm
Peroxide of lead	dark brown	9·28	5·6 to 6·8 "
Sulphuric acid after charge .	clear liquid	1·210	1·37 "
Sulphuric acid after discharge	" "	1·170	1·28 "
Sulphuric acid in pores . . .	" "	below 1·03	8·0 "
Sulphate of lead	white	6·3	non-conductor.

The curve in fig. 9 shows the relative conductivity (reciprocal of resistance) of all the strengths of sulphuric acid solutions, and by its aid and the figures in the preceding table, the specific resistance of any given strength can be determined.

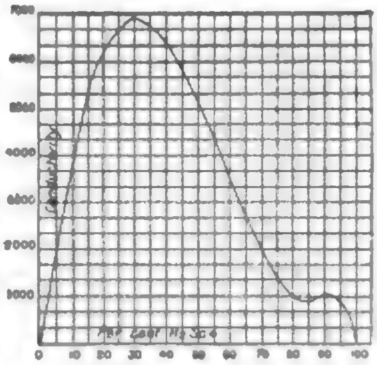

FIG. 9.

The lead accumulator is subject to three kinds of local action. First and chiefly, local action on the positive plate, because of the contact between lead peroxide and the lead grid which supports it. In carelessly made or roughly handled cells this may be a very serious matter. It would be so in all circumstances if the lead sulphate formed on the exposed lead grid did not act as a covering for it. It explains why Planté found "repose" a useful help in "forming," and also why positive plates slowly disintegrate; the lead support is gradually eaten through. Secondly, local action on the negative plate when a more electro-negative metal settles on the lead. This often arises when the original paste or acid contains metallic impurities. Similar impurity is also introduced by scraping copper wire, &c., near a battery. Thirdly, local action due to the acid varying in strength in different parts of a plate. This may arise on either plate and is set up because two specimens of either the same lead or the same peroxide give an E.M.F. when placed in acids of different strengths. J. H. Gladstone and W. Hibbert found that the E.M.F. depends on the difference of strength. With two lead plates, a maximum of about quarter volt was obtained, the lead in the *weaker* acid being positive. With two peroxide plates the maximum voltage was about 0·64, the plate in *stronger* acid being positive to that in weaker. The electromotive force of a cell depends chiefly on the strength of the acid, as may be seen from fig. 10 taken from Gladstone and Hibbert's paper (*Journ. Inst. Elec. Eng.*, 1892). The observations with very strong acid were difficult to obtain, though even that with 98% acid marked X is believed to be trustworthy. C. Heim (*Elek. Zeit*, 1889), F. Streintz (*Ann. Phys. Chem.* xlvi. p. 449) and F. Dolezalek (*Theory of Lead Accumulators*, p. 55) have also given tables.

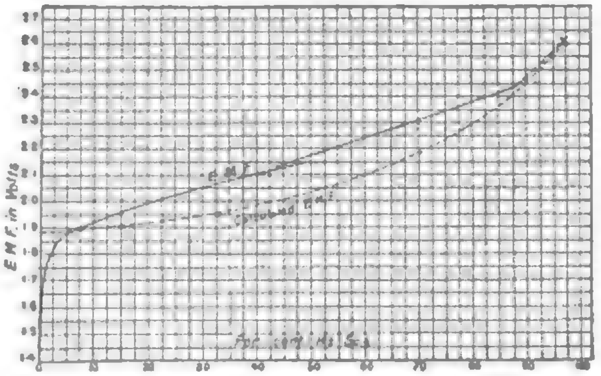

FIG. 10.

It is only necessary to add to these results the facts illustrated by the following diffusion curves, in order to get a complete clue to the behaviour of an accumulator in active work. Fig. 11 shows the rate of diffusion from plates soaked in 1·175 acid and then placed in distilled water. It is from a paper by L. Duncan and H. Wiegand (*Elec. World*, N.Y., 1889), who were the first to show the importance of diffusion. About one half the acid diffused out in 30 minutes, a good illustration of the slowness of this process. The rate of diffusion is much the same for both positive and negative plates; but slower for discharged plates than for charged ones. Discharge affects the rate of diffusion on the lead plate more than on the peroxide plate. This is in accordance with the density values given in Table I. For while lead sulphate is formed in the pores of both plates, the consequent expansions (and obstructions) are different; 100 volumes of lead form 290 volumes of sulphate (a threefold expansion), and 100 volumes of peroxide form 186 volumes of sulphate (a twofold expansion). The influence of diffusion on the electromotive force is illustrated by fig. 12. A cell was prepared with 20% acid. It also held a porous pot containing stronger acid, and into this the positive plate was suddenly transferred from the general body of liquid. The E.M.F. rose by diffusion of stronger acid into the pores. Curve I. in fig. 12 shows the rate of rise when the porous pot contained 34% acid; curve II. was obtained with the stronger (58%) acid (Gladstone and Hibbert, *Phil. Mag.*, 1890). Of these two curves the first is more useful, because its conditions are nearer those which occur in practice.

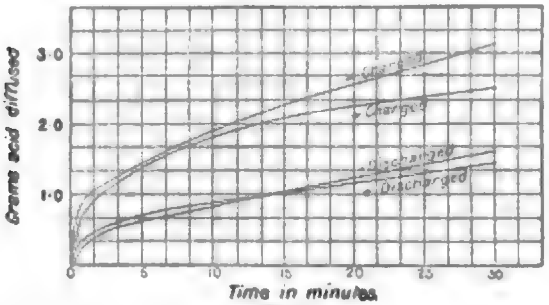

FIG. 11.

At the end of a discharge it is a common thing for the plates to be standing in 25% acid, while inside the pores the acid may not exceed 8% or 10%. If the discharge be stopped, we have conditions somewhat like fig. 12, and the E.M.F. begins to rise. In one minute it has gone up by about 0·08 volt, &c.

Charge and Discharge.—The most important practical questions concerning an accumulator are:—its maximum rate of working; its capacity at various discharge rates; its efficiency; and its length of life. Apart from mechanical injury all these depend primarily on the way the cell is made, and then on the method of charging and discharging. For each type and size of cell there is a normal maximum discharging current. Up to this limit any current may be taken; beyond it, the cell may suffer if discharge be continued for any appreciable time. The most important point to attend to is the voltage at which discharge shall cease. The potential difference at terminals must not fall below 1·80 volt during discharge at ordinary rates (10 hours) or 1·75 to 1·70 volt for 1 or 2 hour rate. The reason underlying the figures is simple. These voltages indicate that the acid in the pores is not being renewed fast enough, and that if the discharge continue the chemical action will change: sulphate will not be formed *in situ* for want of acid. Any such change in action is fatal to reversibility and therefore to life and constancy in capacity. To illustrate: when at slow discharge rates the voltage is 1·80 volt, the acid in the pores has weakened to a mean value of about 2·5% (see fig. 11), which is quite consistent with some part of the interior being practically pure water. With high discharge rates, something like 0·1 volt may be lost in the cells, by ordinary ohmic fall, so that a voltage reading of 1·75 means an E.M.F. of a little over 1·8 volt, and a very weak density of the acid inside the pores. Guided by these figures, an engineer can determine what ought to be the permissible drop in terminal volts for any given working conditions. Messrs W. E. Ayrton, C. G. Lamb, E. W. Smith and M. W. Woods were the first to trace the working of a cell through varied conditions (*Journ. Inst. Elec. Eng.*, 1890), and a brief *résumé* of their results is given below.

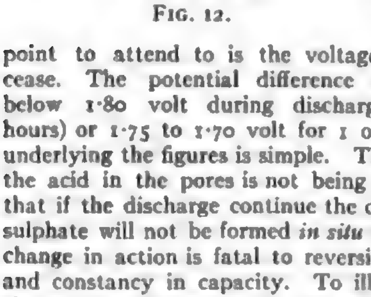

FIG. 12.

They began by charging and discharging between the limits of 2·4 and 1·6 volts.

Fig. 13 shows a typical discharge curve. Noteworthy points are:—(1) At the beginning and at the end there is a rapid fall in P.D., with an intermediate period of fairly uniform value. (2) When the P.D. reaches 1·6 volt the fall is so rapid that there is no advantage in continuing the action. When the P.D. had fallen to 1·6 volt the cell was automatically switched into a charging circuit, and with a current of 9 amperes yielded the curve in fig. 14. Here again there is a rapid variation in P.D. (in these cases a rise) at the beginning and end of the operation. The cells were now carried through the same cycle several times, giving almost identical values for each cycle. After some days, however, they became more and more difficult to charge, and the return on discharge was proportionately less. It became impossible to charge up to a P.D. of 2·4 volts, and finally the capacity fell away to half its first value. Examination showed that the plates were badly scaled, and that some of the scales had partially connected the plates. These scales were cleared away and the experiments resumed, limiting the fall of P.D. to 1·8 volt. The difficulties then disappeared, showing that discharge to 1·6 volt caused injury that did not arise at a limit of 1·8. Before describing the new results it will be useful to examine these two cases in the light of the theory of E.M.F. already given.

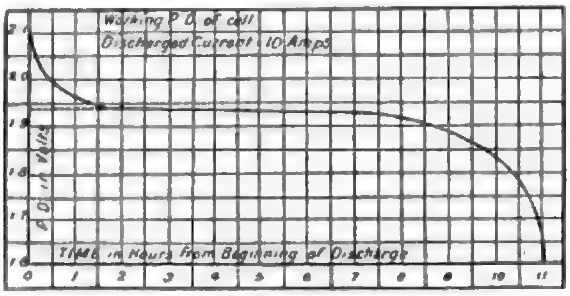

FIG. 13.

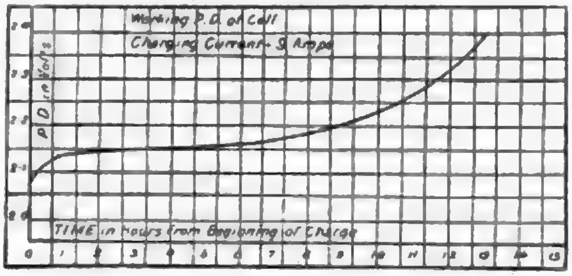

FIG. 14.

(*a*) *Fall in* E.M.F. *at beginning of discharge.*—At the moment when previous charging ceases the pores of the positive plate contain strong acid, brought there by the charging current. There is consequently a high E.M.F. But the strong acid begins to diffuse away at once and the E.M.F. falls rapidly. Even if the cell were not discharged this fall would occur, and if it were allowed to rest for thirty minutes or so the discharge would have begun with the dotted line (fig. 13). (*b*) *Final rapid fall.*—The pores being clogged by sulphate the plugs cannot get acid by diffusion, and when 5% is reached the fall in E.M.F. is disproportionately large (see fig. 10). If discharge be stopped, there is an almost instantaneous diffusion inwards and a rapid rise in E.M.F. (*c*) *The rise in* E.M.F. *at beginning and end of the charging* is due to acid in the pores being strengthened, partly by diffusion, partly by formation of sulphuric acid from sulphate, and partly by electrolytic carrying of strong acid to the positive plate. The injurious results at 1·6 volt arise because then the pores contain water. The chemical reaction is altered, oxide or hydrate is formed, which will partially dissolve, to be changed to sulphate when the sulphuric acid subsequently diffuses in. But formed in this way it will not appear mixed with the active masses in the electrolytic paths, but more or less alone in the pores. In this position it will more or less block the passage and isolate some of the peroxide.

Further, when forming in the narrow passage its disruptive action will tend to force off the outer layers. It is evident that limitation of P.D. to 1·8 volt ought to prevent these injuries, because it prevents exhaustion of acid in the plugs.

Fig. 15 shows the results obtained by study of successive periods of rest, the observations being taken between the limits of 2·4 and 1·8 volts. Curves A and B show the state and capacity at the beginning. After a 10 days' rest the capacity was smaller, but repeated cycles of work brought it back to C and D. A second rest (10 days), followed by many cycles, then gave E and F. After a third rest (16 days) and many cycles, G and H were obtained. After a fourth rest (16 days) the first discharge gave I and the first charge J. Repeated cycles brought the cells back to K and L. Curves M and N show first cycle after a fifth rest (16 days); O and P show the final restoration brought about by repeated cycles of work. The numbers given by the integration of some of these curves are stated in Table III.

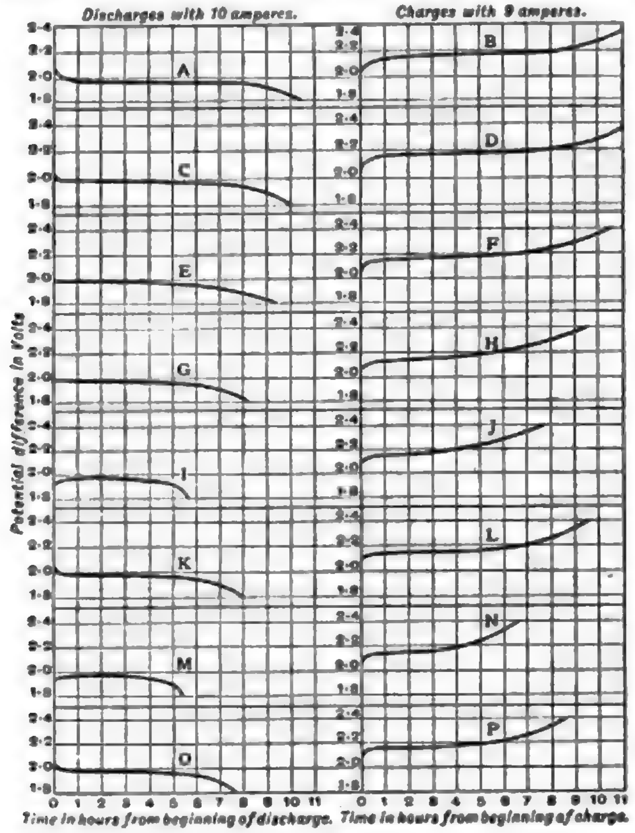

FIG. 15.

TABLE III.

Experiment.	Capacity and Efficiency under Various Conditions of Working.					
	Discharge.		Charge.		Efficiency.	
	Ampere Hours.	Watt Hours.	Ampere Hours.	Watt Hours.	Quantity.	Energy.
Normal cycle.	102	201·7	104·5	230·7	97·2	87·4
Restoration after 1st rest	100	179	103·8	228·2	96·8	85·8
Ditto, after 2nd rest . .	91	176·7	96·8	213·2	94·1	82·8
Ditto, after 3rd rest . .	82·6	161·3	86·2	190·5	95·8	84·7
Discharge immediately after rest	56·5 56·5	110·5 110·5	86·2 71·1	190·5 158·3	65·5 79·6	58[1] 69·6
Restoration after 8 cycles	80	156·9	83·8	184·6	95·5	85

The table shows that the efficiency in a normal cycle may be as high as 87·4%; that during a rest of sixteen days the charged accumulator is so affected that about 30% of its charge is not available, and in subsequent cycles it shows a diminished capacity and efficiency; and that by repeated charges and discharges the capacity may be partially restored and the efficiency more completely so. These changes might be due to—(*a*) leakage or short-circuit, (*b*) some of the active material having fallen to the bottom of the cell or (*c*) some change in the active materials. (*a*) is excluded by the fact that the subsequent charge is smaller, and (*b*) by the continued increase of capacity during the cycles that follow the rest. Hence the third hypothesis is the one which must be relied upon. The change in the active materials has already been given. The formation of lead sulphate by local action on the peroxide plate and by direct action of acid on spongy metal on the lead plate explains the loss of energy shown in curve M, fig. 15, while the fact that it is probably formed, not in the path of the regular currents, but on the wall of the grid (remote from the ordinary action), gives a probable explanation of the subsequent slow recovery. The action of the acid on the lead during rest must not be overlooked.

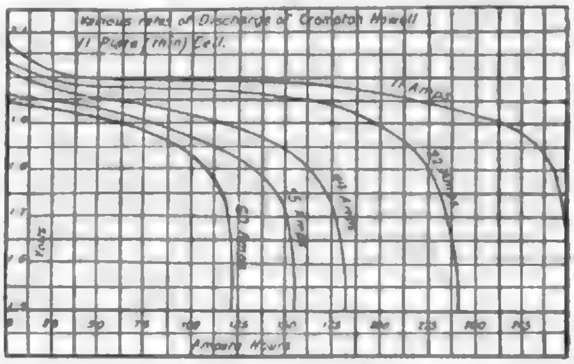

FIG. 16.

We have seen that capacity diminishes as the discharge rate increases; that is, the available output increases as the current diminishes. R. E. B. Crompton's diagram illustrating this fact is given in fig. 16. At the higher rates the consumption of acid is too rapid, diffusion cannot maintain its strength in the pores, and the fall comes so much earlier.

The resistance varies with the condition of the cell, as shown by the curves in fig. 17. It may be unduly increased by long or narrow lugs, and especially by dirty joints between the lugs. It is interesting to note that it increases at the end of both charge and discharge, and much more for the first than the second. Now the composition of the active materials near the end of charge is almost exactly the same as at the beginning of discharge, and at first sight there seems nothing to account for the great fall in resistance from 0·0115 to 0·004 ohm; that is, to about one-third the value. There is, however, one difference between charging and discharging—namely, that due to the strong acid near the positive, with a corresponding weaker acid near the negative electrode. The curve of conductivity for sulphuric acid shows that both strong and weak acid have much higher resistances than the liquid usually employed in accumulators, and it is therefore reasonable to suppose that local variations in strength of acid cause the changes in resistance. That these are not due to the constitution of the plugs is shown by the fact that, while the plugs

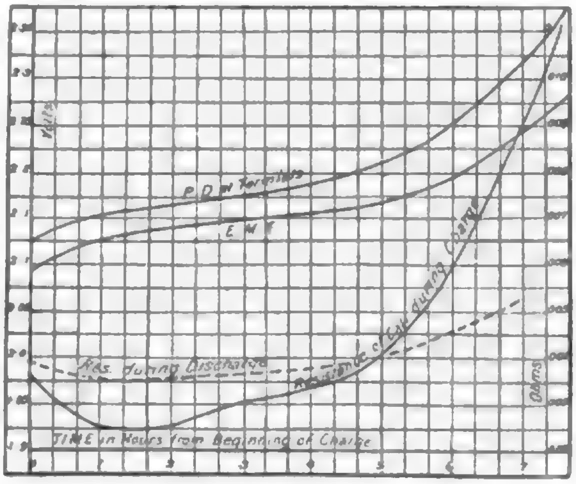

FIG. 17.

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[1] This discharge is here compared with the charge that preceded the rest; in the next line the same discharge is compared with the charge following the rest.

are almost identical at end of discharge and beginning of charge, the resistance falls from 0·0055 to 0·0033 ohm.

While a current flows through a cell, heat is produced at the rate of $C \cdot R \times 0{\cdot}24$ calories (water-gram-degree) per second. As a consequence the temperature tends to rise. But the change of temperature actually observed is much greater during charge, and much less during discharge, than the foregoing expression would suggest; and it is evident that, besides the heat produced according to Joule's law, there are other actions which warm the cell during charge and cool it during discharge. Duncan and Wiegand (*loc. cit.*), who first observed the thermal changes, ascribe the chief influence to the electrochemical addition of H_2SO_4 to the liquid during charge and its removal during discharge. Fig. 18 gives some results obtained by Ayrton, Lamb, &c. This elevation of temperature (due to electrolytic strengthening of acid and local action) is a measure of the energy lost in a cycle, and ought to be minimized as much as possible.

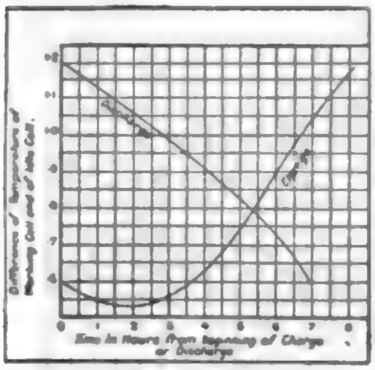

FIG. 18.

Chemistry.—The chemical theory adopted in the foregoing pages is very simple. It declares that sulphate of lead is formed on *both* plates during discharge, the chemical action being reversed in charging. The following equations express the experimental results.

Condition before discharge:—

$$\begin{array}{ccccc} +\text{plate} & & \text{Liquid} & & -\text{plate} \\ x.\ PbO_2 & + & \begin{bmatrix} y.\ H_2SO_4 \\ n.\ H_2O \end{bmatrix} & + & z.\ Pb \end{array}$$

After discharge:—

$$\begin{array}{ccccc} +\text{plate} & & \text{Liquid} & & -\text{plate} \\ \begin{bmatrix} (x-p).\ PbO_2 \\ p.\ PbSO_4 \end{bmatrix} & + & \begin{bmatrix} (y-2p).\ H_2SO_4 \\ (n+2p).\ H_2O \end{bmatrix} & + & \begin{bmatrix} (z-p).\ Pb \\ p.\ PbSO_4 \end{bmatrix} \end{array}$$

During charge, the substances are restored to their original condition: the equation is therefore reversed. An equation of this general nature was published by Gladstone and Tribe in 1882, when they first suggested the "sulphate" theory, which was based on very numerous analyses. Confirmation was given by E. Frankland in 1883, É. Reynier 1884, A. P. P. Crova and P. Garbe 1885, C. Heim and W. F. Kohlrausch 1889, W. E. Ayrton, &c., with G. H Robertson 1890, C. H. J. B. Liebenow 1897, F. Dolezalek 1897, and M. Mugdan 1899. Yet there has been, as Dolezalek says, an incomprehensible unwillingness to accept the theory, though no suggested alternative could offer good verifiable experimental foundation. Those who seek a full discussion will find it in Dolezalek's *Theory of the Lead Accumulator*. We shall take it that the sulphate theory is proved, and apply it to the conditions of charge and discharge.

From the chemical theory it will be obvious that the acid in the pores of both plates will be stronger during charge than that outside. During discharge the reverse will be the case. Fig. 19 shows a curve of potential difference during charge, with others showing the concurrent changes in the percentage of PbO_2 and the density of acid. These increase almost in proportion to the duration of the current, and indicate the decomposition of sulphate and liberation of sulphuric acid. There are breaks in the P.D. curve at A, B, C, D where the current was stopped to extract samples for analysis, &c. The fall in E.M.F. in this short interval is noteworthy; it arises from the diffusion of stronger acid out of the pores. The final rise of pressure is due to increase in resistance and the effect of stronger acid in the pores, this last arising partly from reduced sulphate and partly from the electrolytic convection of SO_4 (see also Dolezalek, *Theory*, p. 113). Fig. 20 gives the data for discharge. The percentage of PbO_2 and the density here fall almost in proportion to the duration of the current. The special feature is the rapid fall of voltage at the end.

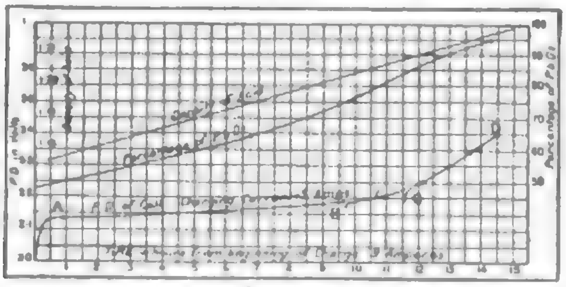

FIG. 19.

Several suggestions have been made about this phenomenon. The writer holds that it is due to the exhaustion of the acid in the pores. Planté, and afterwards Gladstone and Tribe, found a possible cause in the formation of a film of peroxide on the spongy lead. E. J. Wade has suggested a sudden readjustment of the spongy mass into a complex sulphate. To rebut these hypotheses it is only necessary to say that the fall can be deferred for a long time by pressing fresh acid into the pores hydrostatically (see Liebenow, *Zeits. für Elektrochem.*, 1897, iv. 61), or by working at a higher temperature. This increases the diffusion inwards of strong acid, and like the increase due to hydrostatic pressure maintains the E.M.F. The other suggested causes of the fall therefore fail. Fig. 20 also shows that when the discharge current was stopped at points A, B, C, D to extract samples, the voltage immediately rose, owing to inward diffusion of stronger acid. The inward diffusion of fresh acid also accounts for the recuperation found after a rest which follows either a complete discharge or a partial discharge at a very rapid rate. If the discharge be complete the recuperation refers only to the electromotive force; the pressure falls at once on closed circuit. If discharge has been rapid, a rest will enable the cell to resume work because it brings fresh acid into the active regions.

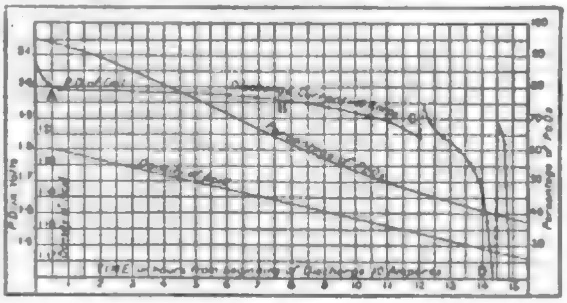

FIG. 20.

As to the effect of repose on a charged cell, Gladstone and Tribe's experiments showed that peroxide of lead lying on its lead support suffers from a local action, which reduces one molecule of PbO_2 to sulphate at the same time that an atom of the grid below it is also changed to sulphate. There is thus not only a loss of the available peroxide, but a corrosion of the grid or plate. It is through this action that the supports gradually give way. On the negative plate an action arises between the finely divided lead and the sulphuric acid, with the result that hydrogen is set free:—

$$Pb + H_2SO_4 = PbSO_4 + H_2.$$

This involves a diminution of available spongy lead, or loss of capacity, occasionally with serious consequences. The capacity of the lead plate is reduced absolutely, of course, but its relative value is more seriously affected. In the discharge it gets sulphated too much, because the better positive keeps up E.M.F. too long. In the succeeding charge, the positive is fully charged before the negative, and the differences between them tend to increase in each cycle.

Kelvin and Helmholtz have shown that the E.M.F. of a voltaic cell can be calculated from the energy developed by the chemical action. For a dyad gram equivalent (=2 grams of hydrogen, 207 grams of lead, &c.), the equation connecting them is

$$E = \frac{H}{46000} + T\frac{dE}{dT}$$

where E is the E.M.F. in volts, H is the heat developed by a dyad equivalent of the reacting substances, T is the absolute temperature, and dE/dT is the temperature coefficient of the E.M.F. If the E.M.F. does not change with temperature, the second term is zero. The thermal values for the various substances formed and decomposed are:—For PbO_2, 62400; for $PbSO_4$, 216210; for H_2SO_4, 192920; and for H_2O, 68400 calories. Writing the equation in its simplest form for strong acid, and ignoring the temperature coefficient term,

$$\begin{array}{c} PbO_2 + 2H_2SO_4 + Pb = 2PbSO_4 + 2H_2O \\ -62440 - 385840 \qquad +432420 + 136720 \end{array}$$

leaving a balance of 120860 calories. Dividing by 46000 gives 2·627 volts. The experimental value in strong acid, according to Gladstone and Hibbert, is 2·607 volts, a very close approximation. For other strengths of acid, the energy will be less by the quantity of heat evolved by dilution of the acid, because the chemical action must take the H_2SO_4 from the diluted liquid. The dotted curve in fig. 10 indicates the calculated E.M.F. at various points when this is taken into account. The difference between it and the continuous curve must, if the chemical theory be correct, depend on the second term in the equation. The figure shows that the observed E.M.F. is above the theoretical for all strengths from 100 down to 5%. Below 5 the position is reversed. The question remains, Can the temperature coefficient be obtained? This is difficult, because the value is so small, and it is not easy to secure a good cycle of observations. Streintz has given the following values:—

E	1·9223	1·9828	2·0031	2·0084	2·0105	2·078	2·2070
$\frac{dE}{dT}\cdot 10^6$	140	228	335	285	255	130	73

Unpublished experiments by the writer give $\frac{dE}{dT}\cdot 10^6 = 350$ for acid of density 1·156. With stronger acid, a true cycle could not be obtained. Taking Streintz's value, 335 for 25% acid, the second term of the equation is $T\frac{dE}{dT} = 290 \times \cdot 000335 = 0\cdot 0971$ volt. The first term gives 88800 calories = 1·9304 volt. Adding the second term, $1\cdot 9304 + 0\cdot 0971 = 2\cdot 2075$ volts. The observed value is 2·030 volts (see fig. 10), a remarkably good agreement. This calculation and the general relation shown in fig. 10 render it highly probable that, if the temperature coefficient were known for all strengths of acid, the result would be equally good. It is worth observing that the reversal of relationship between the observed and calculated curves, which takes place at 5% or 6%, suggests that the chemistry must be on the point of altering as the acid gets weak, a conclusion which has been already arrived at on purely chemical grounds. The thermodynamical relations are thus seen to confirm very strongly the chemical and physical analyses.[1]

Accumulators in Central Stations.—As the efficiency of accumulators is not generally higher than 75%, and machines must be used to charge them, it is not directly economical to use cells alone for public supply. Yet they play an important and an increasing part in public work, because they help to maintain a constant voltage on the mains, and can be used to distribute the load on the running machinery over a much greater fraction of the day. Used in parallel with the dynamo, they quickly yield current when the load increases, and immediately begin to charge when the load diminishes, thus largely reducing the fluctuating stress on dynamo and engine for sudden variations in load. Their use is advantageous if they can be charged and discharged at a time when the steam plant would otherwise be working at an uneconomical load.

Regulation of the potential difference is managed in various ways. More cells may be thrown in as the discharge proceeds, and taken out during charge; but this method often leads to trouble, as some cells get unduly discharged, and the unity of the battery is disturbed. Sometimes the number of cells is kept fixed for supply, but the P.D. they put on the mains is reduced during charge by employing regulating cells in opposition. Both these plans have proved unsatisfactory, and the battery is now preferably joined across the mains in parallel with the dynamo. The cells take the peaks of the load and thus relieve the dynamo and engine of sudden changes, as shown in fig. 21. Here the line current (shown by the erratic curve) varied spasmodically from 0 to 375 amperes, yet the dynamo current varied from 100 to 150 amperes only (see line A). At the same time the line voltage (535 volts normal) was kept nearly constant. In the late evening the cells became exhausted and the dynamo charged them. Extra voltage was required at the end of a "charge" and was provided by a "booster." Originally a booster was an auxiliary dynamo worked in series with the chief machine, and driven in any convenient way. It has developed into a machine with two or more exciting coils, and having its armature in series with the cells (see fig. 22). The exciting coils act in opposition; the one carrying the main current sets up an E.M.F. in the same direction as that of the cells, and helps the cells to discharge as the load rises. When the load is small, the voltage on the mains is highest and the shunt exciting current greatest. The booster E.M.F. now acts with the dynamo and against the cells, and causes them to take a full charge. Even this arrangement did not suffice to keep the line voltage as constant as seemed desirable in some cases, as where lighting and traction work were put on the same plant. Fig. 23 is a diagram of a complex booster which gives very good regulation. The booster B has its armature in series with the accumulators A, and is kept running in a given direction at a constant speed by means of a shunt-wound motor (not shown), so that the E.M.F. induced in the armature depends on the excitation. This is made to vary in value and in direction by means of four independent exciting coils, C_1, C_2, C_3, C_4. The last is not essential, as it merely compensates for the small voltage drop in the armature. It is obvious that the excitation C_3 will be proportionate to the difference in voltage between the battery and the mains, and it is arranged that battery volts and booster volts shall equal the volts on the mains. Under this excitation there is no tendency for the battery to charge or discharge. But any additional excitation leads to strong currents one way or the other. Excitation C_1 rises with the load on the line, and gives an E.M.F. helping the battery to discharge most when the load is greatest. C_2 is dependent on the bus-bar voltage, and is greatest when the generator load is small: it opposes C_1 and therefore excites the booster to charge the battery. The exact generator load at which the booster shall reverse its E.M.F. from a charging to a discharging value is adjusted by the resistance R_2 in series with C_2. A similar resistance R_3 allows the excitation of C_3 to be adjusted. Very remarkable regulation can be obtained by reversible boosters of this type. In traction and lighting stations it is quite possible to keep the variation of bus-bar pressure within 2% of the normal value, although the load may momentarily vary from a few amperes up to 200 or 300.

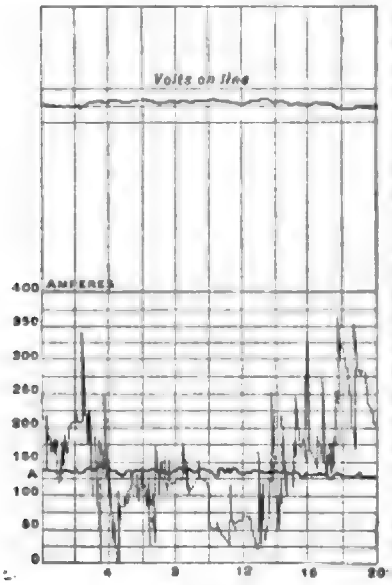

FIG. 21.

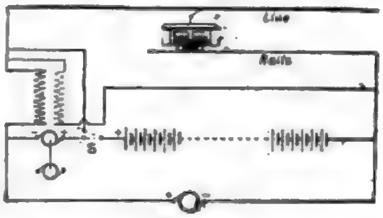

FIG. 22.

J. B. Entz has introduced an auxiliary device which enables him to use a much more simple booster. The Entz booster has no series coil and only one shunt coil, the direction and value of excitation due to this being controlled by a carbon regulator, having two arms, the resistance of each of which can be varied by pressure due to the magnetizing action of a solenoid. The main current from the generator passes through the solenoid and causes one or other of the two carbon arms to have the less resistance. This change in resistance determines the direction of the exciter field current, and therefore the direction of the boost. A photograph of the switchboard at Greenock where this booster is in use shows the voltmeter needle as if it had been held rigid, although the exposure lasted 90 minutes. On the same photograph the ammeter needle does not appear, its incessant and large movements preventing any picture from being formed.

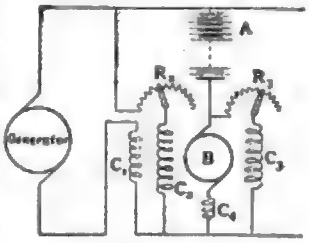

FIG. 23.

Alkaline Accumulators.—Owing to the high electro-chemical equivalent of lead, a great saving in weight would be secured by using almost any other metal. Unfortunately no other metal and its compounds can resist the acid. Hence inventors have been incited to try alkaline liquids as electrolytes. Many attempts have been made to construct accumulators in this way, though with only moderate success. The Lalande-Chaperon, Desmazures, Waddell-Entz and Edison are the chief cells. T. A. Edison's cell has been most developed, and is intended for traction work. He made the plates of very thin sheets of nickel-plated steel, in each of which 24 rectangular holes were stamped, leaving a mere framework of the metal. Shallow rectangular pockets of perforated nickel-steel were fitted in the holes and then burred over the framework by high pressures. The pockets contained the active material. On the positive plate this consisted of nickel peroxide mixed with flake graphite, and on the negative plate of finely divided iron mixed with graphite. Both kinds of active material were prepared in a special way. The graphite gives greater conductivity. The liquid was a 20% solution of caustic potash. During discharge the iron was oxidized, and the nickel reduced to a lower state of oxidation. This change was reversed during charge. Fig. 24 shows the general features.

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[1] For the discussion of later electrolytic theories as applied to accumulators, see Dolezalek, *Theory of the Lead Accumulator*.

The chief results obtained by European experts showed that the E.M.F. was 1·33 volt, with a transient higher value following charge. A cell weighing 17·8 lb had a resistance of 0·0013 ohm, and an output at 60 amperes of 210 watt-hours, or at 120 amperes of 177 watt-hours. Another and improved cell weighing 12·7 lb gave 14·6 watt-hours per pound of cell at a 20-ampere rate, and 13·5 watt-hours per pound at a 60-ampere rate. The cell could be charged and discharged at almost any rate. A full charge could be given in 1 hour, and it would stand a discharge rate of 200 amperes (*Journ. Inst. Elec. Eng.*, 1904, pp. 1-36).

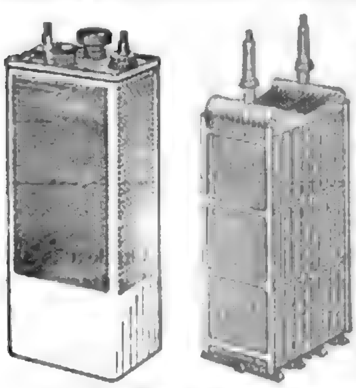
FIG. 24.—Edison Accumulator.

Subsequently Edison found some degree of falling-off in capacity, due to an enlargement of the positive pockets by pressure of gas. Most of the faults have been overcome by altering the form of the pocket and replacing the graphite by a metallic conductor in the form of flakes.

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ACCURSIUS (*Ital.* ACCORSO), **FRANCISCUS** (1182–1260), Italian jurist, was born at Florence about 1182. A pupil of Azo, he first practised law in his native city, and was afterwards appointed professor at Bologna, where he had great success as a teacher. He undertook the great work of arranging into one body the almost innumerable comments and remarks upon the Code, the Institutes and Digests, the confused dispersion of which among the works of different writers caused much obscurity and contradiction. This compilation, bearing the title *Glossa ordinaria* or *magistralis*, but usually known as the Great Gloss, though written in barbarous Latin, has more method than that of any preceding writer on the subject. The best edition of it is that of Denis Godefroi (1549–1621), published at Lyons in 1589, in 6 vols. folio. When Accursius was employed in this work, it is said that, hearing of a similar one proposed and begun by Odofred, another lawyer of Bologna, he feigned indisposition, interrupted his public lectures, and shut himself up, till with the utmost expedition he had accomplished his design. Accursius was greatly extolled by the lawyers of his own and the immediately succeeding age, and he was even called the idol of jurisconsults, but those of later times formed a much lower estimate of his merits. There can be no doubt that he disentangled the sense of many laws with much skill, but it is equally undeniable that his ignorance of history and antiquities often led him into absurdities, and was the cause of many defects in his explanations and commentaries. He died at Bologna in 1260. His eldest son Franciscus (1225–1293), who also filled the chair of law at Bologna, was invited to Oxford by King Edward I., and in 1275 or 1276 read lectures on law in the university.

ACCUSATION (Lat. *accusatio*, *accusare*, to challenge to a *causa*, a suit or trial at law), a legal term signifying the charging of another with wrong-doing, criminal or otherwise. An accusation which is made in a court of justice during legal proceedings is privileged (see PRIVILEGE), though, should the accused have been maliciously prosecuted, he will have a right to bring an action for malicious prosecution. An accusation made outside a court of justice would, if the accusation were false, render the accuser liable to an action for defamation of character, while, if the accusation be committed to writing, the writer of it is liable to indictment, whether the accusation be made only to the party accused or to a third person. A threat or conspiracy to accuse another of a crime or of misconduct which does not amount to a crime for the purpose of extortion is in itself indictable.

ACCUSATIVE (Lat. *accusativus*, sc. *casus*, a translation of the Gr. *αἰτιατικὴ πτῶσις*, the case concerned with cause and effect, from *αἰτία*, a cause), in grammar, a case of the noun, denoting primarily the object of verbal action or the destination of motion.

ACE (derived through the Lat. *as*, from the Tarentine form of the Gr. *εἷς*), the number one at dice, or the single point on a die or card; also a point in the score of racquets, lawn-tennis, tennis and other court games.

ACELDAMA (according to Acts i. 19, "the field of blood"), the name given to the field purchased by Judas Iscariot with the money he received for the betrayal of Jesus Christ. A different version is given in Matthew xxvii. 8, where Judas is said to have cast down the money in the Temple, and the priests who had paid it to have recovered the pieces, with which they bought "the potter's field, to bury strangers in." The MS. evidence is greatly in favour of a form Aceldamach. This would seem to mean "the field of thy blood," which is unsuitable. Since, however, we find elsewhere one name appearing as both Sirach and Sira (ch = א), Aceldamach may be another form of an original Aceldama (חקל דמא), the "field of blood." A. Klostermann, however, takes the *ch* to be part of the Aramaic root *demach*, "to sleep"; the word would then mean "field of sleep" or cemetery (*Probleme im Aposteltexte*, 1-8, 1883), an explanation which fits in well with the account in Matthew xxvii. The traditional site (now Hak el-Dum), S. of Jerusalem on the N.E. slope of the "Hill of Evil Counsel" (Jebel Deir Abu Tor), was used as a burial-place for Christian pilgrims from the 6th century A.D. till as late, apparently, as 1697, and especially in the time of the Crusades. Near it there is a very ancient charnel-house, partly rock-cut, partly of masonry, said to be the work of Crusaders.

ACENAPHTHENE, $C_{12}H_{10}$, a hydrocarbon isolated from the fraction of coal-tar boiling at 260°–270° by M. P. E. Berthelot, who, in conjunction with Bardy, afterwards synthesized it from α-ethyl naphthalene (*Ann. Chem. Phys.*, 1873, vol. xxix.). It forms white needles (from alcohol), melts at 95° and boils at 278°. Oxidation gives naphthalic acid (1·8 naphthalene dicarboxylic acid).

Acenaphthalene, $C_{12}H_8$, a hydrocarbon crystallizing in yellow tables and obtained by passing the vapour of acenaphthene over heated litharge. Sodium amalgam reduces it to acenaphthene; chromic acid oxidizes it to naphthalic acid.

ACEPHALI (from ἀ-, privative, and κεφαλή, head), a term applied to several sects as having no head or leader; and in particular to a strict monophysite sect that separated itself, in the end of the 5th century, from the rule of the patriarch of Alexandria (Peter Mongus), and remained "without king or bishop" till they were reconciled by Mark I. (799–819).[1] The term is also used to denote *clerici vagrantes*, *i.e.* clergy without title or benefice, picking up a living anyhow (cf. Hinschius i. p. 64). Certain persons in England during the reign of King Henry I. were called *Acephali* because they had no lands by virtue of which they could acknowledge a superior lord. The name is also given to certain legendary races described by ancient naturalists and geographers as having no heads, their mouths and eyes being in their breasts, generally identified with Pliny's Blemmyae.

ACEPHALOUS, headless, whether literally or metaphorically, leaderless. The word is used literally in biology; and metaphorically in prosody or grammar for a verse or sentence with a beginning wanting. In zoology, the mollusca are divided into cephalous and acephalous (Acephala), according as they have or have not an organized part of their anatomy as the seat of the brain and special senses. The Acephala, or *Lamellibranchiata* (*q.v.*), are commonly known as bivalve shell-fish. In botany the word is used for ovaries not terminating in a stigma. Acephalocyst is the name given by R. T. H. Laennec to the hydatid, immature or larval tapeworm.

ACERENZA (anc. *Acheruntia*), a town of the province of Potenza, Italy, the seat of an archbishop, 15½ m. N.E. of the station of Pietragalla, which is 9 m. N.W. of Potenza by rail, 2730 ft. above sea-level. Pop. (1901) 4499. Its situation is one of great strength, and it has only one entrance, on the south. It was occupied as a colony at latest by the end of the Republic, and its importance as a fortress was specially appreciated by the Goths and Lombards in the 6th and 7th centuries. It has a fine Norman cathedral, upon the gable of which is one of the best extant busts of Julian the Apostate.

ACEROSE (from Lat. *acus*, needle, or *acer*, sharp), needle-shaped, a term used in botany (since Linnaeus) as descriptive of the leaves, *e.g.*, of pines. From Lat. *acus*, chaff, comes also the distinct meaning of "mixed with chaff."

ACERRA, a town and episcopal see of Campania, Italy, in the province of Caserta, 9 m. N.E. from Naples by rail. Pop. (1901) 16,443. The town lies on the right bank of the Agno, which divides the province of Naples from that of Caserta, 90 ft. above the sea, in a fertile but somewhat marshy district, which in the middle ages was very malarious. The ancient name (*Acerrae*) was also borne by a town in Umbria and another in Gallia Transpadana (the latter now Pizzighettone on the Adda, 13 m. W.N.W. of Cremona). It became a city with Latin rights in 332 B.C. and later a *municipium*. It was destroyed by Hannibal in 216 B.C., but restored in 210; in 90 B.C. it served as the Roman headquarters in the Social war, and was successfully held against the insurgents. It received a colony under Augustus, but appears to have suffered much from floods of the river Clanis. Under the Empire we hear no more of it, and no traces of antiquity, beyond inscriptions, remain.

ACERRA, in Roman antiquity, a small box or pot for holding incense, as distinct from the turibulum (thurible) or censer in which incense was burned. The name was also given by the Romans to a little altar placed near the dead, on which incense was offered every day till the burial. In ecclesiastical Latin the term acerra is still applied to the incense boats used in the Roman ritual.

ACETABULUM, the Latin word for a vinegar cup, an ancient Roman vessel, used as a liquid measure (equal to about half a gill); it is also a word used technically in zoology, by analogy for certain cup-shaped parts, *e.g.* the suckers of a mollusc, the socket of the thigh-bone, &c.; and in botany for the receptacle of Fungi.

ACETIC ACID (*acidum aceticum*), $CH_3 \cdot CO_2H$, one of the most important organic acids. It occurs naturally in the juice of many plants, and as the esters of n-hexyl and n-octyl alcohols in the seeds of *Heracleum giganteum*, and in the fruit of *Heracleum sphondylium*, but is generally obtained, on the large scale, from the oxidation of spoiled wines, or from the destructive distillation of wood. In the former process it is obtained in the form of a dilute aqueous solution, in which also the colouring matters of the wine, salts, &c., are dissolved; and this impure acetic acid is what we ordinarily term vinegar (*q.v.*). Acetic acid (in the form of vinegar) was known to the ancients, who obtained it by the oxidation of alcoholic liquors. Wood-vinegar was discovered in the middle ages. Towards the close of the 18th century, A. L. Lavoisier showed that air was necessary to the formation of vinegar from alcohol. In 1830 J. B. A. Dumas converted acetic acid into trichloracetic acid, and in 1842 L. H. F. Melsens reconverted this derivative into the original acetic acid by reduction with sodium amalgam. The synthesis of trichloracetic acid from its elements was accomplished in 1843 by H. Kolbe; this taken in conjunction with Melsens's observation provided the first synthesis of acetic acid. Anhydrous acetic acid—glacial acetic acid—is a leafy crystalline mass melting at 16·7° C., and possessing an exceedingly pungent smell. It boils at 118°, giving a vapour of abnormal specific gravity. It dissolves in water in all proportions with at first a contraction and afterwards an increase in volume. It is detected by heating with ordinary alcohol and sulphuric acid, which gives rise to acetic ester or ethyl acetate, recognized by its fragrant odour; or by heating with arsenious oxide, which forms the pungent and poisonous cacodyl oxide. It is a monobasic acid, forming one normal and two acid potassium salts, and basic salts with iron, aluminium, lead and copper. Ferrous and ferric acetates are used as mordants; normal lead acetate is known in commerce as sugar of lead (*q.v.*); basic copper acetates are known as verdigris (*q.v.*).

Pharmacology and Therapeutics.—Glacial acetic acid is occasionally used as a caustic for corns. The dilute acid, or vinegar, may be used to bathe the skin in fever, acting as a pleasant refrigerant. Acetic acid has no valuable properties for internal administration. Vinegar, however, which contains about 5% acetic acid, is frequently taken as a cure for obesity, but there is no warrant for this application. Its continued employment may, indeed, so injure the mucous membrane of the stomach as to interfere with digestion and so cause a morbid and dangerous reduction in weight.

The acetates constitute a valuable group of medicinal agents, the potassium salt being most frequently employed. After absorption into the blood, the acetates are oxidized to carbonates, and therefore are *remote alkalies*, and are administered whenever it is desired to increase the alkalinity of the blood or to reduce the acidity of the urine, without exerting the disturbing influence of alkalies upon the digestive tract. The citrates act in precisely similar fashion, and may be substituted. They are somewhat more pleasant but more expensive.

ACETO-ACETIC ESTER, $C_6H_{10}O_3$ or $CH_3 \cdot CO \cdot CH_2 \cdot COOC_2H_5$, a chemical substance discovered in 1863 by A. Geuther, who showed that the chief product of the action of sodium on ethyl acetate was a sodium compound of composition $C_6H_9O_3Na$, which on treatment with acids gave a colourless, somewhat oily liquid of composition $C_6H_{10}O_3$. E. Frankland and B. F. Duppa in 1865 examined the reaction and concluded that Geuther's sodium salt was a derivative of the ethyl ester of acetone carboxylic acid and possessed the constitution $CH_3CO \cdot CHNa \cdot COOC_2H_5$. This view was not accepted by Geuther, who looked upon his compound $C_6H_{10}O_3$ as being an acid. J. Wislicenus also investigated the reaction very thoroughly and accepted the Frankland-Duppa formula (*Annalen*, 1877, 186, p. 163; 1877, 190, p. 257).

The substance is best prepared by drying ethyl acetate over calcium chloride and treating it with sodium wire, which is best introduced in one operation; the liquid boils and is then heated on a water bath for some hours, until the sodium all dissolves. After the reaction is completed, the liquid is acidified with dilute sulphuric acid (1:5) and then shaken with salt solution, separated from the salt solution, washed, dried and fractionated. The portion boiling between 175° and 185°C. is redistilled. The yield amounts to about 30% of that required by theory.

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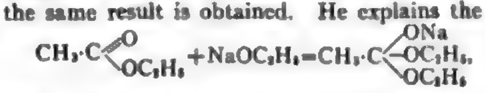
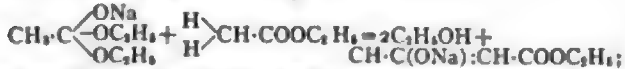
[1] See Gibbon, ch. xlvii. (vol. v. p. 129 in Bury's ed.).

A. Ladenburg and J. A. Wanklyn have shown that pure ethyl acetate free from alcohol will not react with sodium to produce aceto-acetic ester. L. Claisen, whose views are now accepted, studied the reactions of sodium ethylate and showed that if sodium ethylate be used in place of sodium in the above reaction the same result is obtained. He explains the reactions thus:



$$\mathrm{CH_3{\cdot}C}\left\langle\begin{array}{l}\mathrm{O}\\ \mathrm{OC_2H_5}\end{array}\right. + \mathrm{NaOC_2H_5} = \mathrm{CH_3{\cdot}C}\left\langle\begin{array}{l}\mathrm{ONa}\\ \mathrm{OC_2H_5},\\ \mathrm{OC_2H_5}\end{array}\right.$$

this reaction being followed by



$$\mathrm{CH_3{\cdot}C}\left\langle\begin{array}{l}\mathrm{ONa}\\ \mathrm{OC_2H_5}\\ \mathrm{OC_2H_5}\end{array}\right. + \left.\begin{array}{r}\mathrm{H}\\ \mathrm{H}\end{array}\right\rangle\mathrm{CH{\cdot}COOC_2H_5} = 2\mathrm{C_2H_5OH} + \mathrm{CH{\cdot}C(ONa){:}CH{\cdot}COOC_2H_5};$$

and on acidification this last substance gives aceto-acetic ester. Aceto-acetic ester is a colourless liquid boiling at 181°C.; it is slightly soluble in water, and when distilled undergoes some decomposition forming dehydracetic acid $C_8H_8O_4$. It undoubtedly contains a keto-group, for it reacts with hydrocyanic acid, hydroxylamine, phenylhydrazine and ammonia; sodium bisulphite also combines with it to form a crystalline compound, hence it contains the grouping $CH_3{\cdot}CO-$. J. Wislicenus found that only one hydrogen atom in the $-CH_2-$ group is directly replaceable by sodium, and that if the sodium be then replaced by an alkyl group, the second hydrogen atom in the group can be replaced in the same manner. These alkyl substitution products are important, for they lead to the synthesis of many organic compounds, on account of the fact that they can be hydrolysed in two different ways, barium hydroxide or dilute sodium hydroxide solution giving the so-called ketone hydrolysis, whilst concentrated sodium hydroxide gives the acid hydrolysis.

Ketone hydrolysis:—

$CH_3{\cdot}CO{\cdot}C(XY){\cdot}CO_2C_2H_5 \rightarrow CH_3{\cdot}CO{\cdot}CH(XY) + C_2H_5OH + CO_2$;

Acid hydrolysis:—

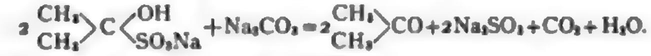
$CH_3{\cdot}CO{\cdot}C(XY){\cdot}CO_2C_2H_5 \rightarrow CH_3{\cdot}CO_2H + C_2H_5OH + CH(XY){\cdot}COOH$;

(where X and Y = alkyl groups).

Both reactions occur to some extent simultaneously. Aceto-acetic ester is a most important synthetic reagent, having been used in the production of pyridines (*q.v.*), quinolines (*q.v.*), pyrazolones, furfurane (*q.v.*), pyrrols (*q.v.*), uric acid (*q.v.*), and many complex acids and ketones.

For a discussion as to the composition, and whether it is to be regarded as possessing the "keto" form $CH_3{\cdot}CO{\cdot}CH_2{\cdot}COOC_2H_5$ or the "enol" form $CH_3{\cdot}C(OH){:}CH{\cdot}COOC_2H_5$, see ISOMERISM, and also papers by J. Wislicenus (*Ann.*, 1877, 186, p. 163; 1877, 190, p. 257), A. Michael (*Journn. Prak. Chem.*, 1887, [2] 37, p. 473), L. Knorr (*Ann.*, 1886, 238, p. 147), W. H. Perkin, senr. (*Journ. of Chem. Soc.*, 1892, 61, p. 800) and J. U. Nef (*Ann.*, 1891, 266, p. 70; 1892, 270, pp. 289, 333; 1893, 276, p. 212).

ACETONE, or DIMETHYL KETONE, $CH_3{\cdot}CO{\cdot}CH_3$, in chemistry, the simplest representative of the aliphatic ketones. It is present in very small quantity in normal urine, in the blood, and in larger quantities in diabetic patients. It is found among the products formed in the destructive distillation of wood, sugar, cellulose, &c., and for this reason it is always present in crude wood spirit, from which the greater portion of it may be recovered by fractional distillation. On the large scale it is prepared by the dry distillation of calcium acetate $(CH_3CO_2)_2Ca = CaCO_3 + CH_3COCH_3$. E. R. Squibb (*Journ. Amer. Chem. Soc.*, 1895, 17, p. 187) manufactures it by passing the vapour of acetic acid through a rotating iron cylinder containing a mixture of pumice and precipitated barium carbonate, and kept at a temperature of from 500° C. to 600° C. The mixed vapours of acetone, acetic acid and water are then led through a condensing apparatus so that the acetic acid and water are first condensed, and then the acetone is condensed in a second vessel. The barium carbonate used in the process acts as a contact substance, since the temperature at which the operation is carried out is always above the decomposition point of barium acetate. Crude acetone may be purified by converting it into the crystalline sodium bisulphite compound, which is separated by filtration and then distilled with sodium carbonate.



$$2\left.\begin{array}{r}\mathrm{CH_3}\\ \mathrm{CH_3}\end{array}\right\rangle\mathrm{C}\left\langle\begin{array}{l}\mathrm{OH}\\ \mathrm{SO_3Na}\end{array}\right. + \mathrm{Na_2CO_3} = 2\left.\begin{array}{r}\mathrm{CH_3}\\ \mathrm{CH_3}\end{array}\right\rangle\mathrm{CO} + 2\mathrm{Na_2SO_3} + \mathrm{CO_2} + \mathrm{H_2O}.$$

It is then dehydrated and redistilled.

Acetone is largely used in the manufacture of cordite (*q.v.*). For this purpose the crude distillate is redistilled over sulphuric acid and then fractionated.

Acetone is a colourless mobile liquid of pleasant smell, boiling at 56·53°C., and has a specific gravity 0·819(0°/4°C.). It is readily soluble in water, alcohol, ether, &c. In addition to its application in the cordite industry, it is used in the manufacture of chloroform (*q.v.*) and sulphonal, and as a solvent. It forms a hydrazone with phenyl hydrazine, and an oxime with hydroxylamine. Reduction by sodium amalgam converts it into isopropyl alcohol; oxidation by chromic acid gives carbon dioxide and acetic acid. With ammonia it reacts to form di- and tri-acetoneamines. It also unites directly with hydrocyanic acid to form the nitrile of α-oxyisobutyric acid.

By the action of various reagents such as lime, caustic potash, hydrochloric acid, &c., acetone is converted into condensation products, mesityl oxide $C_6H_{10}O$, phorone $C_9H_{14}O$, &c., being formed. On distillation with sulphuric acid, it is converted into mesitylene C_9H_{12} (symmetrical trimethyl benzene). Acetone has also been used in the artificial production of indigo. In the presence of iodine and an alkali it gives iodoform. Acetone has been employed medicinally in cases of dyspnoea. With potassium iodide, glycerin and water, it forms the preparation spirone, which has been used as a spray inhalation in paroxysmal sneezing and asthma.

ACETOPHENONE, or PHENYL-METHYL KETONE, C_8H_8O or $C_6H_5CO{\cdot}CH_3$, in chemistry, the simplest representative of the class of mixed aliphatic-aromatic ketones. It can be prepared by distilling a mixture of dry calcium benzoate and acetate, $Ca(O_2CC_6H_5)_2 + (CH_3CO_2)_2Ca = 2CaCO_3 + 2C_6H_5CO{\cdot}CH_3$, or by condensing benzene with acetyl chloride in the presence of anhydrous aluminium chloride (C. Friedel and J. M. Crafts), $C_6H_6 + CH_3COCl = HCl + C_6H_5COCH_3$. It crystallizes in colourless plates melting at 20°C. and boiling at 202°C.; it is insoluble in water, but readily dissolves in the ordinary organic solvents. It is reduced by nascent hydrogen to the secondary alcohol $C_6H_5{\cdot}CH{\cdot}OH{\cdot}CH_3$ phenyl-methyl-carbinol, and on oxidation forms benzoic acid. On the addition of phenylhydrazine it gives a phenylhydrazone, and with hydroxylamine furnishes an oxime $\left.\begin{smallmatrix}C_6H_5\\ CH_3\end{smallmatrix}\right\rangle C{=}N{\cdot}OH$ melting at 59°C. This oxime undergoes a peculiar rearrangement when it is dissolved in ether and phosphorus pentachloride is added to the ethereal solution, the excess of ether distilled off and water added to the residue being converted into the isomeric substance acetanilide, $C_6H_5NHCOCH_3$, a behaviour shown by many ketoximes and known as the Beckmann change (see *Berichte*, 1886, 19, p. 988). With sodium ethylate in ethyl acetate solution it forms the sodium derivative of benzoyl acetone, from which benzoyl acetone, $C_6H_5{\cdot}CO{\cdot}CH_2{\cdot}CO{\cdot}CH_3$, can be obtained by acidification with acetic acid. When heated with the halogens, acetophenone is substituted in the aliphatic portion of the nucleus; thus bromine gives phenacyl bromide, $C_6H_5CO{\cdot}CH_2Br$. Numerous derivatives of acetophenone have been prepared, one of the most important being orthoaminoacetophenone, $NH_2{\cdot}C_6H_4{\cdot}CO{\cdot}CH_3$, which is obtained by boiling orthoaminophenylpropiolic acid with water. It is a thick yellowish oil boiling between 242° C. and 250° C. It condenses with acetone in the presence of caustic soda to a quinoline. *Acetonyl-acetophenone*, $C_6H_5{\cdot}CO{\cdot}CH_2{\cdot}CH_2{\cdot}CO{\cdot}CH_3$, is produced by condensing phenacyl bromide with sodium aceto-acetate with subsequent elimination of carbon dioxide, and on dehydration gives αα-phenyl-methyl-furfurane. Oxazoles (*q.v.*) are produced on condensing phenacyl bromide with acid-amides (M. Lewy, *Berichte*, 1887, 20, p. 2578). K. L. Paal has also obtained pyrrol derivatives by condensing acetophenone-aceto-acetic-ester with substances of the type NH_2R.

Physical properties.

ACETYLENE, klumene or ethine, a gaseous compound of carbon and hydrogen, represented by the formula C_2H_2. It is a colourless gas, having a density of 0·92. When prepared by the action of water upon calcium carbide, it has a very strong and penetrating odour, but when it is thoroughly purified from sulphuretted and phosphuretted hydrogen, which are invariably present with it in minute traces, this extremely pungent odour disappears, and the pure gas has a not unpleasant ethereal smell. It can be condensed into the liquid state by cold or by pressure, and experiments by G. Ansdell show that if the gas be subjected to a pressure of 21·53 atmospheres at a temperature of 0° C., it is converted into the liquid state, the pressure needed increasing with the rise of temperature, and decreasing with the lowering of the temperature, until at −82° C. it becomes liquid under ordinary atmospheric pressure. The critical point of the gas is 37° C., at which temperature a pressure of 68 atmospheres is required for liquefaction. The properties of liquid and solid acetylene have been investigated by D. McIntosh (*Jour. Chem. Soc., Abs.*, 1907, i. 458). A great future was expected from its use in the liquid state, since a cylinder fitted with the necessary reducing valves would supply the gas to light a house for a considerable period, the liquid occupying about $\frac{1}{400}$ the volume of the gas, but in the United States and on the continent of Europe, where liquefied acetylene was made on the large scale, several fatal accidents occurred owing to its explosion under not easily explained conditions. As a result of these accidents M. P. E. Berthelot and L. J. G. Vieille made a series of valuable researches upon the explosion of acetylene under various conditions. They found that if liquid acetylene in a steel bottle be heated at one point by a platinum wire raised to a red heat, the whole mass decomposes and gives rise to such tremendous pressures that no cylinder would be able to withstand them. These pressures varied from 71,000 to 100,000 lb. per square inch. They, moreover, tried the effect of shock upon the liquid, and found that the repeated dropping of the cylinder from a height of nearly 20 feet upon a large steel anvil gave no explosion, but that when the cylinder was crushed under a heavy blow the impact was followed, after a short interval of time, by an explosion which was manifestly due to the fracture of the cylinder and the ignition of the escaping gas, mixed with air, from sparks caused by the breaking of the metal. A similar explosion will frequently follow the breaking in the same way of a cylinder charged with hydrogen at a high pressure. Continuing these experiments, they found that in acetylene gas under ordinary pressures the decomposition brought about in one portion of the gas, either by heat or the firing in it of a small detonator, did not spread far beyond the point at which the decomposition started, while if the acetylene was compressed to a pressure of more than 30 lb on the square inch, the decomposition travelled throughout the mass and became in reality detonation. These results showed clearly that liquefied acetylene was far too dangerous for general introduction for domestic purposes, since, although the occasions would be rare in which the requisite temperature to bring about detonation would be reached, still, if this point were attained, the results would be of a most disastrous character. The fact that several accidents had already happened accentuated the risk, and in Great Britain the storage and use of liquefied acetylene are prohibited.

When liquefied acetylene is allowed to escape from the cylinder in which it is contained into ordinary atmospheric pressure, some of the liquid assumes the gaseous condition with such rapidity as to cool the remainder below the temperature of −90° C., and convert it into a solid snow-like mass.

Solubility of acetylene.

Acetylene is readily soluble in water, which at normal temperature and pressure takes up a little more than its own volume of the gas, and yields a solution giving a purple-red precipitate with ammoniacal cuprous chloride and a white precipitate with silver nitrate, these precipitates consisting of acetylides of the metals. The solubility of the gas in various liquids, as given by different observers, is—

100 Volumes of		Volumes of Acetylene.
Brine	absorb	5
Water	,,	110
Alcohol	,,	600
Paraffin	,,	150
Carbon disulphide	,,	100
Fusel oil	,,	100
Benzene	,,	400
Chloroform	,,	400
Acetic acid	,,	600
Acetone	,,	2500

It will be seen from this table that where it is desired to collect and keep acetylene over a liquid, brine, *i.e.* water saturated with salt, is the best for the purpose, but in practice it is found that, unless water is agitated with acetylene, or the gas bubbled through, the top layer soon gets saturated, and the gas then dissolves but slowly. The great solubility of acetylene in acetone was pointed out by G. Claude and A. Hess, who showed that acetone will absorb twenty-five times its own volume of acetylene at a temperature of 15° C. under atmospheric pressure, and that, providing the temperature is kept constant, the liquid acetone will go on absorbing acetylene at the rate of twenty-five times its own volume for every atmosphere of pressure to which the gas is subjected.

At first it seemed as if this discovery would do away with all the troubles connected with the storage of acetylene under pressure, but it was soon found that there were serious difficulties still to be overcome. The chief trouble was that acetone expands a small percentage of its own volume while it is absorbing acetylene; therefore it is impossible to fill a cylinder with acetone and then force in acetylene, and still more impracticable only partly to fill the cylinder with acetone, as in that case the space above the liquid would be filled with acetylene under high pressure, and would have all the disadvantages of a cylinder containing compressed acetylene only. This difficulty was overcome by first filling the cylinder with porous briquettes and then soaking them with a fixed percentage of acetone, so that after allowing for the space taken up by the bricks the quantity of acetone soaked into the brick will absorb ten times the normal volume of the cylinder in acetylene for every atmosphere of pressure to which the gas is subjected, whilst all danger of explosion is eliminated.

This fact having been fully demonstrated, acetylene dissolved in this way was exempted from the Explosives Act, and consequently upon this exemption a large business has grown up in the preparation and use of dissolved acetylene for lighting motor omnibuses, motor cars, railway carriages, lighthouses, buoys, yachts, &c., for which it is particularly adapted.

Poisonous properties.

Acetylene was at one time supposed to be a highly poisonous gas, the researches of A. Bistrow and O. Liebreich having apparently shown that it acts upon the blood in the same way as carbon monoxide to form a stable compound. Very extensive experiments, however, made by Drs N. Grehant, A. L. Brociner, L. Crismer, and others, all conclusively show that acetylene is much less toxic than carbon monoxide, and indeed than coal gas.

Chemical properties.

When acetylene was first introduced on a commercial scale grave fears were entertained as to its safety, it being represented that it had the power of combining with certain metals, more especially copper and silver, to form acetylides of a highly explosive character, and that even with coal gas, which contains less than 1%, such copper compounds had been known to be formed in cases where the gas-distributing mains were composed of copper, and that accidents had happened from this cause. It was therefore predicted that the introduction of acetylene on a large scale would be followed by numerous accidents unless copper and its alloys were rigidly excluded from contact with the gas. These fears have, however, fortunately proved to be unfounded, and ordinary gas fittings can be used with perfect safety with this gas.

Acetylene has the property of inflaming spontaneously when brought in contact with chlorine. If a few pieces of carbide be dropped into saturated chlorine water the bubbles of gas take

The polymerization of acetylene.

fire as they reach the surface, and if a jet of acetylene be passed up into a bottle of chlorine it takes fire and burns with a heavy red flame, depositing its carbon in the form of soot. If chlorine be bubbled up into a jar of acetylene standing over water, a violent explosion, attended with a flash of intense light and the deposition of carbon, at once takes place. When the gas is kept in a small glass holder exposed to direct sunlight, the surface of the glass soon becomes dimmed, and W. A. Bone has shown that when exposed for some time to the sun's rays it undergoes certain polymerization changes which lead to the deposition of a film of heavy hydrocarbons on the surface of the tube. It has also been observed by L. Cailletet and later by P. Villard that when allowed to stand in the presence of water at a low temperature a solid hydrate is formed. Acetylene is readily decomposed by heat, polymerizing under its influence to form an enormous number of organic compounds; indeed the gas, which can itself be directly prepared from its constituents, carbon and hydrogen, under the influence of the electric arc, can be made the starting-point for the construction of an enormous number of different organic compounds of a complex character. In contact with nascent hydrogen it builds up ethylene; ethylene acted upon by sulphuric acid yields ethyl sulphuric acid; this can again be decomposed in the presence of water to yield alcohol, and it has also been proposed to manufacture sugar from this body. Picric acid can also be obtained from it by first treating acetylene with sulphuric acid, converting the product into phenol by solution in potash and then treating the phenol with fuming nitric acid.

Endothermic nature of acetylene.

Acetylene is one of those bodies the formation of which is attended with the disappearance of heat, and it is for this reason termed an "endothermic" compound, in contradistinction to those bodies which evolve heat in their formation, and which are called "exothermic." Such endothermic bodies are nearly always found to show considerable violence in their decomposition, as the heat of formation stored up within them is then liberated as sensible heat, and it is undoubtedly this property of acetylene gas which leads to its easy detonation by either heat or a shock from an explosion of fulminating mercury when in contact with it under pressure. The observation that acetylene can be resolved into its constituents by detonation is due to Berthelot, who started an explosive wave in it by firing a charge of 0·1 gram of mercury fulminate. It has since been shown, however, that unless the gas is at a pressure of more than two atmospheres this wave soon dies out, and the decomposition is only propagated a few inches from the detonator. Heated in contact with air to a temperature of 480° C., acetylene ignites and burns with a flame, the appearance of which varies with the way in which it is brought in contact with the air. With the gas in excess a heavy lurid flame emitting dense volumes of smoke results, whilst if it be driven out in a sufficiently thin sheet, it burns with a flame of intense brilliancy and almost perfect whiteness, by the light of which colours can be judged as well as they can by daylight. Having its ignition point below that of ordinary gas, it can be ignited by any red-hot carbonaceous matter, such as the brightly glowing end of a cigar. For its complete combustion a volume of acetylene needs approximately twelve volumes of air, forming as products of combustion carbon dioxide and water vapour. When, however, the air is present in much smaller ratio the combustion is incomplete, and carbon, carbon monoxide, carbon dioxide, hydrogen and water vapour are produced. This is well shown by taking a cylinder one-half full of acetylene and one-half of air; on applying a light to the mixture a lurid flame runs down the cylinder and a cloud of soot is thrown up, the cylinder also being thickly coated with it, and often containing a ball of carbon. If now, after a few moments' interval to allow some air to diffuse into the cylinder, a taper again be applied, an explosion takes place, due to a mixture of carbon monoxide and air. It is probable that when a flame is smoking badly, distinct traces of carbon monoxide are being produced, but when an acetylene flame burns properly the products are as harmless as those of coal gas, and, light for light, less in amount. Mixed with air, like every other combustible gas, acetylene forms an explosive mixture. F. Clowes has shown that it has a wider range of explosive proportions when mixed with air than any of the other combustible gases, the limiting percentages being as follows:—

Acetylene	3 to 82
Hydrogen	5 to 72
Carbon monoxide	13 to 75
Ethylene	4 to 22
Methane	5 to 13

Methods of production.

Manufacture of calcium carbide.

The methods which can be and have been employed from time to time for the formation of acetylene in small quantities are exceedingly numerous. Before the commercial production of calcium carbide made it one of the most easily obtainable gases, the processes which were most largely adopted for its preparation in laboratories were:—first, the decomposition of ethylene bromide by dropping it slowly into a boiling solution of alcoholic potash, and purifying the evolved gas from the volatile bromethylene by washing it through a second flask containing a boiling solution of alcoholic potash, or by passing it over moderately heated soda lime; and, second, the more ordinarily adopted process of passing the products of incomplete combustion from a Bunsen burner, the flame of which had struck back, through an ammoniacal solution of cuprous chloride, when the red copper acetylide was produced. This on being washed and decomposed with hydrochloric acid yielded a stream of acetylene gas. This second method of production has the great drawback that, unless proper precautions are taken to purify the gas obtained from the copper acetylide, it is always contaminated with certain chlorine derivatives of acetylene. Edmund Davy first made acetylene in 1836 from a compound produced during the manufacture of potassium from potassium tartrate and charcoal, which under certain conditions yielded a black compound decomposed by water with considerable violence and the evolution of acetylene. This compound was afterwards fully investigated by J. J. Berzelius, who showed it to be potassium carbide. He also made the corresponding sodium compound and showed that it evolved the same gas, whilst in 1862 F. Wöhler first made calcium carbide, and found that water decomposed it into lime and acetylene. It was not, however, until 1892 that the almost simultaneous discovery was made by T. L. Willson in America and H. Moissan in France that if lime and carbon be fused together at the temperature of the electric furnace, the lime is reduced to calcium, which unites with the excess of carbon present to form calcium carbide. The cheap production of this material and the easy liberation by its aid of acetylene at once gave the gas a position of commercial importance. In the manufacture of calcium carbide in the electric furnace, lime and anthracite of the highest possible degree of purity are employed. A good working mixture of these materials may be taken as being 100 parts by weight of lime with 68 parts by weight of carbonaceous material. About 1·8 lb of this is used up for each pound of carbide produced. The two principal processes utilized in making calcium carbide by electrical power are the ingot process and the tapping process. In the former, the anthracite and lime are ground and carefully mixed in the right proportions to suit the chemical actions involved. The arc is struck in a crucible into which the mixture is allowed to flow, partially filling it. An ingot gradually builds up from the bottom of the crucible, the carbon electrode being raised from time to time automatically or by hand to suit the diminution of resistance due to the shortening of the arc by the rising ingot. The crucible is of metal and considerably larger than the ingot, the latter being surrounded by a mass of unreduced material which protects the crucible from the intense heat. When the ingot has been made and the crucible is full, the latter is withdrawn and another substituted. The process is not continuous, but a change of crucibles only takes two or three minutes under the best conditions, and only occurs every ten or fifteen hours. The essence of this process is that the coke and lime are only heated to the point of combination, and are not "boiled" after being formed. It is found that the ingot of calcium carbide formed in the furnace, although itself consisting of pure crystalline calcium carbide, is nearly always surrounded by a crust which contains a certain proportion of imperfectly converted constituents, and therefore gives a lower yield of acetylene than the carbide itself. In breaking up and sending out the carbide for commercial work, packed in air-tight drums, the crust is removed by a sand blast. A statement of the amount made per kilowatt hour may be misleading, since a certain amount of loss is of necessity entailed during this process. For instance, in practical working it has been found that a furnace return of 0·504 ℔ per kilowatt hour is brought down to 0·406 ℔ per kilowatt hour when the material has been broken up, sorted and packed in air-tight drums. In the tapping process a fixed crucible is used, lined with carbon, the electrode is nearly as big as the crucible and a much higher current density is used. The carbide is heated to complete liquefaction and tapped at short intervals. There is no unreduced material, and the process is considerably simplified, while less expensive plant is required. The run carbide, however, is never so rich as the ingot carbide, since an excess of lime is nearly always used in the mixture to act as a flux, and this remaining in the carbide lowers its gas-yielding power. Many attempts have been made to produce the substance without electricity, but have met with no commercial success.

Properties of calcium carbide.

Calcium carbide, as formed in the electric furnace, is a beautiful crystalline semi-metallic solid, having a density of 2·22, and showing a fracture which is often shot with iridescent colours. It can be kept unaltered in dry air, but the smallest trace of moisture in the atmosphere leads to the evolution of minute quantities of acetylene and gives it a distinctive odour. It is infusible at temperatures up to 2000° C., but can be fused in the electric arc. When heated to a temperature of 245° C. in a stream of chlorine gas it becomes incandescent, forming calcium chloride and liberating carbon, and it can also be made to burn in oxygen at a dull red heat, leaving behind a residue of calcium carbonate. Under the same conditions it becomes incandescent in the vapour of sulphur, yielding calcium sulphide and carbon disulphide; the vapour of phosphorus will also unite with it at a red heat. Acted upon by water it is at once decomposed, yielding acetylene and calcium hydrate. Pure crystalline calcium carbide yields 5·8 cubic feet of acetylene per pound at ordinary temperatures, but the carbide as sold commercially, being a mixture of the pure crystalline material with the crust which in the electric furnace surrounds the ingot, yields at the best 5 cubic feet of gas per pound under proper conditions of generation. The volume of gas obtained, however, depends very largely upon the form of apparatus used, and while some will give the full volume, other apparatus will only yield, with the same carbide, 3¾ feet. The purity of the carbide entirely depends on the purity of the material used in its manufacture, and before this fact had been fully grasped by manufacturers, and only the purest material obtainable employed, it contained notable quantities of compounds which during its decomposition by water yielded a somewhat high proportion of impurities in the acetylene generated from it. Although at the present time a marvellous improvement has taken place all round in the quality of the carbide produced, the acetylene nearly always contains minute traces of hydrogen, ammonia, sulphuretted hydrogen, phosphuretted hydrogen, silicon hydride, nitrogen and oxygen, and sometimes minute traces of carbon monoxide and dioxide. The formation of hydrogen is caused by small traces of metallic calcium occasionally found free in the carbide, and cases have been known where this was present in such quantities that the evolved gas contained nearly 20 % of hydrogen. This takes place when in the manufacture of the carbide the material is kept too long in contact with the arc, since this overheating causes the dissociation of some of the calcium carbide and the solution of metallic calcium in the remainder. The presence of free hydrogen is nearly always accompanied by silicon hydride formed by the combination of the nascent hydrogen with the silicon in the carbide. The ammonia found in the acetylene is probably partly due to the presence of magnesium nitride in the carbide.

Impurities.

On decomposition by water, ammonia is produced by the action of steam or of nascent hydrogen on the nitride, the quantity formed depending very largely upon the temperature at which the carbide is decomposed. The formation of nitrides and cyanamides by actions of this kind and their easy conversion into ammonia is a useful method for fixing the nitrogen of the atmosphere and rendering it available for manurial purposes. Sulphuretted hydrogen, which is invariably present in commercial acetylene, is formed by the decomposition of aluminium sulphide. A. Mourlot has shown that aluminium sulphide, zinc sulphide and cadmium sulphide are the only sulphur compounds which can resist the heat of the electric furnace without decomposition or volatilization, and of these aluminium sulphide is the only one which is decomposed by water with the evolution of sulphuretted hydrogen. In the early samples of carbide this compound used to be present in considerable quantity, but now rarely more than $\frac{1}{10}$ % is to be found. Phosphuretted hydrogen, one of the most important impurities, which has been blamed for the haze formed by the combustion of acetylene under certain conditions, is produced by the action of water upon traces of calcium phosphide found in carbide. Although at first it was no uncommon thing to find ½ % of phosphuretted hydrogen present in the acetylene, this has now been so reduced by the use of pure materials that the quantity is rarely above 0·15 %, and it is often not one-fifth of that amount.

Generation of acetylene from carbide.

In the generation of acetylene from calcium carbide and water, all that has to be done is to bring these two compounds into contact, when they mutually react upon each other with the formation of lime and acetylene, while, if there be sufficient water present, the lime combines with it to form calcium hydrate.

$$\overset{\text{Calcium carbide.}}{CaC_2} + \overset{\text{Water.}}{H_2O} = \overset{\text{Acetylene.}}{C_2H_2} + \overset{\text{Lime.}}{CaO}$$

$$\overset{\text{Lime.}}{CaO} + \overset{\text{Water.}}{H_2O} = \overset{\text{Calcium hydrate.}}{Ca(HO)_2}$$

The decomposition of the carbide by water may be brought about either by bringing the water slowly into contact with an excess of carbide, or by dropping the carbide into an excess of water, and these two main operations again may be varied by innumerable ingenious devices by which the rapidity of the contact may be modified or even eventually stopped. The result is that although the forms of apparatus utilized for this purpose are all based on the one fundamental principle of bringing about the contact of the carbide with the water which is to enter into double decomposition with it, they have been multiplied in number to a very large extent by the methods employed in order to ensure control in working, and to get away from the dangers and inconveniences which are inseparable from a too rapid generation.

Generators.

In attempting to classify acetylene generators some authorities have divided them into as many as six different classes, but this is hardly necessary, as they may be divided into two main classes—first, those in which water is brought in contact with the carbide, the carbide being in excess during the first portion of the operation; and, second, those in which the carbide is thrown into water, the amount of water present being always in excess. The first class may again be subdivided into generators in which the water rises in contact with the carbide, in which it drips upon the carbide, and in which a vessel full of carbide is lowered into water and again withdrawn as generation becomes excessive. Some of these generators are constructed to make the gas only as fast as it is consumed at the burner, with the object of saving the expense and room which would be involved by a storage-holder. Generators with devices for regulating and stopping at will the action going on are generally termed "automatic." Another set merely aims at developing the gas from the carbide and putting it into a storage-holder with as little loss as possible, and these are termed "non-automatic." The points to be attained in a good generator are:—

1. Low temperature of generation.
2. Complete decomposition of the carbide.
3. Maximum evolution of the gas.
4. Low pressure in every part of the apparatus.
5. Ease in charging and removal of residues.
6. Removal of all air from the apparatus before generation of the gas.

When carbide is acted upon by water considerable heat is evolved; indeed, the action develops about one-twentieth of the heat evolved by the combustion of carbon. As, however, the temperature developed is a function of the time needed to complete the action, the degree of heat attained varies with every form of generator, and while the water in one form may never reach the boiling-point, the carbide in another may become red-hot and give a temperature of over 800° C. Heating in a generator is not only a source of danger, but also lessens the yield of gas and deteriorates its quality. The best forms of generator are either those in which water rises slowly in contact with the carbide, or the second main division in which the carbide falls into excess of water.

Purification.

It is clear that acetylene, if it is to be used on a large scale as a domestic illuminant, must undergo such processes of purification as will render it harmless and innocuous to health and property, and the sooner it is recognized as absolutely essential to purify acetylene before consuming it the sooner will the gas acquire the popularity it deserves. The only one of the impurities which offers any difficulty in removal is the phosphuretted hydrogen. There are three substances which can be relied on more or less to remove this compound, and the gas to be purified may be passed either through acid copper salts, through bleaching powder or through chromic acid. In experiments with these various bodies it is found that they are all of them effective in also ridding the acetylene of the ammonia and sulphuretted hydrogen, provided only that the surface area presented to the gas is sufficiently large. The method of washing the gas with acid solutions of copper has been patented by A. Frank of Charlottenburg, who finds that a concentrated solution of cuprous chloride in an acid, the liquid being made into a paste with kieselgühr, is the most effective. Where the production of acetylene is going on on a small scale this method of purification is undoubtedly the most convenient one, as the acid present absorbs the ammonia, and the copper salt converts the phosphuretted and sulphuretted hydrogen into phosphates and sulphides. The vessel, however, which contains this mixture has to be of earthenware, porcelain or enamelled iron on account of the free acid present; the gas must be washed after purification to remove traces of hydrochloric acid, and care must be taken to prevent the complete neutralization of the acid by the ammonia present in the gas. The second process is one patented by Fritz Ullmann of Geneva, who utilizes chromic acid to oxidize the phosphuretted and sulphuretted hydrogen and absorb the ammonia, and this method of purification has proved the most successful in practice, the chromic acid being absorbed by kieselgühr and the material sold under the name of "Heratol."

The third process owes its inception to G. Lunge, who recommends the use of bleaching powder. Dr P. Wolff has found that when this is used on the large scale there is a risk of the ammonia present in the acetylene forming traces of chloride of nitrogen in the purifying-boxes, and as this is a compound which detonates with considerable local force, it occasionally gives rise to explosions in the purifying apparatus. If, however, the gas be first passed through a scrubber so as to wash out the ammonia this danger is avoided. Dr Wolff employs purifiers in which the gas is washed with water containing calcium chloride, and then passed through bleaching-powder solution or other oxidizing material.

Burners.

When acetylene is burnt from a 000 union jet burner, at all ordinary pressures a smoky flame is obtained, but on the pressure being increased to 4 inches a magnificent flame results, free from smoke, and developing an illuminating value of 240 candles per 5 cubic feet of gas consumed. Slightly higher values have been obtained, but 240 may be taken as the average value under these conditions. When acetylene was first introduced as a commercial illuminant in England, very small union jet nipples were utilized for its consumption, but after burning for a short time these nipples began to carbonize, the flame being distorted, and then smoking occurred with the formation of a heavy deposit of soot. While these troubles were being experienced in England, attempts had been made in America to use acetylene diluted with a certain proportion of air which permitted it to be burnt in ordinary flat flame nipples; but the danger of such admixture being recognized, nipples of the same class as those used in England were employed, and the same troubles ensued. In France, single jets made of glass were first employed, and then P. Résener, H. Luchaire, G. Ragot and others made burners in which two jets of acetylene, coming from two tubes placed some little distance apart, impinged and splayed each other out into a butterfly flame. Soon afterwards, J. S. Billwiller introduced the idea of sucking air into the flame at or just below the burner tip, and at this juncture the Naphey or Dolan burner was introduced in America, the principle employed being to use two small and widely separated jets instead of the two openings of the union jet burner, and to make each a minute bunsen, the acetylene dragging in from the base of the nipple enough air to surround and protect it while burning from contact with the steatite. This class of burner forms a basis on which all the later constructions of burner have been founded, but had the drawback that if the flame was turned low, insufficient air to prevent carbonization of the burner tips was drawn in, owing to the reduced flow of gas. This fault has now been reduced by a cage of steatite round the burner tip, which draws in sufficient air to prevent deposition.

Oxy-acetylene blowpipe.

When acetylene was first introduced on a commercial scale attempts were made to utilize its great heat of combustion by using it in conjunction with oxygen in the oxy-hydrogen blowpipe. It was found, however, that when using acetylene under low pressures, the burner tip became so heated as to cause the decomposition of some of the gas before combustion, the jet being choked up by the carbon which deposited in a very dense form; and as the use of acetylene under pressures greater than one hundred inches of water was prohibited, no advance was made in this direction. The introduction of acetylene dissolved under pressure in acetone contained in cylinders filled with porous material drew attention again to this use of the gas, and by using a special construction of blowpipe an oxy-acetylene flame is produced, which is far hotter than the oxy-hydrogen flame, and at the same time is so reducing in its character that it can be used for the direct autogenous welding of steel and many minor metallurgical processes.

References.—F. H. Leeds and W. A. Butterfield, *Calcium Carbide and Acetylene* (1903); F. Dommer, *L'Acétylène et ses applications* (1896); V. B. Lewes, *Acetylene* (1900); F. Liebetanz, *Calcium-carbid und Acetylen* (1899); G. Pelissier, *L'Éclairage à l'acétylène* (1897); C. de Perrodil, *Le carbure de calcium et l'acétylène* (1897). For a complete list of the various papers and memoirs on Acetylene, see A. Ludwig's *Führer durch die gesammte Calcium-carbid-und-Acetylen-Literatur*, Berlin. (V. B. L.)

ACHAEA, a district on the northern coast of the Peloponnese, stretching from the mountain ranges of Erymanthus and Cyllene on the S. to a narrow strip of fertile land on the N., bordering the Corinthian Gulf, into which the mountain Panachaicus projects. Achaea is bounded on the W. by the territory of Elis, on the E. by that of Sicyon, which, however, was sometimes included in it. The origin of the name has given rise to much speculation; the current theory is that the Achaeans (*q.v.*) were driven back into this region by the Dorian invaders of the Peloponnese. Another Achaea, in the south of Thessaly, called sometimes Achaea Phthiotis, has been supposed to be the cradle of the race. In Roman times the name of the province of Achaea was given to the whole of Greece, except Thessaly, Epirus, and Acarnania. Herodotus (i. 145) mentions the twelve cities of Achaea; these met as a religious confederacy in the temple of Poseidon Heliconius at Helice; for their later history see ACHAEAN LEAGUE. During the middle ages, after the Latin conquest of the Eastern Empire, Achaea was a Latin principality, the first prince being William de Champlitte (d. 1209). It survived, with various dismemberments, until 1430, when the last prince, Centurione Zaccaria, ceded the remnant of it to his son-in-law, Theodorus II., despot of Mistra. In 1460 it was conquered, with the rest of the Morea, by the Turks. In modern times the coast of Achaea is mainly given up to the currant industry; the currants are shipped from Patras, the second town of Greece, and from Aegion (Vostitza).

ACHAEAN LEAGUE, a confederation of the ancient towns of Achaea. Standing isolated on their narrow strips of plain, these towns were always exposed to the raids of pirates issuing from the recesses of the north coast of the Corinthian Gulf. It was no doubt as a protection against such dangers that the earliest league of twelve Achaean cities arose, though we are nowhere explicitly informed of its functions other than the common worship of Zeus Amarius at Aegium and an occasional arbitration between Greek belligerents. Its importance grew in the 4th century, when we find it fighting in the Theban wars (368–362 B.C.), against Philip (338) and Antipater (330). About 288 Antigonus Gonatas dissolved the league, which had furnished a useful base for pretenders against Cassander's regency; but by 280 four towns combined again, and before long the ten surviving cities of Achaea had renewed their federation. Antigonus' preoccupation during the Celtic invasions, Sparta's prostration after the Chremonidean campaigns, the wealth amassed by Achaean adventurers abroad and the subsidies of Egypt, the standing foe of Macedonia, all enhanced the league's importance. Most of all did it profit by the statesmanship of Aratus (*q.v.*), who initiated its expansive policy, until in 228 it comprised Arcadia, Argolis, Corinth and Aegina.

Aratus probably also organized the new federal constitution, the character of which, owing to the scanty and somewhat perplexing nature of our evidence, we can only approximately determine. The league embraced an indefinite number of city-states which maintained their internal independence practically undiminished, and through their several magistrates, assemblies and law-courts exercised all traditional powers of self-government. Only in matters of foreign politics and war was their competence restricted.

The central government, like that of the constituent cities, was of a democratic cast. The chief legislative powers resided in a popular assembly in which every member of the league over thirty years of age could speak and vote. This body met for three days in spring and autumn at Aegium to discuss the league's policy and elect the federal magistrates. Whatever the number of its attendant burgesses, each city counted but one on a division. Extraordinary assemblies could be convoked at any time or place on special emergencies. A council of 120 unpaid delegates, selected from the local councils, served partly as a committee for preparing the assembly's programme, partly as an administrative board which received embassies, arbitrated between contending cities and exercised penal jurisdiction over offenders against the constitution. But perhaps some of these duties concerned the dicastae and gerousia, whose functions are nowhere described. The chief magistracy was the *strategia* (tenable every second year), which combined with an unrestricted command in the field a large measure of civil authority. Besides being authorized to veto motions, the strategus (general) had practically the sole power of introducing measures before the assembly. The ten elective *demiurgi*, who presided over this body, formed a kind of cabinet, and perhaps acted as departmental chiefs. We also hear of an under-strategus, a secretary, a cavalry commander and an admiral. All these higher officers were unpaid. Philopoemen (*q.v.*) transferred the seat of assembly from town to town by rotation, and placed dependent communities on an equal footing with their former suzerains.

The league prescribed uniform laws, standards and coinage; it summoned contingents, imposed taxes and fined or coerced refractory members.

The first federal wars were directed against Macedonia; in 266–263 the league fought in the Chremonidean league, in 243–241 against Antigonus Gonatas and Aetolia, between 239 and 229 with Aetolia against Demetrius. A greater danger arose (227–223) from the attacks of Cleomenes III. (*q.v.*). Owing to Aratus's irresolute generalship, the indolence of the rich burghers and the inadequate provision for levying troops and paying mercenaries, the league lost several battles and much of its territory; but rather than compromise with the Spartan Gracchus the assembly negotiated with Antigonus Doson, who recovered the lost districts but retained Corinth for himself (223–221). Similarly the Achaeans could not check the incursions of Aetolian adventurers in 220–218, and when Philip V. came to the rescue he made them tributary and annexed much of the Peloponnese. Under Philopoemen the league with a reorganized army routed the Aetolians (210) and Spartans (207, 201). After their benevolent neutrality during the Macedonian war the Roman general, T. Quinctius Flamininus, restored all their lost possessions and sanctioned the incorporation of Sparta and Messene (191), thus bringing the entire Peloponnese under Achaean control. The league even sent troops to Pergamum against Antiochus (190). The annexation of Aetolia and Zacynthus was forbidden by Rome. Moreover, Sparta and Messene always remained unwilling members. After Philopoemen's death the aristocrats initiated a strongly philo-Roman policy, declared war against King Perseus and denounced all sympathizers with Macedonia. This agitation induced the Romans to deport 1000 prominent Achaeans, and, failing proof of treason against Rome, to detain them seventeen years. These hostages, when restored in 150, swelled the ranks of the proletariate opposition, whose leaders, to cover their maladministration at home, precipitated a war by attacking Sparta in defiance of Rome. The federal troops were routed in central Greece by Q. Caecilius Metellus Macedonicus, and again near Corinth by L. Mummius Achaicus (146). The Romans now dissolved the league (in effect, if not in name), and took measures to isolate the communities (see POLYBIUS). Augustus instituted an Achaean synod comprising the dependent cities of Peloponnese and central Greece; this body sat at Argos and acted as guardian of Hellenic sentiment.

The chief defect of the league lay in its lack of proper provision for securing efficient armies and regular payment of imposts, and for dealing with disaffected members. Moreover, owing to difficulties of travel, the assembly and magistracies were practically monopolized by the rich, who shaped the federal policy in their own interest. But their rule was mostly judicious, and when at last they lost control the ensuing mob-rule soon ruined the country. On the other hand, it is the glory of the Achaean league to have combined city autonomy with an organized central administration, and in this way to have postponed the entire destruction of Greek liberty for over a century.

CHIEF SOURCES.—Polybius (esp. bks. ii., iv., v., xxiii., xxviii.), who is followed by Livy (bks. xxxii.-xxxv., xxxviii., &c.); Pausanias vii. 9-24; Strabo viii. 384; E. Freeman, *Federal Government*, i. (ed. 1893, London), chs. v.-ix.; M. Dubois, *Les ligues Étolienne et Achéenne* (Paris, 1885); A. Holm, *Greek History*, iv.; G. Hertzberg, *Geschichte Griechenlands unter den Römern*, i. (Leipzig, 1866); L. Warren, *Greek Federal Coinage* (London, 1863); E. Hicks, *Greek Historical Inscriptions* (Oxford, 1892), 169, 187, 198, 201; W. Dittenberger, *Sylloge Inscriptionum Graecarum* (Leipzig, 1898–1901), 236, 282, 316; H. Francotte in *Musée Belge* (1906), pp. 4-20. See also art. ROME, *History*, ii. "The Republic," sect. B(b).

(M. O. B. C.)

ACHAEANS ('Αχαιοί, Lat. *Achivi*), one of the four chief divisions of the ancient Greek peoples, descended, according to legend, from Achaeus, son of Xuthus, son of Hellen. This Hesiodic genealogy connects the Achaeans closely with the Ionians, but historically they approach nearer to the Aeolians. Some even hold that Aeolus is only a form of Achaeus. In the Homeric poems (1000 B.C.) the Achaeans are the master race in Greece; they are represented both in Homer and in all later traditions as having come into Greece about three generations before the Trojan war (1184 B.C.), *i.e.* about 1300 B.C. They found the land occupied by a people known by the ancients as Pelasgians, who continued down to classical times the main element in the population even in the states under Achaean and later under Dorian rule. In some cases it formed a serf class, *e.g.* the Penestae in Thessaly, the Helots in Laconia and the Gymnesii at Argos, whilst it practically composed the whole population of Arcadia and Attica, which never came under either Achaean or Dorian rule. This people had dwelt in the Aegean from the Stone Age, and, though still in the Bronze Age at the Achaean conquest, had made great advances in the useful and ornamental arts. They were of short stature, with dark hair and eyes, and generally dolichocephalic. Their chief centres were at Cnossus (Crete), in Argolis, Laconia and Attica, in each being ruled by ancient lines of kings. In Argolis Proetus built Tiryns, but later, under Perseus, Mycenae took the lead until the Achaean conquest. All the ancient dynasties traced their descent from Poseidon, who at the time of the Achaean conquest was the chief male divinity of Greece and the islands. The Pelasgians probably spoke an Indo-European language adopted by their conquerors with slight modifications. (See further PELASGIANS for a discussion of other views.)

The Achaeans, on the other hand, were tall, fair-haired and grey-eyed, and their chiefs traced their descent from Zeus, who with the Hyperborean Apollo was their chief male divinity. They first appear at Dodona, whence they crossed Pindus into Phthiotis. The leaders of the Achaean invasion were Pelops, who took possession of Elis, and Aeacus, who became master of Aegina and was said to have introduced there the worship of Zeus Panhellenius, whose cult was also set up at Olympia. They brought with them iron, which they used for their long swords and for their cutting implements; the costume of both sexes was distinct from that of the Pelasgians; they used round shields with a central boss instead of the 8-shaped or rectangular shields of the latter; they fastened their garments with brooches, and burned their dead instead of burying them as did the Pelasgians. They introduced a special style of ornament ("geometric") instead of that of the Bronze Age, characterized by spirals and marine animals and plants. The Achaeans, or Hellenes, as they were later termed, were on this hypothesis one of the fair-haired tribes of upper Europe known to the ancients as *Keltoi* (Celts), who from time to time have pressed down over the Alps into the southern lands, successively as Achaeans, Gauls, Goths and Franks, and after the conquest of the indigenous small dark race in no long time died out under climatic conditions fatal to their physique and morale. The culture of the Homeric Achaeans corresponds to a large extent with that of the early Iron Age of the upper Danube (*Hallstatt*) and to the early Iron Age of upper Italy (*Villanova*).

See W. Ridgeway, *The Early Age of Greece* (1901), for a detailed discussion of the evidence; articles by Ridgeway and J. L. Myres in the *Classical Review*, vol. xvi., 1902, pp. 68-93, 135. See also J. B. Bury's *History of Greece* (1902), and art. in *Journal of Hellenic Studies*, xv., 1895, pp. 217 foll.; G. G. A. Murray, *Rise of the Greek Epic* (1907), chap. ii.; Andrew Lang, *Homer and his Age* (1906); G. Busolt, *Griech. Gesch.* ed. 2, vol. i. p. 190 (1893); D. B. Monro's ed. of the *Iliad* (1901), pp. 484-488. (W. RI.)

ACHAEMENES (HAKHĀMANI), the eponymous ancestor of the royal house of Persia, the Achaemenidae, "a clan φρήτρη of the Pasargadae" (Herod. i. 125), the leading Persian tribe. According to Darius in the Behistun inscription and Herod. iii. 75, vii. 11, he was the father of Teïspes, the great-grandfather of Cyrus. Cyrus himself, in his proclamation to the Babylonians after the conquest of Babylon, does not mention his name. Whether he really was a historical personage, or merely the mythical ancestor of the family, cannot be decided. According to Aelian (*Hist. anim.* xii. 21), he was bred by an eagle. We learn from Cyrus's proclamation that Teïspes and his successors had become kings of Anshan, *i.e.* a part of Elam (Susiana), where they ruled as vassals of the Median kings, until Cyrus the Great in 550 B.C. founded the Persian empire. After the death of Cambyses, the younger line of the Achaemenidae came to the throne with Darius, the son of Hystaspes, who was, like Cyrus, the great-grandson of Teïspes. Cyrus, Darius and all the later kings of Persia call themselves Achaemenides (*Hakhāmanishiya*). With Darius III. *Codomannus* the dynasty became extinct and the Persian empire came to an end (330). The adjective *Achaemenius* is used by the Latin poets as the equivalent of "Persian" (Horace, *Odes*, ii. 12, 21). See PERSIA.

The name Achaemenes is borne by a son of Darius I., brother of Xerxes. After the first rebellion of Egypt, he became satrap of Egypt (484 B.C.); he commanded the Persian fleet at Salamis, and was (460 B.C.) defeated and slain by Inarus, the leader of the second rebellion of Egypt.

ACHARD, FRANZ CARL (1753–1821), Prussian chemist, was born at Berlin on the 28th of April 1753, and died at Kunern, in Silesia, on the 20th of April 1821. He was a pioneer in turning to practical account A. S. Marggraf's discovery of the presence of sugar in beetroot, and by the end of the 18th century he was producing considerable quantities of beet-sugar, though by a very imperfect process, at Kunern, on an estate which was granted him about 1800 by the king of Prussia. There too he carried on a school of instruction in sugar-manufacture, which had an international reputation. For a time he was director of the physics class of the Berlin Academy of Sciences, and he published several volumes of chemical and physical researches, discovering among other things a method of working platinum.

ACHARIUS, ERIK (1757–1819), Swedish botanist, was born on the 10th of October 1757, and in 1773 entered Upsala University, where he was a pupil of Linnaeus. He graduated M.D. at Lund in 1782, and in 1801 was appointed professor of botany at Wadstena Academy. He devoted himself to the study of lichens, and all his publications were connected with that class of plants, his *Lichenographia Universalis* (Göttingen, 1804) being the most important. He died at Wadstena on the 13th of August 1819.

ACHATES, the companion of Aeneas in Virgil's *Aeneid*. The expression "fidus Achates" has become proverbial for a loyal and devoted companion.

ACHELOUS (mod. *Aspropotamo*, "white river"), the largest river in Greece (130 m.). It rises in Mt. Pindus, and, dividing Aetolia from Acarnania, falls into the Ionian Sea. In the lower part of its course the river winds through fertile, marshy plains. Its water is charged with fine mud, which is deposited along its banks and at its mouth, where a number of small islands (Echinades) have been formed. It was formerly called Thoas, from its impetuosity; and its upper portion was called by some Inachus, the name Achelous being restricted to the shorter eastern branch. Achelous is coupled with Ocean by Homer (*Il.* xxi. 193) as chief of rivers, and the name is given to several other rivers in Greece. The name appears in cult and in mythology as that of the typical river-god; a familiar legend is that of his contest with Heracles for Deianira.

ACHENBACH, ANDREAS (1815–), German landscape painter, was born at Cassel in 1815. He began his art education in 1827 in Düsseldorf under W. Schadow and at the academy. In his early work he followed the pseudo-idealism of the German romantic school, but on removing to Munich in 1835, the stronger influence of L. Gurlitt turned his talent into new channels, and he became the founder of the German realistic school. Although his landscapes evince too much of his aim at picture-making and lack personal temperament, he is a master of technique, and is historically important as a reformer. A number of his finest works are to be found at the Berlin National Gallery, the New Pinakothek in Munich, and the galleries at Dresden, Darmstadt, Cologne, Düsseldorf, Leipzig and Hamburg.

His brother, OSWALD ACHENBACH (1827–1905), was born at Düsseldorf and received his art education from Andreas. His landscapes generally dwell on the rich and glowing effects of colour which drew him to the Bay of Naples and the neighbourhood of Rome. He is represented at most of the important German galleries of modern art.

ACHENWALL, GOTTFRIED (1719–1772), German statistician, was born at Elbing, in East Prussia, in October 1719. He studied at Jena, Halle and Leipzig, and took a degree at the last-named university. He removed to Marburg in 1746, where for two years he read lectures on history and on the law of nature and of nations. Here, too, he commenced those inquiries in statistics by which his name became known. In 1748 he was given a professorship at Göttingen, where he resided till his death in 1772. His chief works were connected with statistics. The *Staatsverfassung der heutigen vornehmsten europäischen Reiche* appeared first in 1749, and revised editions were published in 1762 and 1768.

ACHERON, in Greek mythology, the son of Gaea or Demeter. As a punishment for supplying the Titans with water in their contest with Zeus, he was turned into a river of Hades, over which departed souls were ferried by Charon. The name (meaning the river of "woe") was eventually used to designate the whole of the lower world (Stobaeus, *Ecl. Phys.* i. 41, §§ 50, 54).

ACHIACHARUS, a name occurring in the book of Tobit (i. 21 f.) as that of a nephew of Tobit and an official at the court of Esarhaddon at Nineveh. There are references in Rumanian, Slavonic, Armenian, Arabic and Syriac literature to a legend, of which the hero is Aḥiḳar (for Armenian, Arabic and Syriac, see *The Story of Aḥiḳar*, F. C. Conybeare, Rendel Harris and Agnes Lewis, Camb. 1898), and it was pointed out by George Hoffmann in 1880 that this Aḥiḳar and the Achiacharus of Tobit are identical. It has been contended that there are traces of the legend even in the New Testament, and there is a striking similarity between it and the *Life of Aesop* by Maximus Planudes (ch. xxiii.-xxxii.). An eastern sage Achaïcarus is mentioned by Strabo. It would seem, therefore, that the legend was undoubtedly oriental in origin, though the relationship of the various versions can scarcely be recovered.

See the *Jewish Encyclopaedia* and the *Encyclopaedia Biblica*; also M. R. James in *The Guardian*, Feb. 2, 1898, p. 163 f.

ACHILL ("Eagle"), the largest island off Ireland, separated from the Curraun peninsula of the west coast by the narrow Achill Sound. Pop. (1901) 4929. It is included in the county Mayo, in the western parliamentary division. Its shape is triangular, and its extent is 15 m. from E. to W. and 12 from N. to S. The area is 57 sq. m. The island is mountainous, the highest points being Slieve Croaghaun (2192 ft.) in the west, and Slievemore (2204 ft.) in the north; the extreme western point is the bold and rugged promontory of Achill Head, and the north-western and south-western coasts consist of ranges of magnificent cliffs, reaching a height of 800 ft. in the cliffs of Minaun, near the village of Keel on the south. The seaward slope of Croaghaun is abrupt and in parts precipitous, and its jagged flanks, together with the serrated ridge of the Head and the view over the broken coast-line and islands of the counties Mayo and Galway, attract many visitors to the island during summer. Desolate bogs, incapable of cultivation, alternate with the mountains; and the inhabitants earn a scanty subsistence by fishing and tillage, or by seeking employment in England and Scotland during the harvesting. The Congested Districts Board, however, have made efforts to improve the condition of the people, and a branch of the Midland Great Western railway to Achill Sound, together with a swivel bridge across the sound, improved communications and make for prosperity. Dugort, the principal village, contains several hotels. Here is a Protestant colony, known as "the Settlement" and founded in 1834. There are antiquarian remains (cromlechs, stone circles and the like) at Slievemore and elsewhere.

ACHILLES (Gr. Ἀχιλλεύς), one of the most famous of the legendary heroes of ancient Greece and the central figure of Homer's *Iliad*. He was said to have been the son of Peleus, king of the Myrmidones of Phthia in Thessaly, by Thetis, one of the Nereïds. His grandfather Aeacus was, according to the legend, the son of Zeus himself. The story of the childhood of Achilles in Homer differs from that given by later writers. According to Homer, he was brought up by his mother at Phthia with his cousin and intimate friend Patroclus, and learned the arts of war and eloquence from Phoenix, while the Centaur Chiron taught him music and medicine. When summoned to the war against Troy, he set sail at once with his Myrmidones in fifty ships.

Post-Homeric sources add to the legend certain picturesque details which bear all the evidence of their primitive origin, and which in some cases belong to the common stock of Indo-Germanic myths. According to one of these stories Thetis used to lay the infant Achilles every night under live coals, anointing him by day with ambrosia, in order to make him immortal. Peleus, having surprised her in the act, in alarm snatched the boy from the flames; whereupon Thetis fled back to the sea in anger (Apollodorus iii. 13; Apollonius Rhodius iv. 869). According to another story Thetis dipped the child in the waters of the river Styx, by which his whole body became invulnerable, except that part of his heel by which she held him; whence the proverbial "heel of Achilles" (Statius, *Achilleis*, i. 269). With this may be compared the similar story told of the northern hero Sigurd. The boy was afterwards entrusted to the care of Chiron, who, to give him the strength necessary for war, fed him with the entrails of lions and the marrow of bears and wild boars. To prevent his going to the siege of Troy, Thetis disguised him in female apparel, and hid him among the maidens at the court of King Lycomedes in Scyros; but Odysseus, coming to the island in the disguise of a pedlar, spread his wares, including a spear and shield, before the king's daughters, among whom was Achilles. Then he caused an alarm to be sounded; whereupon the girls fled, but Achilles seized the arms, and so revealed himself, and was easily persuaded to follow the Greeks (Hyginus, *Fab.* 96; Statius, *Ach.* i.; Apollodorus, *l.c.*). This story may be compared with the Celtic legend of the boyhood of Peredur or Perceval.

During the first nine years of the war as described in the *Iliad*, Achilles ravaged the country round Troy, and took twelve cities. In the tenth year occurred the quarrel with Agamemnon. In order to appease the wrath of Apollo, who had visited the camp with a pestilence, Agamemnon had restored Chryseïs, his prize of war, to her father, a priest of the god, but as a compensation deprived Achilles, who had openly demanded this restoration, of his favourite slave Briseïs. Achilles withdrew in wrath to his tent, where he consoled himself with music and singing, and refused to take any further part in the war. During his absence the Greeks were hard pressed, and at last he so far relaxed his anger as to allow his friend Patroclus to personate him, lending him his chariot and armour. The slaying of Patroclus by the Trojan hero Hector roused Achilles from his indifference; eager to avenge his beloved comrade, he sallied forth, equipped with new armour fashioned by Hephaestus, slew Hector, and, after dragging his body round the walls of Troy, restored it to the aged King Priam at his earnest entreaty. The *Iliad* concludes with the funeral rites of Hector. It makes no mention of the death of Achilles, but hints at its taking place "before the Scaean gates." In the *Odyssey* (xxiv. 36. 72) his ashes are said to have been buried in a golden urn, together with those of Patroclus, at a place on the Hellespont, where a tomb was erected to his memory; his soul dwells in the lower world, where it is seen by Odysseus. The contest between Ajax and Odysseus for his arms is also mentioned. The *Aethiopis* of Arctinus of Miletus took up the story of the *Iliad*. It told how Achilles, having slain the Amazon Penthesileia and Memnon, king of the Aethiopians, who had come to the assistance of the Trojans, was himself slain by Paris (Alexander), whose arrow was guided by Apollo to his vulnerable heel (Virgil, *Aen.* vi. 57; Ovid, *Met.* xii. 600). Again, it is said that Achilles, enamoured of Polyxena, the daughter of Priam, offered to join the Trojans on condition that he received her hand in marriage. This was agreed to; Achilles went unarmed to the temple of Apollo Thymbraeus, and was slain by Paris (Dictys iv. 11). According to some, he was slain by Apollo himself (Quint. Smyrn. iii. 61; Horace, *Odes*, iv. 6, 3). Hyginus (*Fab.* 107) makes Apollo assume the form of Paris.

Later stories say that Thetis snatched his body from the pyre and conveyed it to the island of Leuke, at the mouth of the Danube, where he ruled with Iphigeneia as his wife; or that he was carried to the Elysian fields, where his wife was Medea or Helen. He was worshipped in many places: at Leuke, where he was honoured with offerings and games; in Sparta, Elis, and especially Sigeum on the Hellespont, where his famous tumulus was erected.

Achilles is a typical Greek hero; handsome, brave, celebrated for his fleetness of foot, prone to excess of wrath and grief, at the same time he is compassionate, hospitable, full of affection for his mother and respect for the gods. In works of art he is represented, like Ares, as a young man of splendid physical proportions, with bristling hair like a horse's mane and a slender neck. Although the figure of the hero frequently occurs in groups—such as the work of Scopas showing his removal to the island of Leuke by Poseidon and Thetis, escorted by Nereids and Tritons, and the combat over his dead body in the Aeginetan sculptures—no isolated statue or bust can with certainty be identified with him; the statue in the Louvre (from the Villa Borghese), which was thought to have the best claim, is generally taken for Ares or possibly Alexander. There are many vase and wall paintings and bas-reliefs illustrative of incidents in his life. Various etymologies of the name have been suggested: "without a lip" (ἀ, χεῖλος), Achilles being regarded as a river-god, a stream which overflows its banks, or, referring to the story that, when Thetis laid him in the fire, one of his lips, which he had licked, was consumed (Tzetzes on Lycophron, 178); "restrainer of the people" (ἐχέ-λαος); "healer of sorrow" (ἀχε-λώιος); "the obscure" (connected with ἀχλύς, "mist"); "snake-born" (ἔχις), the snake being one of the chief forms taken by Thetis. The most generally received view makes him a god of light, especially of the sun or of the lightning.

See E. H. Meyer, *Indogermanische Mythen, ii., Achilleis*, 1887; F. G. Welcker, *Der epische Cyclus*, 1865–1882; articles in Pauly-Wissowa, *Real-Encyclopädie der classischen Altertumswissenschaft*, Daremberg and Saglio's *Dictionnaire des Antiquités* and Roscher's *Lexikon der Mythologie*; see also T. W. Allen in *Classical Review*, May 1906; A. E. Crawley, J. G. Frazer, A. Lang, *Ibid.*, June, July 1893, on Achilles in Scyros. In the article GREEK ART, fig. 12 represents the conflict over the dead body of Achilles.

ACHILLES TATIUS, of Alexandria, Greek rhetorician, author of the erotic romance, the *Adventures of Leucippe and Cleitophon*, flourished about A.D. 450, perhaps later. Suidas, who alone calls him Statius, says that he became a Christian and eventually a bishop—like Heliodorus, whom he imitated—but there is no evidence of this. Photius, while severely criticizing his lapses into indecency, highly praises the conciseness and clearness of his style, which, however, is artificial and laboured. Many of the incidents of the romance are highly improbable, and the characters, except the heroine, fail to enlist sympathy. The descriptive passages and digressions, although tedious and introduced without adequate reasons, are the best part of the work. The large number of existing MSS. attests its popularity. (*Editio princeps*, 1601; first important critical edition by Jacobs, 1821; later editions by Hirschig, 1856; Hercher, 1858. There are translations in many languages; in English by Anthony H[odges], 1638, and R. Smith, 1855. See also ROMANCE.)

Suidas also ascribes to this author an *Etymology*, a *Miscellaneous History of Famous Men*, and a treatise *On the Sphere*. Part of the last is extant under the title of *An Introduction to the Phaenomena of Aratus*. But if the writer is the *prudentissimus Achilles* referred to by Firmicus Maternus (about 336) in his *Matheseos libri*, iv. 10, 17 (ed. Kroll), he must have lived long before the author of *Leucippe*. The fragment was first published in 1567, then in the *Uranologion* of Petavius, with a Latin translation, 1630. Nothing definite is known as to the authorship of the other works, which are lost.

ACHILLINI, ALESSANDRO (1463–1512), Italian philosopher, born on the 29th of October 1463 at Bologna, was celebrated as a lecturer both in medicine and in philosophy at Bologna and Padua, and was styled the second Aristotle. His philosophical works were printed in one volume folio, at Venice, in 1508, and reprinted with considerable additions in 1545, 1551 and 1568. He was also distinguished as an anatomist (see ANATOMY), among his writings being *Corporis humani Anatomia* (Venice, 1516–1524), and *Anatomicae Annotationes* (Bologna, 1520). He died at Bologna on the 2nd of August 1512.

His brother, GIOVANNI FILOTEO ACHILLINI (1466–1533), was the author of *Il Viridario* and other writings, verse and prose, and his grand-nephew, CLAUDIO ACHILLINI (1574–1640), was a lawyer who achieved some notoriety as a versifier of the school of the Secentisti.

ACHIMENES (perhaps from the Gr. ἀχαιμενίς, an Indian plant used in magic), a genus of plants, natural order *Gesneraceae* (to which belong also Gloxinia and Streptocarpus), natives of tropical America, and well known in cultivation as stove or warm greenhouse plants. They are herbaceous perennials, generally with hairy serrated leaves and handsome flowers. The corolla is tubular with a spreading limb, and varies widely in colour, being white, yellow, orange, crimson, scarlet, blue or purple. A large number of hybrids exist in cultivation. The plants are grown in the stove till the flowering period, when they may be removed to the greenhouse. They are propagated by cuttings, or from the leaves, which are cut off and pricked in well-drained pots of sandy soil, or by the scales from the underground tubes, which are rubbed off and sown like seeds, or by the seeds, which are very small.

ACHIN (Dutch *Atjeh*), a Dutch government forming the northern extremity of the island of Sumatra, having an estimated area of 20,544 sq. m. The government is divided into three assistant-residencies—the east coast, the west coast and Great Achin. The physical geography (see SUMATRA) is imperfectly understood. Ranges of mountains, roughly parallel to the long axis of the island, and characteristic of the whole of it, appear to occupy the interior, and reach an extreme height of about 12,000 ft. in the south-west of the government. The coasts are low and the rivers insignificant, rising in the coast ranges and flowing through the coast states (the chief of which are Pedir, Gighen and Samalanga on the N.; Edi, Perlak and Langsar on the E.; Kluwah, Rigas and Melabuh on the W.). The chief ports are Olehleh, the port of Kotaraja or Achin (formerly Kraton, now the seat of the Dutch government), Segli on the N., Edi on the E., and Analabu or Melabuh on the W. Kotaraja lies near the northern extremity of the island, and consists of detached houses of timber and thatch, clustered in enclosed groups called *kampongs*, and buried in a forest of fruit-trees. It is situated nearly 3 m. from the sea, in the valley of the Achin river, which in its upper part, near Selimun, is 3 m. broad, the river having a breadth of 99 ft. and a depth of 1½ ft.; but in its lower course, north of its junction with the Krung Daru, the valley broadens to 12½ m. The marshy soil is covered by rice-fields, and on higher ground by *kampongs* full of trees. The river at its mouth is 327 ft. broad and 20–33 ft. deep, but before it lies a sandbank covered at low water by a depth of only 4 ft. The Dutch garrison in Kotaraja occupies the old Achinese citadel. The town is connected by rail with Olehleh, and the line also extends up the valley. The construction of another railway has been undertaken along the east coast. The following industries are of some importance—gold-working, weapon-making, silk-weaving, the making of pottery, fishing and coasting trade. The annual value of the exports (chiefly pepper) is about £58,000; of the imports, from £165,000 to £250,000. The population of Achin in 1898 was estimated at 535,432, of whom 328 were Europeans, 3933 Chinese, 30 Arabs, and 372 other foreign Asiatics.

The Achinese, a people of Malayan stock but darker, somewhat taller and not so pleasant-featured as the true Malays, regard themselves as distinct from the other Sumatrans. Their nobles claim Arab descent. They were at one time Hinduized, as is evident from their traditions, the many Sanskrit words in their language, and their general appearance, which suggests Hindu as well as Arab blood. They are Mahommedans, and although Arab influence has declined, their nobles still wear the Moslem flowing robe and turban (though the women go unveiled), and they use Arabic script. The chief characteristic is their love of fighting; every man is a soldier and every village has its army. They are industrious and skilful agriculturists, metal-workers and weavers. They build excellent ships. Their chief amusements are gambling and opium-smoking. Their social organization is communal. They live in *kampongs*, which combine to form *mukims*, districts or hundreds (to use the nearest English term), which again combine to form *sagis*, of which there are three. Achin literature, unlike the language, is entirely Malay; it includes poetry, a good deal of theology and several chronicles. Northern Sumatra was visited by several European travellers in the middle ages, such as Marco Polo, Friar Odorico and Nicolo Conti. Some of these as well as Asiatic writers mention Lambri, a state which must have nearly occupied the position of Achin. But the first voyager to visit Achin, by that name, was Alvaro Tellez, a captain of Tristan d'Acunha's fleet, in 1506. It was then a mere dependency of the adjoining state of Pedir; and the latter, with Pasei, formed the only states on the coast whose chiefs claimed the title of sultan. Yet before twenty years had passed Achin had not only gained independence, but had swallowed up all other states of northern Sumatra. It attained its climax of power in the time of Sultan Iskandar Muda (1607–1636), under whom the subject coast extended from Aru opposite Malacca round by the north to Benkulen on the west coast, a sea-board of not less than 1100 miles; and besides this, the king's supremacy was owned by the large island of Nias, and by the continental Malay states of Johor, Pahang, Kedah and Perak.

The chief attraction of Achin to traders in the 17th century must have been gold. No place in the East, unless Japan, was so abundantly supplied with gold. The great repute of Achin as a place of trade is shown by the fact that to this port the first Dutch (1599) and first English (1602) commercial ventures to the Indies were directed. Sir James Lancaster, the English commodore, carried letters from Queen Elizabeth to the king of Achin, and was well received by the prince then reigning, Alauddin Shah. Another exchange of letters took place between King James I. and Iskandar Muda in 1613. But native caprice and jealousy of the growing force of the European nations in these seas, and the rivalries between those nations themselves, were destructive of sound trade; and the English factory, though several times set up, was never long maintained. The French made one great effort (1621) to establish relations with Achin, but nothing came of it. Still the foreign trade of Achin, though subject to interruptions, was important. William Dampier (*c.* 1688) and others speak of the number of foreign merchants settled there—English, Dutch, Danes, Portuguese, Chinese, &c. Dampier says the anchorage was rarely without ten or fifteen sail of different nations, bringing vast quantities of rice, as well as silks, chintzes, muslins and opium. Besides the Chinese merchants settled at Achin, others used to come annually with the junks, ten or twelve in number, which arrived in June. A regular fair was then established, which lasted two months, and was known as the China camp, a great resort of foreigners.

Hostilities with the Portuguese began from the time of the first independent king of Achin; and they had little remission till the power of Portugal fell with the loss of Malacca (1641). Not less than ten times before that event were armaments despatched from Achin to reduce Malacca, and more than once its garrison was hard pressed. One of these armadas, equipped by Iskandar Muda in 1615, gives an idea of the king's resources. It consisted of 500 sail, of which 250 were galleys, and among these a hundred were greater than any then used in Europe. Sixty thousand men were embarked.

On the death of Iskandar's successor in 1641, the widow was placed on the throne; and as a female reign favoured the oligarchical tendencies of the Malay chiefs, three more queens were allowed to reign successively. In 1699 the Arab or fanatical party suppressed female government, and put a chief of Arab blood on the throne. The remaining history of Achin was one of rapid decay.

After the restoration of Java to the Netherlands in 1816, a good deal of weight was attached by the neighbouring British colonies to the maintenance of influence in Achin; and in 1819 a treaty of friendship was concluded with the Calcutta government which excluded other European nationalities from fixed residence in Achin. When the British government, in 1824, made a treaty with the Netherlands, surrendering the remaining British settlements in Sumatra in exchange for certain possessions on the continent of Asia, no reference was made in the articles to the Indian treaty of 1819; but an understanding was exchanged that it should be modified, while no proceedings hostile to Achin should be attempted by the Dutch.

This reservation was formally abandoned by the British government in a convention signed at the Hague on the 2nd of November 1871; and in March 1873 the government of Batavia declared war upon Achin. Doubtless there was provocation, for the sultan of Achin had not kept to the understanding that he was to guarantee immunity from piracy to foreign traders; but the necessity for war was greatly doubted, even in Holland. A Dutch force landed at Achin in April 1873, and attacked the palace. It was defeated with considerable loss, including that of the general (Köhler). The approach of the south-west monsoon precluded the immediate renewal of the attempt; but hostilities were resumed, and Achin fell in January 1874. The natives, however, maintained themselves in the interior, inaccessible to the Dutch troops, and carried on a guerilla warfare. General van der Heyden appeared to have subdued them in 1878–81, but they broke out again in 1896 under the traitor Taku Umar, who had been in alliance with the Dutch. He died shortly afterwards, but the trouble was not ended. General van Hentsz carried on a successful campaign in 1898 seq., but in 1901, the principal Achinese chiefs on the north coast having surrendered, the pretender-sultan fled to the Gajoes, a neighbouring inland people. Several expeditions involving heavy fighting were necessary against these in 1901–4, and a certain amount of success was achieved, but the pretender escaped, revolt still smouldered and hostilities were continued.

See P. J. Veth, *Atchin en sijne betrekkingen tot Nederland* (Leyden, 1873); J. A. Kruijt, *Atjeh en de Atjehers* (Leyden, 1877); Kielstra, *Beschrijving van den Atjeh-oorlog* (The Hague, 1885); Van Langen, *Atjeh's Wesskust, Tijdschrift Aardrijko, Genotktsch.* (Amsterdam, 1888), p. 226; Renaud, *Jaarboek van het Mynwesen* (1882); J. Jacobs, *Het famille-en Kamponglevven op Groot Atjeh* (Leyden, 1894); C. Snouck Hurgronje, *De Atjehers* (Batavia, 1894).

ACHOLI, a negro people of the upper Nile valley, dwelling on the east bank of the Bahr-el-Jebel, about a hundred miles north of Albert Nyanza. They are akin to the Shilluks of the White Nile. They frequently decorate the temples or checks with wavy or zigzag scars, and also the thighs with scrolls; some pierce the ears. Their dwelling-places are circular huts with a high peak, furnished with a mud sleeping-platform, jars of grain and a sunk fireplace. The interior walls are daubed with mud and decorated with geometrical or conventional designs in red, white or grey. The Acholi are good hunters, using nets and spears, and keep goats, sheep and cattle. In war they use spears and long, narrow shields of giraffe or ox hide. Their dialect is closely allied to those of the Alur, Lango and Ja-Luo tribes, all four being practically pure Nilotic. Their religion is a vague fetishism. By early explorers the Acholi were called Shuli, a name now obsolete.

ACHROMATISM (Gr. α-, privative, χρῶμα, colour), in optics, the property of transmitting white light, without decomposing it into the colours of the spectrum; "achromatic lenses" are lenses which possess this property. (See LENS, ABERRATION and PHOTOGRAPHY.)

ACID (from the Lat. root *ac-*, sharp; *acere*, to be sour), the name loosely applied to any sour substance; in chemistry it has a more precise meaning, denoting a substance containing hydrogen which may be replaced by metals with the formation of salts. An acid may therefore be regarded as a salt of hydrogen. Of the general characters of acids we may here notice that they dissolve alkaline substances, certain metals, &c., neutralize alkalies and redden many blue and violet vegetable colouring matters.

The ancients probably possessed little knowledge indeed of acids. Vinegar (or impure acetic acid), which is produced when wine is allowed to stand, was known to both the Greeks and Romans, who considered it to be typical of acid substances; this is philologically illustrated by the words ὀξύς, *acidus*, sour, and ὄξος, *acetus*, vinegar. Other acids became known during the alchemistic period; and the first attempt at a generalized conception of these substances was made by Paracelsus, who supposed them to contain a principle which conferred the properties of sourness and solubility. Somewhat similar views were promoted by Becher, who named the principle *acidum primogenium*, and held that it was composed of the Paracelsian elements "earth" and "water." At about the same time Boyle investigated several acids; he established their general reddening of litmus, their solvent power of metals and basic substances, and the production of neutral bodies, or salts, with alkalies. Theoretical conceptions were revived by Stahl, who held that acids were the fundamentals of all salts, and the erroneous idea that sulphuric acid was the principle of all acids.

The phlogistic theory of the processes of calcination and combustion necessitated the view that many acids, such as those produced by combustion, *e.g.* sulphurous, phosphoric, carbonic, &c., should be regarded as elementary substances. This principle more or less prevailed until it was overthrown by Lavoisier's doctrine that oxygen was the acid-producing element; Lavoisier being led to this conclusion by the almost general observation that acids were produced when non-metallic elements were burnt. The existence of acids not containing oxygen was, in itself, sufficient to overthrow this idea, but, although Berthollet had shown, in 1789, that sulphuretted hydrogen (or hydrosulphuric acid) contained no oxygen, Lavoisier's theory held its own until the researches of Davy, Gay-Lussac and Thénard on hydrochloric acid and chlorine, and of Gay-Lussac on hydrocyanic acid, established beyond all cavil that oxygen was not essential to acidic properties.

In the Lavoisierian nomenclature acids were regarded as binary oxygenated compounds, the associated water being relegated to the position of a mere solvent. Somewhat similar views were held by Berzelius, when developing his dualistic conception of the composition of substances. In later years Berzelius renounced the "oxygen acid" theory, but not before Davy, and, almost simultaneously, Dulong, had submitted that hydrogen and not oxygen was the acidifying principle. Opposition to the "hydrogen-acid" theory centred mainly about the hypothetical radicals which it postulated; moreover, the electrochemical theory of Berzelius exerted a stultifying influence on the correct views of Davy and Dulong. In Berzelius' system potassium sulphate is to be regarded as $\overset{+}{K_2O}.\overset{-}{SO_3}$; electrolysis should simply effect the disruption of the positive and negative components, potash passing with the current, and sulphuric acid against the current. Experiment showed, however, that instead of only potash appearing at the negative electrode, hydrogen is also liberated; this is inexplicable by Berzelius's theory, but readily explained by the "hydrogen-acid" theory. By this theory potassium is liberated at the negative electrode and combines immediately with water to form potash and hydrogen.

Further and stronger support was given when J. Liebig promoted his doctrine of polybasic acids. Dalton's idea that elements preferentially combined in equiatomic proportions had as an immediate inference that metallic oxides contained one atom of the metal to one atom of oxygen, and a simple expansion of this conception was that one atom of oxide combined with one atom of acid to form one atom of a neutral salt. This view, which was specially supported by Gay-Lussac and Leopold Gmelin and accepted by Berzelius, necessitated that all acids were monobasic. The untenability of this theory was proved by Thomas Graham's investigation of the phosphoric acids; for he then showed that the ortho- (ordinary), pyro- and metaphosphoric acids contained respectively 3, 2 and 1 molecules of "basic water" (which were replaceable by metallic oxides) and one molecule of phosphoric oxide, P_2O_5. Graham's work was developed by Liebig, who called into service many organic acids—citric, tartaric, cyanuric, comenic and meconic—and showed that these resembled phosphoric acid; and he established as the criterion of polybasicity the existence of compound salts with different metallic oxides. In formulating these facts Liebig at first retained the dualistic conception of the structure of acids; but he shortly afterwards perceived that this view lacked generality since the halogen acids, which contained no oxygen but yet formed salts exactly similar in properties to those containing oxygen, could not be so regarded. This and other reasons led to his rejection of the dualistic hypothesis and the adoption, on the ground of probability, and much more from convenience, of the tenet that "acids are particular compounds of hydrogen, in which the latter can be replaced by metals"; while, on the constitution of salts, he held that "neutral salts are those compounds of the same class in which the hydrogen is replaced by its equivalent in metal. The substances which we at present term anhydrous acids (acid oxides) only become, for the most part, capable of forming salts with metallic oxides after the addition of water, or they are compounds which decompose these oxides at somewhat high temperatures."

The hydrogen theory and the doctrine of polybasicity as enunciated by Liebig is the fundamental characteristic of the modern theory. A polybasic acid contains more than one atom of hydrogen which is replaceable by metals; moreover, in such an acid the replacement may be entire with the formation of normal salts, partial with the formation of acid salts, or by two or more different metals with the formation of compound salts (see SALTS). These facts may be illustrated with the aid of orthophosphoric acid, which is tribasic:—

Acid.	Normal salt.	Acid salts.
H_3PO_4.	Ag_3PO_4.	Na_2HPO_4; NaH_2PO_4.
Phosphoric acid.	Silver phosphate.	Acid sodium phosphates.

Compound salts.

$Mg(NH_4)PO_4$;	$Na(NH_4)HPO_4$.
Magnesium ammonium phosphate;	Microcosmic salt.

Reference should be made to the articles CHEMICAL ACTION, THERMOCHEMISTRY and SOLUTIONS, for the theory of the strength or avidity of acids.

Organic Acids.—Organic acids are characterized by the presence of the monovalent group $-CO·OH$, termed the carboxyl group, in which the hydrogen atom is replaceable by metals with the formation of salts, and by alkyl radicals with the formation of esters. The basicity of an organic acid, as above defined, is determined by the number of carboxyl groups present. Oxy-acids are carboxylic acids which also contain a hydroxyl group; similarly we may have aldehyde-acids, ketone-acids, &c. Since the more important acids are treated under their own headings, or under substances closely allied to them, we shall here confine ourselves to general relations.

Classification.—It is convenient to distinguish between aliphatic and aromatic acids; the first named being derived from open-chain hydrocarbons, the second from ringed hydrocarbon nuclei. Aliphatic monobasic acids are further divided according to the nature of the parent hydrocarbon. Methane and its homologues give origin to the "paraffin" or "fatty series" of the general formula $C_nH_{2n+1}COOH$, ethylene gives origin to the acrylic acid series, $C_nH_{2n-1}COOH$, and so on. Dibasic acids of the paraffin series of hydrocarbons have the general formula $C_nH_{2n}(COOH)_2$; malonic and succinic acids are important members. The isomerism which occurs as soon as the molecule contains a few carbon atoms renders any classification based on empirical molecular formulae somewhat ineffective; on the other hand, a scheme based on molecular structure would involve more detail than it is here possible to give. For further information, the reader is referred to any standard work on organic chemistry. A list of the acids present in fats and oils is given in the article OILS.

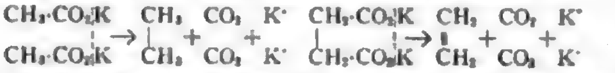
Syntheses of Organic Acids.—The simplest syntheses are undoubtedly those in which a carboxyl group is obtained directly from the oxides of carbon, carbon dioxide and carbon monoxide. The simplest of all include: (1) the synthesis of sodium oxalate by passing carbon dioxide over metallic sodium heated to 350°–360°; (2) the synthesis of potassium formate from moist carbon dioxide and potassium, potassium carbonate being obtained simultaneously; (3) the synthesis of potassium acetate and propionate from carbon dioxide and sodium methide and sodium ethide; (4) the synthesis of aromatic acids by the interaction of carbon dioxide, sodium and a bromine substitution derivative; and (5) the synthesis of aromatic oxy-acids by the interaction of carbon dioxide and sodium phenolates (see SALICYLIC ACID). Carbon monoxide takes part in the syntheses of sodium formate from sodium hydrate, or soda lime (at 200°–220°), and of sodium acetate and propionate from sodium methylate and sodium ethylate at 160°–200°. Other reactions which introduce carboxyl groups into aromatic groups are: the action of carbonyl chloride on aromatic hydrocarbons in the presence of aluminium chloride, acid-chlorides being formed which are readily decomposed by water to give the acid; the action of urea chloride $Cl{\cdot}CO{\cdot}NH_2$, cyanuric acid $(CONH)_3$, nascent cyanic acid, or carbanile on hydrocarbons in the presence of aluminium chloride, acid-amides being obtained which are readily decomposed to give the acid. An important nucleus-synthetic reaction is the saponification of nitriles, which may be obtained by the interaction of potassium cyanide with a halogen substitution derivative or a sulphonic acid.

Acids frequently result as oxidation products, being almost invariably formed in all cases of energetic oxidation. There are certain reactions, however, in which oxidation can be successfully applied to the synthesis of acids. Thus primary alcohols and aldehydes, both of the aliphatic and aromatic series, readily yield on oxidation acids containing the same number of carbon atoms. These reactions may be shown thus:—

$$R{\cdot}CH_2OH \rightarrow R{\cdot}CHO \rightarrow R{\cdot}CO{\cdot}OH.$$

In the case of aromatic aldehydes, acids are also obtained by means of "Cannizzaro's reaction" (see BENZALDEHYDE). An important oxidation synthesis of aromatic acids is from hydrocarbons with aliphatic side chains; thus toluene, or methyl-benzene, yields benzoic acid, the xylenes, or dimethyl-benzene, yield methyl-benzoic acids and phthalic acids. Ketones, secondary alcohols and tertiary alcohols yield a mixture of acids on oxidation. We may also notice the disruption of unsaturated acids at the double linkage into a mixture of two acids, when fused with potash.

In the preceding instances the carboxyl group has been synthesized or introduced into a molecule; we have now to consider syntheses from substances already containing carboxyl groups. Of foremost importance are the reactions termed the malonic acid and the aceto-acetic ester syntheses; these are discussed under their own headings. The electrosyntheses call for mention here. It is apparent that metallic salts of organic acids would, in aqueous solution, be ionized, the positive ion being the metal, and the negative ion the acid residue. Esters, however, are not ionized. It is therefore apparent that a mixed salt and ester, for example $KO_2C{\cdot}CH_2{\cdot}CH_2{\cdot}CO_2C_2H_5$, would give only two ions, viz. potassium and the rest of the molecule. If a solution of potassium acetate be electrolysed the products are ethane, carbon dioxide, potash and hydrogen; in a similar manner, normal potassium succinate gives ethylene, carbon dioxide, potash and hydrogen; these reactions may be represented:—



$$\begin{matrix} CH_3{\cdot}CO_2K & & CH_3 & & CO_2 & & K^{\cdot} & & CH_2{\cdot}CO_2K & & CH_2 & & CO_2 & & K^{\cdot} \\ \vdots & \rightarrow & | & + & & + & & & | \quad\quad \vdots & \rightarrow & \| & + & & + & \\ CH_3{\cdot}CO_2K & & CH_3 & & CO_2 & & K^{\cdot} & & CH_2{\cdot}CO_2K & & CH_2 & & CO_2 & & K^{\cdot} \end{matrix}$$

By electrolysing a solution of potassium ethyl succinate, $KO_2C{\cdot}(CH_2)_2CO_2C_2H_5$, the $KO_2C{\cdot}$ groups are split off and the two residues $\cdot(CH_2)_2CO_2C_2H_5$ combine to form the ester $(CH_2)_4(CO_2C_2H_5)_2$. In the same way, by electrolysing a mixture of a metallic salt and an ester, other nuclei may be condensed; thus potassium acetate and potassium ethyl succinate yield $CH_3{\cdot}CH_2{\cdot}CH_2{\cdot}CO_2C_2H_5$.

Reactions.—Organic acids yield metallic salts with bases, and ethereal salts or esters (*q.v.*), $R{\cdot}CO{\cdot}OR'$, with alcohols. Phosphorus chlorides give acid chlorides, $R{\cdot}CO{\cdot}Cl$, the hydroxyl group being replaced by chlorine, and acid anhydrides, $(R{\cdot}CO)_2O$, a molecule of water being split off between two carboxyl groups. The ammonium salts when heated lose one molecule of water and are converted into acid-amides, $R{\cdot}CO{\cdot}NH_2$, which by further dehydration yield nitriles, $R{\cdot}CN$. The calcium salts distilled with calcium formate yield aldehydes (*q.v.*); distilled with soda-lime, ketones (*q.v.*) result.

ACIDALIUS, VALENS (1567–1595), German scholar and critic, was born at Wittstock in Brandenburg. After studying at Rostock, Greifswald and Helmstedt, and residing about three years in Italy, he settled at Breslau, where he is said to have embraced the Roman Catholic religion. Early in 1595 he accepted an invitation to Neisse, about fifty miles from Breslau, where he died of brain fever on the 25th of May, at the age of twenty-eight. His excessive application to study, and the attacks made upon him in connexion with a pamphlet of which he was reputed the author, doubtless hastened his premature end. Acidalius wrote notes on Velleius Paterculus (1590), Curtius (1594), the panegyrists, Tacitus and Plautus, published after his death.

See Leuschner, *Commentatio de A. V. Vita, Moribus, et Scriptis* (1757); F. Adam, "Der Neisser Rektor," in *Bericht der Philomathie in Neisse* (1872).

ACID-AMIDES, chemical compounds which may be considered as derived from ammonia by replacement of its hydrogen with acidyl residues, the substances produced being known as primary, secondary or tertiary amides, according to the number of hydrogen atoms replaced. Of these compounds, the primary amides of the type $R{\cdot}CO{\cdot}NH_2$ are the most important. They may be prepared by the dry distillation of the ammonium salts of the acids (A. W. Hofmann, *Ber.*, 1882, 15, p. 977), by the partial hydrolysis of the nitriles, by the action of ammonia or ammonium carbonate on acid chlorides or anhydrides, or by heating the esters (*q.v.*) with ammonia. They are solid crystalline compounds (formamide excepted) which are at first soluble in water, the solubility, however, decreasing as the carbon content of the molecule increases. They are easily hydrolysed, breaking up into their components when boiled with acids or alkalies. They form compounds with hydrochloric acid when this gas is passed into their ethereal solution; these compounds, however, are very unstable, being readily decomposed by water. On the other hand, they show faintly acid properties since the hydrogen of the amido group can be replaced by metals to give such compounds as mercury acetamide $(CH_3CONH)_2Hg$. Nitrous acid decomposes them, with elimination of nitrogen and the formation of the corresponding acid,

$$RCO{\cdot}NH_2 + ONOH = R{\cdot}COOH + N_2 + H_2O.$$

When distilled with phosphoric anhydride they yield nitriles. By the action of bromine and alcoholic potash on the amides, they are converted into amines containing one carbon atom less than the original amide, a reaction which possesses great theoretical importance (A. W. Hofmann),

$$R{\cdot}CONH_2 \rightarrow R{\cdot}CONHBr \rightarrow R{\cdot}NH_2 + K_2CO_3 + KBr + H_2O.$$

Formamide, $H{\cdot}CONH_2$, is a liquid readily soluble in water, boiling at about 195° C. with partial decomposition. Acetamide, $CH_3{\cdot}CONH_2$, is a white deliquescent crystalline solid, which melts at 82–83° C. and boils at 222° C. It is usually prepared by distilling ammonium acetate. It is readily soluble in water and alcohol, but insoluble in ether. Benzamide, $C_6H_5{\cdot}CONH_2$, crystallizes in leaflets which melt at 130° C. It is prepared by the action of ammonium carbonate on benzoyl chloride. It yields a silver salt which with ethyl iodide forms benzimido-ethyl ether, $C_6H_5C:(NH){\cdot}OC_2H_5$, a behaviour which points to the silver salt as being derived from the tautomeric imido-benzoic acid, $C_6H_5C:(NH){\cdot}OH$ (J. Tafel, *Ber.*, 1890, 23, p. 104). On the preparation of the substituted amides from the corresponding sodamides see A. W. Titherley (*Journ. Chem. Soc.*, 1901, 59, p. 391). The secondary and tertiary amides of the types $(RCO)_2NH$ and $(RCO)_3N$ may be prepared by heating the primary amides or the nitriles with acids or acid anhydrides to 200° C. Thiamides of the type $R{\cdot}CSNH_2$ are known, and result by the addition of sulphuretted hydrogen to the nitriles, or by the action of phosphorus pentasulphide on the acid-amides. They readily decompose on heating, and are easily hydrolysed by alkalies; they possess a somewhat more acid character than the acid-amides.

ACINACES (from the Greek), an ancient Persian sword, short and straight, and worn, contrary to the Roman fashion, on the right side, or sometimes in front of the body, as shown in the bas-reliefs found at Persepolis. Among the Persian nobility it was frequently made of gold, being worn as a badge of distinction. The acinaces was an object of religious worship with the Scythians and others (Herod. iv. 62).

ACINETA (so named by C. G. Ehrenberg), a genus of suctorial Infusoria characterized by the possession of a stalk and cup-shaped sheath or theca for the body, and endogenous budding. O. Bütschli has separated off the genus *Metacineta* (for *A. mystacina*), which reproduces by direct bud-fission.

ACINUS (Lat. for a berry), a term in botany applied to such fruits as the blackberry or raspberry, composed of small seed-like berries, and also to those berries themselves, or to grape-stones. By analogy, *acinus* is applied in anatomy to similar granules or glands, or lobules of a gland.

ACIREALE, a town and episcopal see of the province of Catania, Sicily; from the town of the same name it is distant 9 m. N. by E. Pop. (1901) 35,418. It has some importance as a thermal station, and the springs were used by the Romans. It takes its name from the river Acis, into which, according to the legend, Acis, the lover of Galatea, was changed after he had been slain by Polyphemus. The rocks which Polyphemus hurled at Ulysses are identified with the seven *Scogli de' Ciclopi*, or *Faraglioni*, a little to the south of Acireale.

ACIS, in Greek mythology, the son of Pan (Faunus) and the nymph Symaethis, a beautiful shepherd of Sicily, was the lover of the Nereïd Galatea. His rival the Cyclops Polyphemus surprised them together, and crushed him to pieces with a rock. His blood, gushing forth from beneath, was metamorphosed by Galatea into the river bearing his name (now Fiume di Jaci), which was celebrated for the coldness of its waters (Ovid, *Met.* xiii. 750; Silius Italicus, *Punica*, xiv. 221).

ACKERMAN, FRANCIS (*c.* 1335–1387), Flemish soldier and diplomatist, was born at Ghent, and about 1380 became prominent during the struggle between the burghers of that town and Louis II. (de Mâle), count of Flanders. He was partly responsible for inducing Philip van Artevelde to become first captain of the city of Ghent in 1382, and at the head of some troops scoured the surrounding country for provisions and thus saved Ghent from being starved into submission. By his diplomatic abilities he secured the assistance of the citizens of Brussels, Louvain and Liège, and, having been made admiral of the Flemish fleet, visited England and obtained a promise of help from King Richard II. After Artevelde's death in November 1382, he acted as leader of the Flemings, gained several victories and increased his fame by skilfully conducting a retreat from Damme to Ghent in August 1385. He took part in the conclusion of the treaty of peace between Ghent and Philip the Bold, duke of Burgundy, the successor of Count Louis, in December 1385. Trusting in Philip, and ignoring the warnings of his friends, Ackerman remained in Flanders, and was murdered at Ghent on the 22nd of July 1387, leaving a memory of chivalry and generosity.

See Jean Froissart, *Chroniques*, edited by S. Luce and G. Raynaud (Paris, 1869–1897); Johannes Brandon, *Chronodromon*, edited by K. de Lettenhove in the *Chroniques relatives à l'histoire de la Belgique sous la domination des ducs de Bourgogne* (Brussels, 1870).

ACKERMANN, JOHANN CHRISTIAN GOTTLIEB (1756–1801), German physician, was born at Zeulenroda, in Upper Saxony, on the 17th of February 1756, and died at Altdorf on the 9th of March 1801. At the age of fifteen he became a student of medicine at Jena under E. G. Baldinger, whom he followed to Göttingen in 1773, and afterwards he studied for two years at Halle. A few years' practice at Stendal (1778–1799), where there were numerous factories, enabled him to add many valuable original observations to his translation (1780–1783) of Bernardino Ramazzini's (1633–1714) treatise on diseases of artificers. In 1786 he became professor of medicine at the university of Altdorf, in Franconia, occupying first the chair of chemistry, and then, from 1794 till his death in 1801, that of pathology and therapeutics. He wrote *Institutiones Historiae Medicinae* (Nuremberg, 1792) and *Institutiones Therapiae Generalis* (Nuremberg and Altdorf, 1784–1795), besides various handbooks and translations.

ACKERMANN, LOUISE VICTORINE CHOQUET (1813–1890), French poet, was born in Paris on the 30th of November 1813. Educated by her father in the philosophy of the Encyclopaedists, Victorine Choquet went to Berlin in 1838 to study German, and there married in 1843 Paul Ackermann, an Alsatian philologist. After little more than two years of happy married life her husband died, and Madame Ackermann went to live at Nice with a favourite sister. In 1855 she published *Contes en vers*, and in 1862 *Contes et poésies*. Very different from these simple and charming *contes* is the work on which Madame Ackermann's real reputation rests. She published in 1874 *Poésies, premières poésies, poésies philosophiques*, a volume of sombre and powerful verse, expressing her revolt against human suffering. The volume was enthusiastically reviewed in the *Revue des deux mondes* for May 1871 by E. Caro, who, though he deprecated the *impiété désespérée* of the verses, did full justice to their vigour and the excellence of their form. Soon after the publication of this volume Madame Ackermann removed to Paris, where she gathered round her a circle of friends, but published nothing further except a prose volume, the *Pensées d'un solitaire* (1883), to which she prefixed a short autobiography. She died at Nice on the 2nd of August 1890.

See also Anatole France, *La vie littéraire*, 4th series (1892); the comte d'Haussonville, *Mme. Ackermann* (1882); M. Citoleux, *La poésie philosophique au XIXe. siècle* (vol. i., *Mme. Ackermann d'après de nombreux documents inédits*, Paris, 1906).

ACKERMANN, RUDOLPH (1764–1834), Anglo-German inventor and publisher, was born on the 20th of April 1764 at Schneeberg, in Saxony. He had been a saddler and coach-builder in different German cities, Paris and London for ten years before, in 1795, he established a print-shop and drawing-school in the Strand. Ackermann set up a lithographic press, and applied it in 1817 to the illustration of his *Repository of Arts, Literature, Fashions, &c.* (monthly until 1828 when forty volumes had appeared). Rowlandson and other distinguished artists were regular contributors. He also introduced the fashion of the once popular English Annuals, beginning in 1825 with *Forget-me-not*; and he published many illustrated volumes of topography and travel, *The Microcosm of London* (3 vols., 1808–1811), *Westminster Abbey* (2 vols., 1812), *The Rhine* (1820), *The World in Miniature* (43 vols., 1821–1826), &c. Ackermann was an enterprising man; he patented (1801) a method for rendering paper and cloth waterproof, erected a factory at Chelsea for the purpose and was one of the first to illuminate his own premises with gas. Indeed the introduction of lighting by gas owed much to him. After the battle of Leipzig Ackermann collected nearly a quarter of a million sterling for the German sufferers. He died at Finchley, near London, on the 30th of March 1834.

ACKNOWLEDGMENT (from the old *acknow*, a compound of *on-* and *know*, to know by the senses, which passed through the forms *oknow, aknow* and *acknow; acknowledge* is formed on analogy of "knowledge"), an admission that something has been given or done, a term used in law in various connexions. The acknowledgment of a debt, if in writing signed by the debtor or his agent, is sufficient to take it out of the Statutes of Limitations. The signature to a will by a testator, if not made in the presence of two witnesses, may be afterwards acknowledged in their presence. The acknowledgment by a woman married before 1882 of deeds for the conveyance of real property not her separate property, requires to be made by her before a judge of the High Court or of a county court or before a perpetual or special commissioner. Before such an acknowledgment can be received, the judge or commissioner is required to examine her apart from her husband, touching her knowledge of the deed, and to ascertain whether she freely and voluntarily consents to it. An acknowledgment to the right of the production of deeds of conveyance is an obligation on the vendor, when he retains any portion of the property to which the deeds relate, and is entitled to retain the deeds, to produce them from time to time at the request of the person to whom the acknowledgment is given, to allow copies to be made, and to undertake for their safe custody (Conveyancing Act 1881, s. 9). The term "acknowledgment" is, in the United States, applied to the certificate of a public officer that an instrument was acknowledged before him to be the deed or act of the person who executed it.

"Acknowledgment money" is the sum paid in some parts of England by copyhold tenants on the death of the lord of the manor.

ACLAND, CHRISTIAN HENRIETTA CAROLINE (1750–1815), usually called Lady Harriet Acland, was born on the 3rd of January 1750, the daughter of the first earl of Ilchester. In 1770 she married John Dyke Acland, who as a member of parliament became a vigorous supporter of Lord North's policy towards the American colonies, and, entering the British army in 1774, served with Burgoyne's expedition as major in the 20th regiment of foot. Lady Harriet accompanied her husband, and, when he was wounded at Ticonderoga, nursed him in his tent at the front. In the second battle of Saratoga Major Acland was again badly wounded and subsequently taken prisoner. Lady Harriet was determined to be with him, and underwent great hardship to accomplish her object, proving herself a courageous and devoted wife. A story has been told that being provided with a letter from General Burgoyne to the American general Gates, she went up the Hudson river in an open boat to the enemy's lines, arriving late in the evening. The American outposts threatened to fire into the boat if its occupants stirred, and Lady Harriet had to wait eight "dark and cold hours," until the sun rose, when she at last received permission to join her husband. Major Acland died in 1778, and Lady Harriet on the 21st of July 1815.

ACLAND, SIR HENRY WENTWORTH, Bart. (1815–1900), English physician and man of learning, was born near Exeter on the 23rd of August 1815, and was the fourth son of Sir Thomas Dyke Acland (1787–1871). Educated at Harrow and at Christ Church, Oxford, he was elected fellow of All Souls in 1840, and then studied medicine in London and Edinburgh. Returning to Oxford, he was appointed Lee's reader in anatomy at Christ Church in 1845, and in 1851 Radcliffe librarian and physician to the Radcliffe infirmary. Seven years later he became regius professor of medicine, a post which he retained till 1894. He was also a curator of the university galleries and of the Bodleian Library, and from 1858 to 1887 he represented his university on the General Medical Council, of which he served as president from 1874 to 1887. He was created a baronet in 1890, and ten years later, on the 16th of October 1900, he died at his house in Broad Street, Oxford. Acland took a leading part in the revival of the Oxford medical school and in introducing the study of natural science into the university. As Lee's reader he began to form a collection of anatomical and physiological preparations on the plan of John Hunter, and the establishment of the Oxford University museum, opened in 1861, as a centre for the encouragement of the study of science, especially in relation to medicine, was largely due to his efforts. "To Henry Acland," said his lifelong friend, John Ruskin, "physiology was an entrusted gospel of which he was the solitary preacher to the heathen," but on the other hand his thorough classical training preserved science at Oxford from too abrupt a severance from the humanities. In conjunction with Dean Liddell, he revolutionized the study of art and archaeology, so that the cultivation of these subjects, for which, as Ruskin declared, no one at Oxford cared before that time, began to flourish in the university. Acland was also interested in questions of public health. He served on the royal commission on sanitary laws in England and Wales in 1869, and published a study of the outbreak of cholera at Oxford in 1854, together with various pamphlets on sanitary matters. His memoir on the topography of the Troad, with panoramic plan (1839), was among the fruits of a cruise which he made in the Mediterranean for the sake of his health.

ACME (Gr. ἀκμή, point), the highest point attainable; first used as an English word by Ben Jonson.

ACMITE, or Aegirite, a mineral of the pyroxene (*q.v.*) group, which may be described as a soda-pyroxene, being essentially a sodium and ferric metasilicate, $NaFe(SiO_3)_2$. In its crystallographic characters it is close to ordinary pyroxene (augite and diopside), being monoclinic and having nearly the same angle between the prismatic cleavages. There are, however, important differences in the optical characters: the birefringence of acmite is negative, the pleochroism is strong and the extinction angle on the plane of symmetry measured to the vertical axis is small (3°–5°). The hardness is 6–6½, and the specific gravity 3·55. Crystals are elongated in the direction of the vertical axis, and are blackish green (aegirite) or dark brown (acmite) in colour. Being isomorphous with augite, crystals intermediate in composition between augite or diopside and aegirite are not uncommon, and these are known as aegirine-augite or aegirine-diopside.

Acmite is a characteristic constituent of igneous rocks rich in soda, such as nepheline-syenites, phonolites, &c. It was first discovered as slender crystals, sometimes a foot in length, in the pegmatite veins of the granite of Rundemyr, near Kongsberg in Norway, and was named by F. Stromeyer in 1821 from the Gr. ἀκμή, a point, in allusion to the pointed terminations of the crystals. Aegirite (named from Aegir, the Scandinavian sea-god) was described in 1835 from the elaeolite-syenite of southern Norway. Although exhibiting certain varietal differences, the essential identity of acmite and aegirite has long been established, but the latter and more recent name is perhaps in more general use, especially among petrologists.

ACNE, a skin eruption produced by inflammation of the sebaceous glands and hair follicles, the essential point in the disease being the plugging of the mouths of the sebaceous follicles by a "comedo," familiarly known as "blackhead." It is now generally acknowledged that the cause of this disease is the organism known as bacillus acnes. It shows itself in the form of red pimples or papules, which may become pustular and be attended with considerable surrounding irritation of the skin. This affection is likewise most common in early adult life, and occurs on the chest and back as well as on the face, where it may, when of much extent, produce considerable disfigurement. It is apt to persist for months or even years, but usually in time disappears entirely, although slight traces may remain in the form of scars or stains upon the skin. Eruptions of this kind are sometimes produced by the continued internal use of certain drugs, such as the iodide or bromide of potassium. In treating this condition the face should first of all be held over steaming water for several minutes, and then thoroughly bathed. The blackheads should next be removed, not with the finger-nail, but with an inexpensive little instrument known as the "comedo expressor." When the more noticeable of the blackheads have been expressed, the face should be firmly rubbed for three or four minutes with a lather made from a special soap composed of sulphur, camphor and balsam of Peru. Any lather remaining on the face at the end of this time should be wiped off with a soft handkerchief. As this treatment might give rise to some irritation of the skin, it should be replaced every fourth night by a simple application of cold cream. Of drugs used internally sulphate of calcium, in pill, ½ grain three times a day, is a very useful adjunct to the preceding. The patient should take plenty of exercise in the fresh air, a very simple but nourishing diet, and, if present, constipation and anaemia must be suitably treated.

Rosacea, popularly known as *acne rosacea*, is a more severe and troublesome disorder, a true dermatitis with no relation to the foregoing, and in most cases secondary to seborrhea of the scalp. It is characterized by great redness of the nose and cheeks, accompanied by pustular enlargements on the surface of the skin, which produce marked disfigurement. Although often seen in persons who live too freely, it is by no means confined to such, but may arise in connexion with disturbances of the general health, especially of the function of digestion, and in females with menstrual disorders. It is apt to be exceedingly intractable to treatment, which is here too, as in the preceding form, partly local and partly constitutional. Of internal remedies preparations of iodine and of arsenic are sometimes found of service.

ACOEMETI (Gr. ἀκοίμητος, sleepless), an order of Eastern monks who celebrated the divine service without intermission day or night. This was done by dividing the communities into choirs, which relieved each other by turn in the church. Their first monastery was established on the Euphrates, in the beginning of the 5th century, and soon afterwards one was founded in Constantinople. Here also, *c.* 460, was founded by the consular Studius the famous monastery of the Studium, which was put in the hands of the Acoemeti and became their chief house, so that they were sometimes called Studites. At Agaunum (St Maurice in the Valais) a monastery was founded by the Burgundian king Sigismund, in 515, in which the perpetual office was kept up; but it is doubtful whether this had any connexion with the Eastern Acoemeti.

The Constantinopolitan Acoemeti took a prominent part in the Christological controversies of the 5th and 6th centuries, at first strenuously opposing Acacius, patriarch of Constantinople, in his attempted compromise with the monophysites; but afterwards, in Justinian's reign, falling under ecclesiastical censure for Nestorian tendencies.

See the article in *Dictionary of Christian Antiquities*; Wetzer und Welte, *Kirchenlexicon* (2nd ed.); and Herzog-Hauck, *Realencyklopädie* (3rd ed.); also the general histories of the time. (E. C. B.)

ACOLYTE (Gr. ἀκόλουθος, follower), the last of the four minor orders in the Roman Church. As an office it appears to be of local origin, and is entirely unknown in the Eastern Church, with the exception of the Armenians who borrowed it from the West. Before the council of Nicaea (325) it was only to be found at Rome and Carthage. When in 251 Pope Cornelius, in a letter to Fabius of Antioch, mentions among the Roman clergy forty-two acolytes, placing them after the subdeacons and before the other minor officials (see Eusebius, *Hist. Ecc.* lib. v. cap. 43), he gives no hint that the office was a new one, but speaks of them as holding an already established position. Their institution has therefore to be sought for at an earlier date than his pontificate. It is possible that the *Liber Pontificalis* refers to the office under the Latin synonym, when it says of Pope Victor (186–197) that he made *sequentes cleros*, a term—*sequens*—which Pope Gaius (283–293) uses in the sense of acolyte. While the office was well known in Rome, there is nothing to prove that it was also an order through which, as to-day, every candidate to the priesthood must pass. The contrary is a fact proved by many monumental inscriptions and authentic statements. Though the office is found at Carthage, and St Cyprian (200?–258) makes many references to acolytes, whom he used to carry his letters, this seems to be the only place in Africa where they were known. Tertullian, while speaking of readers and exorcists, says nothing about acolytes; neither does St Augustine. The Irish Church did not know them; and in Spain the council of Toledo (400) makes no mention either of the office or of the order. The *Statuta Ecclesiae Antiqua* (falsely called the Canons of the Fourth Council of Carthage in 397), a Gallican collection, originating in the province of Arles at the beginning of the 6th century, mentions the acolyte, but does not give, as in the case of the other orders, any form for the ordination. The Roman books are silent, and there is no mention of it in the collection known as the *Leonine Sacramentary*; while in the so-called *Gelasian Mass-book*, which, as we have it, is full of Gallican additions made to St Gregory's reform, there is the same silence, though in one MS. of the 10th century given by Muratori we find a form for the ordination of an acolyte. While there is frequent mention of the acolyte's office in the *Ordines Romani*, it is only in the *Ordo* VIII. (which is not earlier than the 7th century) that we find the very simple form for admitting an acolyte to his office. At the end of the mass the cleric, clad in chasuble and stole and bearing a linen bag on one arm, comes before the pope or bishop and receives a blessing. There is no collation of power or order but a simple admission to an office. The evidence available, therefore, points to the fact that the acolyte was only a local office and was not a necessary step or order for every candidate. In England, though the ecclesiastical organization came from Rome and was directed by Romans, we find no trace of such an office or order until the time of Ecgbert of York (767), the friend of Alcuin and therefore subject to Gallican influence. The Pontifical known as Ecgbert's shows that it was then in use both as an office and as an order, and Aelfric (1006) in both his pastoral epistle and canons mentions the acolyte. The conclusion, then, which seems warranted by the evidence, is that the acolyte was an office only at Rome, and, becoming an order in the Gallican Church, found its way as such into the Roman books at some period before the fusion of the two rites under Charlemagne.

The duties of the acolyte, as given in the Roman Pontifical, are identical with those mentioned in the *Statuta Ecclesiae Antiqua* of Arles: "It is the duty of acolytes to carry the candlesticks, to light the lamps of the church, to administer wine and water for the Eucharist." It might seem, from the number forty-two mentioned by Pope Cornelius, that at Rome the acolytes were divided among the seven ecclesiastical regions of the city; but we have no proof that, at that date, there were six acolytes attached to each region. From the ancient division of the Roman acolytes into *Palatini*, or those in attendance on the pope at the Lateran palace, *Stationarii*, or those who served at the churches where there was a "station," and *Regionarii*, or those attached directly to the regions, it would seem that the number forty-two was only the actual number then existing and not an official number. We get a glimpse of their duties from the *Ordines Romani*. When the pope rode in procession to the station an acolyte, on foot, preceded him, bearing the holy chrism; and at the church seven regionary acolytes with candles went before him in the procession to the altar, while two others, bearing the vessel that contained a pre-consecrated Host, presented it for his adoration. During the mass an acolyte bore the thurible (*Ordo* VI.) and three assisted at the washing of the hands. At the moment of communion the acolytes received in linen bags the consecrated Hosts to carry to the assisting priests. This office of bearing the sacrament is an ancient one, and is mentioned in the legend of Tarcisius, the Roman acolyte, who was martyred on the Appian Way while carrying the Hosts from the catacombs. The official dress of the acolyte, according to *Ordo* V., was a close-fitting linen garment (*camisia*) girt about him, a napkin hanging from the left side, a white tunic, a stole (*orarium*) and a chasuble (*planeta*) which he took off when he sang on the steps of the *ambone*.

At the present day, despite the earnest wish of the council of Trent (*Sess.* xxiii. cap. 17 *d.r.*), the acolyte, while remaining an order, has ceased to be essentially a clerical office, since the duties are now performed, almost everywhere, by laymen. The office has been revived, though unofficially, in the Church of England, as a result of the Tractarian movement.

See Morin, *Commentarius in sacris Ecclesiae ordinationibus* (Antwerp, 1685), ii. p. 209, iii. p. 152; Martène, *De Antiquis Ecclesiae ritibus* (Antwerp, 1739), ii. pp. 47 and 86; Mabillon, *Musaeum Italicum II.* for the *Ordines Romani*; Muratori, *Liturgia Romana Vetus*; Cabrol, *Dictionnaire d'archéologie chrétienne et de liturgie*, vol. i. col. 348-536. (E. Tn.)

ACOMINATUS (Akominatos), **MICHAEL** (*c.* 1140–1220), Byzantine writer and ecclesiastic, was born at Chonae (the ancient Colossae). At an early age he studied at Constantinople, and about 1175 was appointed archbishop of Athens. After the capture of Constantinople by the Franks and the establishment of the Latin empire (1204), he retired to the island of Ceos, where he died. He was a versatile writer, and composed homilies, speeches and poems, which, with his correspondence, throw considerable light upon the miserable condition of Attica and Athens at the time. His memorial to Alexis III. Angelus on the abuses of Byzantine administration, the poetical lament over the degeneracy of Athens and the monodes on his brother Nicetas and Eustathius, archbishop of Thessalonica, deserve special mention.

Edition of his works by S. Lambros (1879–1880); Migne, *Patrologia Graeca*, cxl.; see also A. Ellissen, *Michael Akominatos* (1846), containing several pieces with German translation; F. Gregorovius, *Geschichte der Stadt Athen im Mittelalter*, i. (1889); G. Finlay, *History of Greece*, iv. pp. 133-134 (1877).

His younger brother Nicetas (Niketas), sometimes called Choniates, who accompanied him to Constantinople, took up politics as a career. He held several appointments under the Angelus emperors (amongst them that of "great logotheto" or chancellor) and was governor of the "theme" of Philippopolis at a critical period. After the fall of Constantinople he fled to Nicaea, where he settled at the court of the emperor Theodorus Lascaris, and devoted himself to literature. He died between 1210 and 1220. His chief work is his *History*, in 21 books, of the period from 1180 to 1206. In spite of its florid and bombastic style, it is of considerable value as a record (on the whole impartial) of events of which he was either an eye-witness or had heard at first hand. Its most interesting portion is the description of the capture of Constantinople, which should be read with Villehardouin's and Paolo Rannusio's works on the same subject. The little treatise *On the Statues* destroyed by the Latins (perhaps, as we have it, altered by a later writer) is of special interest to the archaeologist. His dogmatic work (*Θησαυρὸς Ὀρθοδοξίας*, *Thesaurus Orthodoxae Fidei*), although it is extant in a complete form in MS., has only been published in part. It is one of the chief authorities for the heresies and heretical writers of the 12th century.

Editions: *History*, editio princeps, H. Wolf (1557); and in the Bonn *Corpus Scriptorum Hist. Byz.*, 1st ed., Bekker (1835); Rhetorical Pieces in C. Sathas, *Μεσαιωνικὴ Βιβλιοθήκη*, i. (1872); *Thesaurus* in Migne, *Patrologia Graeca*, cxxxix., cxl.; see also C. A. Sainte-Beuve, "Geoffroy de Villehardouin" in *Causeries du Lundi*, ix.; S. Reinach, "La fin de l'empire grec" in *Esquisses Archéologiques* (1888); C. Neumann, *Griechische Geschichtsschreiber im 12. Jahrhundert* (1888); Gibbon, *Decline and Fall*, ch. lx.; and (for both Michael and Nicetas) C. Krumbacher, *Geschichte der byzantinischen Litteratur* (1897).

ACONCAGUA, a small northern province of central Chile, bounded N. by Coquimbo, E. by Argentina, S. by Santiago and Valparaiso and W. by the Pacific. Its area is officially computed at 5487 sq. m. Pop. (1895) 113,165; (1902, official estimate based on civil registry returns) 131,255. The province is very mountainous, and is traversed from east to west by the broad valley of the Aconcagua river. The climate is hot and dry, the rainfall being too small to influence climatic conditions. The valleys are highly fertile, and where irrigation is employed large crops are easily raised. Beyond the limits of irrigation the country is semi-barren. Alfalfa and grapes are the principal products, and considerable attention is given to the cultivation of other fruits, such as figs, peaches and melons. The "Vale of Quillota," through which the railway passes between Valparaiso and Santiago, is celebrated for its gardens. The Aconcagua river rises on the southern slope of the volcano Aconcagua, flows eastward through a broad valley, or bay in the mountains, and enters the Pacific 12 m. north of Valparaiso. The river has a course of about 200 m., and its waters irrigate the best and most populous part of the province. Two other rivers—the Ligua and Choapa—traverse the province, the latter forming the northern boundary line. The capital is San Felipe, on the Aconcagua river; it had a population of 11,313 in 1895, and an estimated population of 11,660 in 1902. The other chief town is Santa Rosa de los Andes (est. pop. 6854), which is a principal station on the Transandine branch of the state railway. The only port in the province is Los Vilos, in lat. 32° S., from which a railway 40 m. long runs north-east to the valley of the Choapa. Another short line connects Cabildo, in the valley of the Ligua, with the state railway.

ACONCIO, GIACOMO (1492–1566?), pioneer of religious toleration, was born at Trent, it is said, on the 7th of September 1492. He was one of the Italians like Peter Martyr and Bernardino Ochino who repudiated papal doctrine and ultimately found refuge in England. Like them, his revolt against Romanism took an extremer form than Lutheranism, and after a temporary residence in Switzerland and at Strassburg, he arrived in England soon after Elizabeth's accession. He had studied law and theology, but his profession was that of an engineer, and in this capacity he found employment with the English government. He was granted an annuity of £60 on the 27th of February 1560, and letters of naturalization on the 8th of October 1561 (*Cal. State Papers*, Dom. Ser., Addenda, 1547–1566, p. 495), and was for some time occupied with draining Plumstead marshes, for which object various acts of parliament were passed at this time (*Lords' Journals*, vol. i., and *Commons' Journals*, vol. i., *passim*). In 1564 he was sent to report on the fortifications of Berwick (*Cal. St. Pap.* For Ser. 1564–1565, *passim*; *Acts P.C.*, 1558–1570, p. 146); his report is now in the Record Office (*C.S.P.* For., 1564–1565, No. 512).

But his real importance depends upon his contribution to the history of religious toleration. Before reaching England he had published a treatise on the methods of investigation, *De Methodo, hoc est, de recte investigandarum tradendarumque Scientiarum ratione* (Basel, 1558, 8vo); and his critical spirit placed him outside all the recognized religious societies of his time. On his arrival in London he had joined the Dutch Reformed Church in Austin Friars, but he was "infected with Anabaptistical and Arian opinions" and was excluded from the sacrament by Grindal, bishop of London. The real nature of his heterodoxy is revealed in his *Stratagemata Satanae*, published in 1565 and translated into various languages. The "stratagems of Satan" are the dogmatic creeds which rent the Christian church. Aconcio sought to find the common denominator of the various creeds; this was essential doctrine, the rest was immaterial. To arrive at this common basis, he had to reduce dogma to a low level, and his result was generally repudiated. Even Selden applied to Aconcio the remark *ubi bene, nil melius; ubi male, nemo pejus*. The dedication of such a work to Queen Elizabeth illustrates the tolerance or religious laxity during the early years of her reign. Aconcio found another patron in the earl of Leicester, and died about 1566.

Authorities.—Gough's *Index to Parker Soc. Publ.*; Strype's *Grindal*, pp. 62, 66; Bayle's *Dictionnaire*; G. Tiraboschi, *Storia della lett. italiana* (Florence, 1805–1813); *Österreichisches Biogr. Lexikon*; *Nouvelle biogr. générale*; *Dict. Nat. Biogr.* (A. F. P.)

ACONITE (*Aconitum*), a genus of plants belonging to the natural order Ranunculaceae, the buttercup family, commonly known as aconite, monkshood or wolfsbane, and embracing about 60 species, chiefly natives of the mountainous parts of the northern hemisphere. They are distinguished by having one of the five blue or yellow coloured sepals (the posterior one) in the form of a helmet; hence the English name monkshood. Two of the petals placed under the hood of the calyx are supported on long stalks, and have a hollow spur at their apex, containing honey. They are handsome plants, the tall stem being crowned by racemes of showy flowers. *Aconitum Napellus*, common monkshood, is a doubtful native of Britain, and is of therapeutic and toxicological importance. Its roots have occasionally been mistaken for horse-radish. The aconite has a short underground stem, from which dark-coloured tapering roots descend. The crown or upper portion of the root gives rise to new plants. When put to the lip, the juice of the aconite root produces a feeling of numbness and tingling. The horse-radish root, which belongs to the natural order Cruciferae, is much longer than that of the aconite, and it is not tapering; its colour is yellowish, and the top of the root has the remains of the leaves on it.

Many species of aconite are cultivated in gardens, some having blue and others yellow flowers. *Aconitum lycoctonum*, wolfsbane, is a yellow-flowered species common on the Alps of Switzerland. The roots of *Aconitum ferox* supply the famous Indian (Nepal) poison called bikh, bish or nabee. It contains considerable quantities of the alkaloid pseudaconitine, which is the most deadly poison known. *Aconitum palmatum* yields another of the celebrated bikh poisons. The root of *Aconitum luridum*, of the Himalayas, is said to be as virulent as that of *A. ferox* or *A. Napellus*. As garden plants the aconites are very ornamental, hardy perennials. They thrive well in any ordinary garden soil, and will grow beneath the shade of trees. They are easily propagated by divisions of the root or by seeds; great care should be taken not to leave pieces of the root about owing to its very poisonous character.

Chemistry.—The active principle of *Aconitum Napellus* is the alkaloid aconitine, first examined by P. L. Geiger and Hesse (*Ann.*, 1834, 7, p. 267). Alder Wright and A. P. Luff obtained apoaconitine, aconine and benzoic acid by hydrolysis; while, in 1892, C. Ehrenberg and A. Purfürst (*Journ. Prat. Chem.*, 1892, 45, p. 604) observed acetic acid as a hydrolytic product. This, and allied alkaloids, have formed the subject of many investigations by Wyndham Dunstan and his pupils in England, and by Martin Freund and Paul Beck in Berlin. But their constitution is not yet solved, there even being some divergence of opinion as to their empirical formulae. Aconitine ($C_{34}H_{45}NO_{11}$, according to Dunstan; $C_{34}H_{47}NO_{11}$, according to Freund) is a crystalline base, soluble in alcohol, but very sparingly in water; its alcoholic solution is dextrorotatory, but its salts are laevorotatory. When heated it loses water and forms pyraconitine. Hydrolysis gives acetic acid and benzaconine, the chief constituent of the alkaloids picraconitine and napelline; further hydrolysis gives aconine. Pseudaconitine, obtained from *Aconitum ferox*, gives on hydrolysis acetic acid and veratrylpseudaconine, the latter of which suffers further hydrolysis to veratric acid and pseudaconine. Japaconitine, obtained from the Japanese aconites, known locally as "kuza-uzu," hydrolyses to japbenzaconine, which further breaks down to benzoic acid and japaconine. Other related alkaloids are lycaconitine and myoctonine which occur in wolfsbane, *Aconitum lycoctonum*. The usual test for solutions of aconitine consists in slight acidulation with acetic acid and addition of potassium permanganate, which causes the formation of a red crystalline precipitate. In 1905, Dunstan and his collaborators discovered two new aconite alkaloids, indaconitine in "mohri" (*Aconitum chasmanthum*, Stapf), and bikhaconitine in "bikh" (*Aconitum spicatum*); he also proposes to classify these alkaloids according to whether they yield benzoic or veratric acid on hydrolysis (*Jour. Chem. Soc.*, 1905, 87, pp. 1620, 1650).

From the root of *Aconitum Napellus* are prepared a liniment and a tincture. The dose of the latter (Brit. Pharmacop.) is of importance as being exceptionally small, for it is not advisable to give more than at most five drops at a time. The official preparation is an ointment which contains one part of the alkaloid in fifty. It must be used with extreme care, and in small quantities, and it must not be used at all where cuts or cracks are present in the skin.

Pharmacology of Aconite and Aconitine.—Aconite first stimulates and later paralyses the nerves of pain, touch and temperature, if applied to the skin, broken or unbroken, or to a mucous membrane; the initial tingling therefore gives place to a long-continued anaesthetic action. Taken internally aconite acts very notably on the circulation, the respiration and the nervous system. The pulse is slowed, the number of beats per minute being actually reduced, under considerable doses, to forty, or even thirty, per minute. The blood-pressure synchronously falls, and the heart is arrested in diastole. Immediately before arrest the heart may beat much faster than normally, though with extreme irregularity, and in the lower animals the auricles may be observed occasionally to miss a beat, as in poisoning by veratrine and colchicum. The action of aconitine on the circulation is due to an initial stimulation of the cardio-inhibitory centre in the medulla oblongata (at the root of the vagus nerves), and later to a directly toxic influence on the nerve-ganglia and muscular fibres of the heart itself. The fall in blood-pressure is not due to any direct influence on the vessels. The respiration becomes slower owing to a paralytic action on the respiratory centre and, in warm-blooded animals, death is due to this action, the respiration being arrested before the action of the heart. Aconite further depresses the activity of all nerve-terminals, the sensory being affected before the motor. In small doses it therefore tends to relieve pain, if this be present. The activity of the spinal cord is similarly depressed. The pupil is at first contracted, and afterwards dilated. The cerebrum is totally unaffected by aconite, consciousness and the intelligence remaining normal to the last. The antipyretic action which considerable doses of aconite display is not specific, but is the result of its influence on the circulation and respiration and of its slight diaphoretic action.

Therapeutics.—The indications for its employment are limited, but definite. It is of undoubted value as a local anodyne in sciatica and neuralgia, especially in ordinary facial or trigeminal neuralgia. The best method of application is by rubbing in a small quantity of the aconitine ointment until numbness is felt, but the costliness of this preparation causes the use of the aconite liniment to be commonly resorted to. This should be painted on the affected part with a camel's hair brush dipped in chloroform, which facilitates the absorption of the alkaloid. Aconite is indicated for internal administration whenever it is desirable to depress the action of the heart in the course of a fever. Formerly used in every fever, and even in the septic states that constantly followed surgical operations in the pre-Listerian epoch, aconite is now employed only in the earliest stage of the less serious fevers, such as acute tonsilitis, bronchitis and, notably, laryngitis. The extreme pain and rapid swelling of the vocal cords—with threatened obstruction to the respiration—that characterize acute laryngitis may often be relieved by the sedative action of this drug upon the circulation. In order to reduce the pulse to its normal rate in these cases, without at the same time lessening the power of the heart, the drug must be given in doses of about two minims of the tincture every half-hour and then every hour until the pulse falls to the normal rate. Thereafter the drug must be discontinued. It is probably never right to give aconite in doses much larger than that named. There is one condition of the heart itself in which aconite is sometimes useful. Whilst absolutely contra-indicated in all cases of valvular disease, it is of value in cases of cardiac hypertrophy with over-action. But the practitioner must be assured that neither valvular lesion nor degeneration of the myocardium is present.

Toxicology.—In a few minutes after the introduction of a poisonous dose of aconite, marked symptoms supervene. The initial signs of poisoning are referable to the alimentary canal. There is a sensation of burning, tingling and numbness in the mouth, and of burning in the abdomen. Death usually supervenes before a numbing effect on the intestine can be observed. After about an hour there is severe vomiting. Much motor weakness and cutaneous sensations similar to those above described soon follow. The pulse and respiration steadily fail, death occurring from asphyxia. As in strychnine poisoning, the patient is conscious and clear-minded to the last. The only *post-mortem* signs are those of asphyxia. The treatment is to empty the stomach by tube or by a *non-depressant* emetic. The physiological antidotes are atropine and digitalin or strophanthin, which should be injected subcutaneously in maximal doses. Alcohol, strychnine and warmth must also be employed.

ACONTIUS (Gr. *Akontios*), in Greek legend, a beautiful youth of the island of Ceos, the hero of a love-story told by Callimachus in a poem now lost, which forms the subject of two of Ovid's *Heroides* (xx., xxi.). During the festival of Artemis at Delos, Acontius saw Cydippe, a well-born Athenian maiden of whom he was enamoured, sitting in the temple of the goddess. He wrote on an apple the words, "I swear by the sacred shrine of the goddess that I will marry you," and threw it at her feet. She picked it up, and mechanically read the words aloud, which amounted to a solemn undertaking to carry them out. Unaware of this, she treated Acontius with contempt; but, although she was betrothed more than once, she always fell ill before the wedding took place. The Delphic oracle at last declared the cause of her illnesses to be the wrath of the offended goddess; whereupon her father consented to her marriage with Acontius (Aristaenetus, *Epistolae*, i. 10; Antoninus Liberalis, *Metamorphoses*, i., tells the story with different names).

ACORN, the fruit of the oak-tree; a word also used, by analogy with the shape, in nautical language, for a piece of wood keeping the vane on the mast-head. The etymology of the word (earlier *akerne*, and *acharn*) is well discussed in the *New English Dictionary*. It is derived from a word (Goth. *akran*) which meant "fruit," originally "of the unenclosed land," and so of the most important forest produce, the oak. Chaucer speaks of "achornes of okes." By degrees, popular etymology connected the word both with "corn" and "oak-horn," and the spelling changed accordingly.

ACORUS CALAMUS, sweet-sedge or sweet-flag, a plant of the natural order Araceae, which shares with the Cuckoo Pint (*Arum*) the representation in Britain of that order of Monocotyledons. The name is derived from *acorus*, Gr. ἄκορος, the classical name for the plant. It was the *Calamus aromaticus* of the medieval druggists and perhaps of the ancients, though the latter has been referred by some to the Citron grass, *Andropogon Nardus*. The spice "Calamus" or "Sweet-cane" of the Scriptures, one of the ingredients of the holy anointing oil of the Jews, was perhaps one of the fragrant species of *Andropogon*. The plant is a herbaceous perennial with a long, branched root-stock creeping through the mud, about ¾ inch thick, with short joints and large brownish leaf-scars. At the ends of the branches are tufts of flat, sword-like, sweet-scented leaves 3 or 4 ft. long and about an inch wide, closely arranged in two rows as in the true Flag (*Iris*); the tall, flowering stems (scapes), which very much resemble the leaves, bear an apparently lateral, blunt, tapering spike of densely packed, very small flowers. A long leaf (spathe) borne immediately below the spike forms an apparent continuation of the scape, though really a lateral outgrowth from it, the spike of flowers being terminal. The plant has a wide distribution, growing in wet situations in the Himalayas, North America, Siberia and various parts of Europe, including England, and has been naturalized in Scotland and Ireland. Though regarded as a native in most counties of England at the present day, where it is now found thoroughly wild on sides of ditches, ponds and rivers, and very abundantly in some districts, it is probably not indigenous. It seems to have been spread in western and central Europe from about the end of the 16th century by means of botanic gardens. The botanist Clusius (Charles de l'Escluse or Lécluse, 1526–1609) first cultivated it at Vienna from a root received from Asia Minor in 1574, and distributed it to other botanists in central and western Europe, and it was probably introduced into England about 1596 by the herbalist Gerard. It is very readily propagated by means of its branching root-stock. It has an agreeable odour, and has been used medicinally. The starchy matter contained in its rhizome is associated with a fragrant oil, and it is used as hair-powder. Sir J. E. Smith (*Eng. Flora*, ii. 158, 2nd ed., 1828) mentions it as a popular remedy in Norfolk for ague. In India it is used as an insectifuge, and is administered in infantile diarrhoea. It is an ingredient in *pot-pourri*, is employed for flavouring beer and is chewed to clear the voice; and its volatile oil is employed by makers of snuff and aromatic vinegar. The rhizome of *Acorus Calamus* is sometimes adulterated with that of *Iris Pseudacorus*, which, however, is distinguishable by its lack of odour, a stringent taste and dark colour.

ACOSTA, JOSÉ DE (1539?–1600), Spanish author, was born at Medina del Campo about the year 1539. He joined the Jesuits in 1551, and in 1571 was sent as a missionary to Peru; he acted as provincial of his order from 1576 to 1581, was appointed theological adviser to the council of Lima in 1582, and in 1583 published a catechism in Quichua and Aymara—the first book printed in Peru. Returning to Spain in 1587, and placing himself at the head of the opposition to Acquaviva, Acosta was imprisoned in 1592–1593; on his submission in 1594 he became superior of the Jesuits at Valladolid, and in 1598 rector of the Jesuit college at Salamanca, where he died on the 15th of February 1600. His treatise *De natura novi orbis libri duo* (Salamanca, 1588–1589) may be regarded as the preliminary draft of his celebrated *Historia natural y moral de las Indias* (Seville, 1590) which was speedily translated into Italian (1596), French (1597), Dutch (1598), German (1601), Latin (1602) and English (1604). The *Historia* is in three sections: books I. and II. deal with generalities; books III. and IV. with the physical geography and natural history of Mexico and Peru; books V., VI. and VII. with the religious and political institutions of the aborigines. Apart from his sophistical defence of Spanish colonial policy, Acosta deserves high praise as an acute and diligent observer whose numerous new and valuable data are set forth in a vivid style. Among his other publications are *De procuranda salute Indorum libri sex* (Salamanca, 1588), *De Christo revelato libri novem* (Rome, 1590), *De temporibus novissimis libri quatuor* (Rome, 1590), and three volumes of sermons issued respectively in 1596, 1597 and 1599.

Authorities.—José R. Carricido, *El P. José de Acosta y su importancia en la literatura científica española* (Madrid, 1899); C. Sommervogel, *Bibliothèque de la Compagnie de Jésus, Première Partie* (Brussels and Paris, 1890), vol. i., col. 31–42; and Edward Grimston's translation of the *Historia* reprinted (1880) for the Hakluyt Society with introduction and notes by Sir Clements R. Markham. (J. F.-K.)

ACOSTA, URIEL (d. 1647), a Portuguese Jew of noble family, was born at Oporto towards the close of the 16th century. His father being a convert to Christianity, Uriel was brought up in the Roman Catholic faith, and strictly observed the rites of the church till the course of his inquiries led him, after much painful doubt, to abandon the religion of his youth for Judaism. Passing over to Amsterdam, he was received into the synagogue, having his name changed from Gabriel to Uriel. His wayward disposition found, however, no satisfaction in the Jewish fold. He came into conflict with the authorities of the synagogue and was excommunicated. Unlike Spinoza (who was about fifteen at the time of Acosta's death), Acosta was not strong enough to stand alone. Wearied by his melancholy isolation, he was driven to seek a return to the Jewish communion. Having recanted his heresies, he was readmitted after an excommunication of fifteen years, but was soon excommunicated a second time. After seven years of exclusion, he once more sought admission, and, on passing through a humiliating penance, was again received. His vacillating autobiography, *Exemplar Humanae Vitae*, was published with a "refutation" by Limborch in 1687, and republished in 1847. In this brief work Acosta declares his opposition both to Christianity and Judaism, though he speaks with the more bitterness of the latter religion. The only authority which he admits is the *lex naturae*. Acosta was not an original thinker, but he stands in the direct line of the rational Deists. His history forms the subject of a tale and of a tragedy by Gutzkow. Acosta committed suicide in 1647. The significance of his career has been much exaggerated.

ACOTYLEDONES, the name given by Antoine Laurent de Jussieu in 1789 to the lowest class in his Natural System of Botany, embracing flowerless plants, such as ferns, lycopods, horse-tails, mosses, liverworts, sea-weeds, lichens and fungi. The name is derived from the absence of a seed-leaf or cotyledon. Flowering plants bear a seed containing an embryo, with usually one or two cotyledons, or seed-leaves; while in flowerless plants there is no seed and therefore no true cotyledon. The term is synonymous with Cryptogams, by which it was replaced in later systems of classification.

ACOUSTICS (from the Gr. ἀκούειν to hear), a title frequently given to the science of sound, that is, to the description and theory of the phenomena which give rise to the sensation of sound (*q.v.*). The term "acoustics" might, however, with advantage be reserved for the aspect of the subject more immediately connected with hearing. Thus we may speak appropriately of the acoustic quality of a room or hall, describing it as good or bad acoustically, according as speaking is heard in it easily or with difficulty. When a room has bad acoustic quality we can almost always assign the fault to large smooth surfaces on the walls, floor or ceiling, which reflect or echo the voice of the speaker so that the direct waves sent out by him at any instant are received by a hearer with the waves sent out previously and reflected at these smooth surfaces. The syllables overlap, and the hearing is confused. The acoustic quality of a room may be improved by breaking up the smooth surfaces by curtains or by arrangement of furniture. The echo is then broken up into small waves, none of which may be sufficiently distinct to interfere with the direct voice. Sometimes a sounding-board over the head of a speaker improves the hearing probably by preventing echo from a smooth wall behind him. A large bare floor is undoubtedly bad for acoustics, for when a room is filled by an audience the hearing is much improved.

Wires are frequently stretched across a room overhead, probably with the idea that they will prevent the voice from reaching the roof and being reflected there, but there is no reason to suppose that they are efficient. The only cure appears to consist in breaking up the reflecting surfaces so that the reflexion shall be much less regular and distinct. Probably drapery assists by absorbing the sound to some extent, and thus it lessens the echo besides breaking it up. (J. H. P.)

ACQUI, a city and episcopal see of Piedmont, Italy, in the province of Alessandria; from the town of that name it is 21 m. S.S.W. by rail. Pop. (1901) 13,786. Its warm sulphur springs are still resorted to; under the name of Aquae Statiellae they were famous in Roman times, and Paulus Diaconus and Liutprand speak of the ancient bath establishment. In the neighbourhood of the town are remains of the aqueduct which supplied it. The place was connected by road with Alba Pompeia and Augusta Taurinorum. The tribe of the Statielli, to whom the district belonged, had joined the Romans at an early period, but was attacked in 173 and in part transferred to the north of the Po. The town possesses a fine Gothic cathedral.

ACRÉ, or AQUIRY, a river of Brazil and principal tributary of the Purús, rising on the Bolivian frontier and flowing easterly and northerly to a junction with the Purús at 8° 45′ S. lat. The name is also applied to a district situated on the same river and on the former (1867) boundary line between Bolivia and Brazil. The region, which abounds in valuable rubber forests, was settled by Bolivians between 1870 and 1878, but was invaded by Brazilian rubber collectors during the next decade and became tributary to the rubber markets of Manáos and Pará. In 1899 the Bolivian government established a custom-house at Puerto Alonso, on the Acré river, for the collection of export duties on rubber, which precipitated a conflict with the Brazilian settlers and finally brought about a boundary dispute between the two republics. In July 1899 the Acreanos declared their independence and set up a republic of their own, but in the following March they were reduced to submission by Brazil. Various disorders followed until Brazil decided to occupy Puerto Alonso with a military force. The boundary dispute was finally settled at Petropolis on the 17th of November 1903 through the purchase by Brazil of the rubber-producing territory south to about the 11th parallel, estimated at more than 60,000 sq. m.

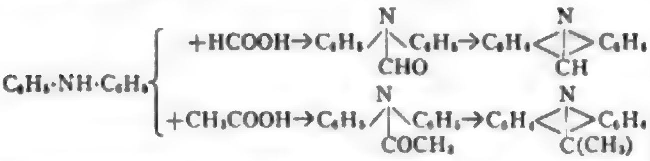
ACRE, *'Akka*, or ST JEAN D'ACRE, the chief town of a governmental district of Palestine which includes Haifa, Nazareth and Tiberias. It stands on a low promontory at the northern extremity of the Bay of Acre, 80 m. N.N.W. from Jerusalem, and 25 m. S. of Tyre. The population is about 11,000; 8000 being Moslems, the remainder Christians, Jews, &c. It was long regarded as the "Key of Palestine," on account of its commanding position on the shore of the broad plain that joins the inland plain of Esdraelon, and so affords the easiest entrance to the interior of the country. But trade is now passing over to Haifa, at the south side of the bay, as its harbour offers a safer roadstead, and is a regular calling-place for steamers. Business, rapidly declining, is still carried on in wheat, maize, oil, sesame, &c., in the town market. There are few buildings of interest, owing to the frequent destructions the town has undergone. The wall, which is now ruinous and has but one gate, dates from the crusaders: the mosque was built by Jezzar Pasha (d. 1804) from materials taken from Caesarea Palaestina: his tomb is within. Acre is the seat of the head of the Babist religion.

History.—Few towns have had a more chequered or calamitous history. Of great antiquity, it is probably to be identified with the *'Aäk* of the tribute-lists of Tethmosis (Thothmes) III. (*c.* 1500 B.C.), and it is certainly the *Akka* of the Tell el-Amarna correspondence. To the Hebrews it was known as *Acco* (Revised Version spelling), but it is mentioned only once in the Old Testament, namely Judges i. 31, as one of the places from which the Israelites did not drive out the Canaanite inhabitants. Theoretically it was in the territory of the tribe of Asher, and Josephus assigns it by name to the district of one of Solomon's provincial governors. Throughout the period of Hebrew domination, however, its political connexions were always with Syria rather than with Palestine proper: thus, about 725 B.C. it joined Sidon and Tyre in a revolt against Shalmaneser IV. It had a stormy experience during the three centuries preceding the Christian era. The Greek historians name it *Ake* (Josephus calls it also *Akre*); but the name was changed to *Ptolemais*, probably by Ptolemy Soter, after the partition of the kingdom of Alexander. Strabo refers to the city as once a rendezvous for the Persians in their expeditions against Egypt. About 165 B.C. Simon Maccabaeus defeated the Syrians in many battles in Galilee, and drove them into Ptolemais. About 153 B.C. Alexander Balas, son of Antiochus Epiphanes, contesting the Syrian crown with Demetrius, seized the city, which opened its gates to him. Demetrius offered many bribes to the Maccabees to obtain Jewish support against his rival, including the revenues of Ptolemais for the benefit of the Temple, but in vain. Jonathan threw in his lot with Alexander, and in 150 B.C. he was received by him with great honour in Ptolemais. Some years later, however, Tryphon, an officer of the Syrians, who had grown suspicious of the Maccabees, enticed Jonathan into Ptolemais and there treacherously took him prisoner. The city was also assaulted and captured by Alexander Jannaeus, by Cleopatra and by Tigranes. Here Herod built a gymnasium, and here the Jews met Petronius, sent to set up statues of the emperor in the Temple, and persuaded him to turn back. St Paul spent a day in Ptolemais. The Arabs captured the city in A.D. 638, and lost it to the crusaders in 1110. The latter made the town their chief port in Palestine. It was re-taken by Saladin in 1187, besieged by Guy de Lusignan in 1189 (see below), and again captured by Richard Cœur de Lion in 1191. In 1229 it was placed under the control of the knights of St John (whence one of its alternative names), but finally lost by the Franks in 1291. The Turks under Sultan Selim I. captured the city in 1517, after which it fell into almost total decay. Maundrell in 1697 found it a complete ruin, save for a khan occupied by some French merchants, a mosque and a few poor cottages. Towards the end of the 18th century it seems to have revived under the comparatively beneficent rule of Dhahar el-Amîr, the local sheikh: his successor, Jezzar Pasha, governor of Damascus, improved and fortified it, but by heavy imposts secured for himself all the benefits derived from his improvements. About 1780 Jezzar peremptorily banished the French trading colony, in spite of protests from the French government, and refused to receive a consul. In 1799 Napoleon, in pursuance of his scheme for raising a Syrian rebellion against Turkish domination, appeared before Acre, but after a siege of two months (March–May) was repulsed by the Turks, aided by Sir W. Sidney Smith and a force of British sailors. Jezzar was succeeded on his death by his son Suleiman, under whose milder rule the town advanced in prosperity till 1831, when Ibrahim Pasha besieged and reduced the town and destroyed its buildings. On the 4th of November 1840 it was bombarded by the allied British, Austrian and French squadrons, and in the following year restored to Turkish rule.

Battle of Acre.—The battle of 1189, fought on the ground to the west of Acre, affords a good example of battles of the Crusades. The crusading army under Guy of Lusignan, king of Jerusalem, which was besieging Acre, gave battle on the 4th of October 1189 to the relieving army which Saladin had collected. The Christian army consisted of the feudatories of the kingdom of Jerusalem, numerous small contingents of European crusaders and the military orders, and contingents from Egypt, Turkestan, Syria and Mesopotamia fought under Saladin. The Saracens lay in a semicircle west of the town facing inwards towards Acre. The Christians opposed them with crossbowmen in first line and the heavy cavalry in second. At Arsuf the Christians fought coherently; here the battle began with a disjointed combat between the Templars and Saladin's right wing. The crusaders were so far successful that the enemy had to send up reinforcements from other parts of the field. Thus the steady advance of the Christian centre against Saladin's own corps, in which the crossbows prepared the way for the charge of the men-at-arms, met with no great resistance. But the victors scattered to plunder. Saladin rallied his men, and, when the Christians began to retire with their booty, let loose his light horse upon them. No connected resistance was offered, and the Turks slaughtered the fugitives until checked by the fresh troops of the Christian right wing. Into this fight Guy's reserve, charged with holding back the Saracens in Acre, was also drawn, and, thus freed, 5000 men sallied out from the town to the northward; uniting with the Saracen right wing, they fell upon the Templars, who suffered severely in their retreat. In the end the crusaders repulsed the relieving army, but only at the cost of 7000 men. (R. A. S. M.)

ACRE, a land measure used by English-speaking races. Derived from the Old Eng. *acer* and cognate with the Lat. *ager*, Gr. ἀγρός, Sans. *ajras*, it has retained its original meaning "open country," in such phrases as "God's acre," or a churchyard, "broad acres," &c. As a measure of land, it was first defined as the amount a yoke of oxen could plough in a day; statutory values were enacted in England by acts of Edward I., Edward III., Henry VIII. and George IV., and the Weights and Measures Act 1878 now defines it as containing 4840 sq. yds. In addition to this "statute" or "imperial acre," other "acres" are still, though rarely, used in Scotland, Ireland, Wales and certain English counties. The Scottish acre contains 6150·4 sq. yds.; the Irish acre 7840 sq. yds.; in Wales, the land measures *erw* (4320 sq. yds.), *stang* (3240 sq. yds.) and *paladr* are called "acres"; the Leicestershire acre (2308¼ sq. yds.), Westmoreland acre (6760 sq. yds.) and Cheshire acre (10,240 sq. yds.) are examples of local values.

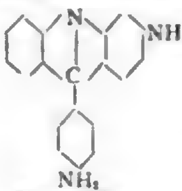
ACRIDINE, $C_{13}H_9N$, in chemistry, a heterocyclic ring compound found in crude coal-tar anthracene. It may be separated by shaking out with dilute sulphuric acid, and then precipitating the sulphuric acid solution with potassium bichromate, the resulting acridine bichromate being decomposed by ammonia. It was first isolated in 1890 by C. Graebe and H. Caro (*Ann.*, 1871, 158, p. 265). Many synthetic processes are known for the production of acridine and its derivatives. A. Bernthsen (*Ann.*, 1884, 224, p. 1) condensed diphenylamine with fatty acids, in the presence of zinc chloride. Formic acid yields acridine, and the higher homologues give derivatives substituted at the *meso* carbon atom,



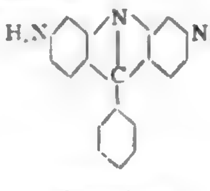
$$C_6H_5{\cdot}NH{\cdot}C_6H_5\begin{cases}+HCOOH\rightarrow C_6H_5\overset{N}{\underset{CHO}{/|\backslash}}C_6H_5\rightarrow C_6H_4<\overset{N}{\underset{CH}{|}}>C_6H_4\\ +CH_3COOH\rightarrow C_6H_5\overset{N}{\underset{COCH_3}{/|\backslash}}C_6H_5\rightarrow C_6H_4<\overset{N}{\underset{C(CH_3)}{|}}>C_6H_4\end{cases}$$

Acridine may also be obtained by passing the vapour of phenyl-ortho-toluidine through a red-hot tube (C. Graebe, *Ber.*, 1884, 17, p. 1370); by condensing diphenylamine with chloroform, in presence of aluminium chloride (O. Fischer, *Ber.*, 1884, 17, p. 102); by passing the vapours of orthoaminodiphenylmethane over heated litharge (O. Fischer); by heating salicylic aldehyde with aniline and zinc chloride to 260° C. (R. Mohlau, *Ber.*, 1886, 19, p. 2452); and by distilling acridone over zinc dust (C. Graebe, *Ber.*, 1892, 25, p. 1735).

Acridine and its homologues are very stable compounds of feebly basic character. They combine readily with the alkyl iodides to form alkyl acridinium iodides, which are readily transformed by the action of alkaline potassium ferricyanide to N-alkyl acridones. Acridine crystallizes in needles which melt at 110° C. It is characterized by its irritating action on the skin, and by the blue fluorescence shown by solutions of its salts. On oxidation with potassium permanganate it yields acridinic acid (quinoline -α-β-dicarboxylic acid) $C_9H_5N(COOH)_2$. Numerous derivatives of acridine are known and may be prepared by methods analogous to those used for the formation of the parent base. For the preparation of the naphthacridines, see F. Ullmann, German Patents 117472, 118439, 127586, 128754, and also *Ber.*, 1902, 35, pp. 316, 2670. Phenyl-acridine is the parent base of chrysaniline, which is the chief constituent of the dye-stuff phosphine (a bye-product in the manufacture of rosaniline). Chrysaniline (diamino-phenylacridine) forms red-coloured salts, which dye silk and wool a fine yellow; and the solutions of the salts are characterized by their fine yellowish-green fluorescence. It was synthesized by O. Fischer and G. Koerner (*Ber.*, 1884, 17, p. 203) by condensing ortho-nitrobenzaldehyde with aniline, the resulting ortho-nitro-para-diamino-triphenylmethane being reduced to the corresponding orthoamino compound, which on oxidation yields chrysaniline. Benzoflavin, an isomer of chrysaniline, is also a dye-stuff, and has been prepared by K. Oehler (English Patent 9614) from meta-phenylenediamine and benzaldehyde. These substances condense to form tetra-aminotriphenylmethane, which, on heating with acids, loses ammonia and yields diaminodihydrophenylacridine, from which benzoflavin is obtained by oxidation. It is a yellow powder, soluble in hot water. The formulae of these substances are:—



Chrysaniline.



Benzoflavin.

ACRO (or Acron), **HELENIUS,** Roman grammarian and commentator, probably flourished at the end of the 2nd century A.D. He wrote commentaries on Terence and perhaps Persius. A collection of scholia on Horace, originally anonymous in the earlier MSS., and on the whole not of great value, was wrongly attributed to him at a much later date, probably during the 15th century. It has been published by Pauly (1861) and Hauthal (1866), together with the other Horace scholia.

See *Pseudoacronis Scholia in Horatium Vetustiora*, ed. O. Keller (1902–1904).

ACROBAT (Gr. ἀκροβατεῖν, to walk on tiptoe), originally a rope-dancer; the word is now used generally to cover professional performers on the trapeze, &c., contortionists, balancers and tumblers. Evidence exists that there were very skilful performers on the tight-rope (*funambuli*) among the ancient Romans. Modern rope-walkers (*e.g.* Blondin) or wire-dancers generally use a pole, loaded at the ends, or some such assistance in balancing, and by shifting this are enabled to maintain, or readily to recover, their equilibrium.

ACROGENAE ("growing at the apex"), an obsolete botanical term, originally applied to the higher Cryptogams (mosses and ferns), which were erroneously distinguished from the lower (Algae and Fungi) by apical growth of the stem. The lower Cryptogams were contrasted as Amphigenae ("growing all over"), a misnomer, as apical growth is common among them.

ACROLITHS (Gr. ἀκρόλιθοι, *i.e.* ending in stone), statues of a transition period in the history of plastic art, in which the trunk of the figure was of wood, and the head, hands and feet of marble. The wood was concealed either by gilding or, more commonly, by drapery, and the marble parts alone were exposed. Acroliths are frequently mentioned by Pausanias, the best known specimen being the Athene Areia of the Plataeans.

ACROMEGALY, the name given to a disease characterized by a true hypertrophy (an overgrowth involving both bony and soft parts) of the terminal parts of the body, especially of the face and extremities (Gr. ἄκρον, point, and μέγας, large). It is more frequent in the female sex, between the ages of 25 and 40. Its causation is generally associated with disturbances in the pituitary gland, and an extract of this body has been tried in the treatment, as one of the recent developments in organotherapeutics; thyroid extract has also been used, but without marked success, on the apparent analogy of acromegaly with myxoedema.

ACRON, a Greek physician, born at Agrigentum in Sicily, was contemporary with Empedocles, and must therefore have lived in the 5th century before Christ. The successful measure of lighting large fires, and purifying the air with perfumes, to put a stop to the plague in Athens (430 B.C.), is said to have originated with him; but this has been questioned on chronological grounds. Suidas gives the titles of several medical works written by him in the Doric dialect.

ACROPOLIS (Gr. *ἄκρος*, top, *πόλις*, city), literally the upper part of a town. For purposes of defence early settlers naturally chose elevated ground, frequently a hill with precipitous sides, and these early citadels became in many parts of the world the nuclei of large cities which grew up on the surrounding lower ground. The word Acropolis, though Greek in origin and associated primarily with Greek towns (Athens, Argos, Thebes, Corinth), may be applied generically to all such citadels (Rome, Jerusalem, many in Asia Minor, or even Castle Hill at Edinburgh). The most famous is that of Athens, which, by reason of its historical associations and the famous buildings erected upon it, is generally known without qualification as *the* Acropolis (see ATHENS).

ACROPOLITA (AKROPOLITĒS), **GEORGE** (1217–1282), Byzantine historian and statesman, was born at Constantinople. At an early age he was sent by his father to the court of John Ducas Batatzes (Vatatzes), emperor of Nicaea, by whom and by his successors (Theodorus II. Lascaris and Michael VIII. Palaeologus) he was entrusted with important state missions. The office of "great logothete" or chancellor was bestowed upon him in 1244. As commander in the field in 1257 against Michael Angelus, despot of Epirus, he showed little military capacity. He was captured and kept for two years in prison, from which he was released by Michael Palaeologus. Acropolita's most important political task was that of effecting a reconciliation between the Greek and Latin Churches, to which he had been formerly opposed. In 1273 he was sent to Pope Gregory X., and in the following year, at the council of Lyons, in the emperor's name he recognized the spiritual supremacy of Rome. In 1282 he was sent on an embassy to John II., emperor of Trebizond, and died in the same year soon after his return. His historical work (Χρονικὴ Συγγραφή, *Annales*) embraces the period from the capture of Constantinople by the Latins (1204) to its recovery by Michael Palaeologus (1261), thus forming a continuation of the work of Nicetas Acominatus. It is valuable as written by a contemporary, whose official position as great logothete, military commander and confidential ambassador afforded him frequent opportunities of observing the course of events. Acropolita is considered a trustworthy authority as far as the statement of facts is concerned, and he is easy to understand, although he exhibits special carelessness in the construction of his sentences. He was also the author of several shorter works, amongst them being a funeral oration on John Batatzes, an epitaph on his wife Eirene and a panegyric of Theodorus II. Lascaris of Nicaea. While a prisoner at Epirus he wrote two treatises on the procession of the Holy Ghost (Ἐκπόρευσις, *Processio Spiritus Sancti*).

Editio princeps by Leo Allatius (1651), with the editor's famous treatise *De Georgiis eorumque Scriptis*; editions in the Bonn *Corpus Scriptorum Hist. Byz.*, by I. Bekker (1836), and Migne, *Patrologia Graeca*, cxl.; in the Teubner series by A. Heisenberg (1903), the second volume of which contains a full life, with bibliography; see also C. Krumbacher, *Geschichte der byzantinischen Litteratur* (1897).

ACROSTIC (Gr. *ἄκρος*, at the end, and *στίχος*, line or verse), a short verse composition, so constructed that the initial letters of the lines, taken consecutively, form words. The fancy for writing acrostics is of great antiquity, having been common among the Greeks of the Alexandrine period, as well as with the Latin writers since Ennius and Plautus, many of the arguments of whose plays were written with acrostics on their respective titles. One of the most remarkable acrostics was contained in the verses cited by Lactantius and Eusebius in the 4th century, and attributed to the Erythraean sibyl, the initial letters of which form the words Ἰησοῦς Χριστὸς Θεοῦ υἱὸς σωτήρ: "Jesus Christ, the Son of God, the Saviour." The initials of the shorter form of this again make up the word ἰχθύς (fish), to which a mystical meaning has been attached (Augustine, *De Civitate Dei*, 18, 23), thus constituting another kind of acrostic.

The monks of the middle ages, who wrote in Latin, were fond of acrostics, as well as the poets of the Middle High German period, notably Gottfried of Strassburg and Rudolph of Ems. The great poets of the Italian renaissance, among them Boccaccio, indulged in them, as did also the early Slavic writers. Sir John Davies (1569–1626) wrote twenty-six elegant *Hymns to Astraea*, each an acrostic on "Elisabetha Regina"; and Mistress Mary Fage, in *Fame's Roule*, 1637, commemorated 420 celebrities of her time in acrostic verses. The same trick of composition is often to be met with in the writings of more recent versifiers. Sometimes the lines are so combined that the final letters as well as the initials are significant. Edgar Allan Poe worked two names—one of them that of Frances Sargent Osgood—into verses in such a way that the letters of the names corresponded to the first letter of the first line, the second letter of the second, the third letter of the third, and so on.

Acrostic verse has always been held in slight estimation from a literary standpoint. Dr Samuel Butler says, in his "Character of a Small Poet," "He uses to lay the outsides of his verses even, like a bricklayer, by a line of rhyme and acrostic, and fill the middle with rubbish." Addison (*Spectator*, No. 60) found it impossible to decide whether the inventor of the anagram or the acrostic were the greater blockhead; and, in describing the latter, says, "I have seen some of them where the verses have not only been edged by a name at each extremity, but have had the same name running down like a seam through the middle of the poem." And Dryden, in *Mac Flecknoe*, scornfully assigned Shadwell the rule of

Some peaceful province in acrostic land.

The name acrostic is also applied to alphabetical or "abecedarian" verses. Of these we have instances in the Hebrew psalms (*e.g.* Ps. xxv. and xxxiv.), where successive verses begin with the letters of the alphabet in their order. The structure of Ps. cxix. is still more elaborate, each of the verses of each of the twenty-two parts commencing with the letter which stands at the head of the part in our English translation.

At one period much religious verse was written in a form imitative of this alphabetical method, possibly as an aid to the memory. The term acrostic is also applied to the formation of words from the initial letters of other words. Ἰχθύς, referred to above, is an illustration of this. So also is the word "Cabal," which, though it was in use before, with a similar meaning, has, from the time of Charles II., been associated with a particular ministry, from the accident of its being composed of Clifford, Ashley, Buckingham, Arlington and Lauderdale. Akin to this are the names by which the Jews designated their Rabbis; thus Rabbi Moses ben Maimon (better known as Maimonides) was styled "Rambam," from the initials R.M.B.M.; Rabbi David Kimchi (R.D.K.), "Radak," &c.

Double acrostics are such as are so constructed, that not only initial letters of the lines, but also the middle or last letters, form words. For example:—1. By Apollo was my first made. 2. A shoemaker's tool. 3. An Italian patriot. 4. A tropical fruit. The initials and finals, read downwards, give the name of a writer and his *nom de plume*. Answer: *Lamb, Elia*.

1. L yr E
2. A w L
3. M azzin I
4. B anan A

ACROTERIUM (Gr. *ἀκρωτήριον*, the summit or vertex), in architecture, a statue or ornament of any kind placed on the apex of a pediment. The term is often restricted to the plinth, which forms the podium merely for the acroterium.

ACT (Lat. *actus*, *actum*), something done, primarily a voluntary deed or performance, though any accomplished fact is often included. The signification of the word varies according to the sense in which it is employed. It is often synonymous with "statute" (see ACT OF PARLIAMENT). It may also refer to the result of the vote or deliberation of any legislature, the decision of a court of justice or magistrate, in which sense records, decrees, sentences, reports, certificates, &c., are called acts.

In law it means any instrument in writing, for declaring or justifying the truth of a bargain or transaction, as: "I deliver this as my act and deed." The origin of the legal use of the word "act" is in the *acta* of the Roman magistrates or people, of their courts of law, or of the senate, meaning (1) what was done before the magistrates, the people or the senate; (2) the records of such public proceedings.

In connexion with other words "act" is employed in many phrases, e.g. *act of God*, any event, such as the sudden, violent or overwhelming occurrence of natural forces, which cannot be foreseen or provided against. This is a good defence to a suit for non-performance of a contract. *Act of honour* denotes the acceptance by a third party of a protested bill of exchange for the honour of any party thereto. *Act of grace* denotes the granting of some special privilege.

In universities, the presenting and publicly maintaining a thesis by a candidate for a degree, to show his proficiency, is an act. "*The* Act" at Oxford, up to 1856 when it was abolished, was the ceremony held early in July for this purpose, and the expressions "Act Sunday," "Act Term" still survive.

In dramatic literature, *act* signifies one of those parts into which a play is divided to mark the change of time or place, and to give a respite to the actors and to the audience. In Greek plays there are no separate acts, the unities being strictly observed, and the action being continuous from beginning to end. If the principal actors left the stage the chorus took up the argument, and contributed an integral part of the play, though chiefly in the form of comment upon the action. When necessary, another *drama*, which is etymologically the same as an *act*, carried on the history to a later time or in a different place, and thus we have the Greek trilogies or groups of three dramas, in which the same characters reappear. The Roman poets first adopted the division into acts, and suspended the stage business in the intervals between them. Their number was usually five, and the rule was at last laid down by Horace in the *Ars Poetica*—

> Neve minor, neu sit quinto productior actu
> Fabula, quae posci vult, et spectata reponi.
> "If you would have your play deserve success,
> Give it five acts complete, nor more nor less." (*Francis.*)

On the revival of letters this rule was almost universally observed by dramatists, and that there is an inherent convenience and fitness in the number five is evident from the fact that Shakespeare, who refused to be trammelled by merely arbitrary rules, adopts it in all his plays. Some critics have laid down rules as to the part each act should sustain in the development of the plot, but these are not essential, and are by no means universally recognized. In comedy the rule as to the number of acts has not been so strictly adhered to as in tragedy, a division into two acts or three acts being quite usual since the time of Molière, who first introduced it. It may be well to mention here Milton's *Samson Agonistes* as a specimen in English literature of a dramatic work founded on a purely Greek model, in which, consequently, there is no division into acts.

For "acting," as the art and theory of dramatic representation (or *histrionics*, from Lat. *histrio*, an actor), see the article Drama.

ACTA DIURNA (Lat. *acta*, public acts or records; *diurnus*, daily, from *dies*), called also *Acta Populi*, *Acta Publica* and simply *Acta* or *Diurna*, in ancient Rome a sort of daily gazette, containing an officially authorized narrative of noteworthy events at Rome. Its contents were partly official (court news, decrees of the emperor, senate and magistrates), partly private (notices of births, marriages and deaths). Thus to some extent it filled the place of the modern newspaper (*q.v.*). The origin of the *Acta* is attributed to Julius Caesar, who first ordered the keeping and publishing of the acts of the people by public officers (59 B.C.; Suetonius, *Caesar*, 20). The *Acta* were drawn up from day to day, and exposed in a public place on a whitened board (see Album). After remaining there for a reasonable time they were taken down and preserved with other public documents, so that they might be available for purposes of research. The *Acta* differed from the Annals (which were discontinued in 133 B.C.) in that only the greater and more important matters were given in the latter, while in the former things of less note were recorded. Their publication continued till the transference of the seat of the empire to Constantinople. There are no genuine fragments extant.

Leclerc, *Des journaux chez les Romains* (1838); Renssen, *De Diurnis aliisque Romanorum Actis* (1857); Hübner, *De Senatus Populique Romani Actis* (1860); Gaston Boissier, *Tacitus and other Roman Studies* (Eng. trans., W. G. Hutchison, 1906), pp. 197-229.

ACTAEON, son of Aristaeus and Autonoë, a famous Theban hero and hunter, trained by the centaur Cheiron. According to the story told by Ovid (*Metam.* iii. 131; see also Apollod iii. 4), having accidentally seen Artemis (Diana) on Mount Cithaeron while she was bathing, he was changed by her into a stag, and pursued and killed by his fifty hounds. His statue was often set up on rocks and mountains as a protection against excessive heat. The myth itself probably represents the destruction of vegetation during the fifty dog-days. Aeschylus and other tragic poets made use of the story, which was a favourite subject in ancient works of art. There is a well-known small marble group in the British Museum illustrative of the story.

ACTA SENATUS, or Commentarii Senatus, minutes of the discussions and decisions of the Roman senate. Before the first consulship of Julius Caesar (59 B.C.), minutes of the proceedings of the senate were written and occasionally published, but unofficially; Caesar, desiring to tear away the veil of mystery which gave an unreal importance to the senate's deliberations, first ordered them to be recorded and issued authoritatively. The keeping of them was continued by Augustus, but their publication was forbidden (Suetonius, *Augustus*, 36). A young senator (*ab actis senatus*) was chosen to draw up these Acta, which were kept in the imperial archives and public libraries (Tacitus, *Ann.* v. 4). Special permission from the city praefect was necessary in order to examine them. For authorities see Acta Diurna.

ACTINOMETER (Gr. *ἀκτίς*, ray, *μέτρον*, measure), an instrument for measuring the heating and chemical effects of light. The name was first given by Sir John Herschel to an apparatus for measuring the heating effect of solar rays (*Edin. Journ. Science*, 1825); Herschel's instrument has since been discarded in favour of the pyrheliometer (Gr. πῦρ, fire, ἥλιος, sun). (See Radiation.) The word actinometer is now usually applied to instruments for measuring the *actinic* or chemical effect of luminous rays; their action generally depends upon photochemical changes (see Photo-Chemistry). Certain practical forms are described in the article Photography.

ACTINOMYCOSIS (Streptotrichosis), a chronic infective disease occurring in both cattle and man. In both these groups it presents the same clinical course, being characterized by chronic inflammation with the formation of granulomatous tumours, which tend to undergo suppuration, fibrosis or calcification. It used to be believed that this disease was caused by a single vegetable parasite, the Ray-Fungus, but there is now an overwhelming mass of observations to show that the clinical features may be produced by a number of different species of parasites, for which the generic name Streptothrix has been generally adopted. In 1899 the committee of the Pathological Society of London recommended that the term Streptotrichosis should be used as the appropriate clinical epithet of the large class of Streptothrix infections. And since that year the name Actinomycosis has been falling into disuse, and in any case is only used synonymously with Streptotrichosis. For a further account of these parasites see the articles on Bacteriology and on Parasitic Diseases.

Pathological Anatomy.—The naked-eye appearance of the different organs affected by Streptothrix infection varies according to the duration and acuteness of the disease. In some tissues the appearance is that of simple inflammation, whereas in others it may be characteristic. The liver when affected shows scattered foci of suppuration, which may become aggregated into spheroidal masses, surrounded by a zone of inflammation. In the lungs the changes may be any that are produced by the following conditions. (1) An acute bronchitis. (2) A phthisical lung, grey nodules being scattered here and there almost exactly simulating tuberculous nodules. (3) An acute broncho-pneumonia with some interstitial fibrosis and a tendency to abscess formation. The most characteristic lesions are in the skin. These appear as nodules, sarcomatous-looking, soft and pulpy. Their colour is mottled, yellow and purplish red. The skin over them is thinned out, and broken down in places to form one or two crateriform ulcers from which a clear sticky fluid exudes. The size varies from that of a pea to a small orange. The pus is characteristic, varying in consistency though usually viscid, and containing numerous minute specks.

The disease is more common in males than in females, and more prevalent in Germany and Russia than in England. The infection is probably spread by grain (corn or barley), on which the fungus may often be found. In a great number of recorded cases the patient has been following agricultural pursuits. The disease can only be transmitted from one individual to another with considerable difficulty, and no case of direct transmission from animal to man has yet been noted.

Clinical History.—The course of actinomycosis is usually a chronic one, but occasionally the fungus gets into the blood, when the course is that of an acute infective disease or even pyaemia. The symptoms are entirely dependent on the organ attacked, and are in no way specially characteristic. During life a diagnosis of phthisis is continually made, and only a microscopic examination after death renders the true nature of the disease apparent. The nature of the skin lesion is the most evident, and here the parasite can be detected early in the illness. The only drug which appears to have any beneficial influence on the course of the disease is potassium iodide, and this has occasionally been used with great benefit. Surgical interference is usually needed, either excision of the part affected, or, where possible, a thorough scraping of the lesion and free application of antiseptics.

ACTINOZOA, a term in systematic zoology, first used by H. M. D. de Blainville about 1834, to designate animals the organs of which were disposed radially about a centre. De Blainville included in his group many unicellular forms such as *Noctiluca* (see PROTOZOA), sea-anemones, corals, jelly-fish and hydroid polyps, echinoderms, polyzoa and rotifera. T. H. Huxley afterwards restricted the term. He showed that in de Blainville's group there were associated with a number of heterogeneous forms a group of animals characterized by being composed of two layers of cells comparable with the first two layers in the development of vertebrate animals. Such forms he distinguished as Coelentera, and showed that they had no special affinity with echinoderms, polyzoa, &c. He divided the Coelentera into a group Hydrozoa, in which the sexually produced embryos were usually set free from the surface of the body, and a group Actinozoa, in which the embryos are detached from the interior of the body and escape generally by the oral aperture. Huxley's Actinozoa comprised the sea-anemones, corals and sea-pens, on the one hand, and the Ctenophora on the other. Later investigations, whilst confirming the general validity of Huxley's conclusions, have slightly altered the limits and definitions of his groups. (See ANTHOZOA, COELENTERA, CTENOPHORA and HYDROZOA.) (P. C. M.)

ACTION, in law, a term used by jurists in three different senses: (1) a right to institute proceedings in a court of justice to obtain redress for a wrong (*actio nihil aliud est quam jus prosequendi in judicio quod alicui debetur*, Bracton, *de Legibus Angliae*, bk. iii. ch. i., f. 98 *b*); (2) the proceeding itself (*action n'est auter chose que loyall demande de son droit*, Co. Litt. 285 (a)); (3) the particular form of the proceeding. The term is derived from the Roman law (*actio*), in which it is used in all three senses. In the history of Roman law, actions passed through three stages. The first period (terminated about 170 B.C. by the *Lex Aebutia*) is known as the system of *legis actiones*, and was based on the precepts of the XII. tables and used before the *praetor urbanus*. These *actiones* were five in number—*sacramenti, per judicis postulationem, per condictionem, per manus injectionem, per pignoris captionem*. The first was the primitive and characteristic action of the Roman law, and the others were little more than modes of applying it to cases not contemplated in the original form, or of carrying the result of it into execution when the action had been decided. The *legis actiones* were superseded by the *formulae*, originated by the *praetor peregrinus* for the determination of controversies between foreigners, but found more flexible than the earlier system and made available for citizens by the *Lex Aebutia*. Under both these systems the *praetor* referred the matter in dispute to an arbiter (*judex*), but in the later he settled the *formula* (*i.e.* the issues to be referred and the appropriate form of relief) before making the order of reference. In the third stage, the formulary stage fell into disuse, and after A.D. 342 the magistrate himself or his deputy decided the controversy after the defending party had been duly summoned by a *libellus*.

The classifications of *actiones* in Roman law were very numerous. The division which is still most universally recognized is that of actions *in rem* and actions *in personam* (Sohm, *Roman Law*, tr. by Ledlie, 2nd ed. 277). An action *in rem* asserts a right to a particular thing against all the world. An action *in personam* asserts a right only against a particular person. Perhaps the best modern example of the distinction is that made in maritime cases between an action against a ship after a collision at sea, and an action against the owners of the ship.

In English law the term "action" at a very early date became associated with civil proceedings in the Court of Common Pleas, which were distinguished from pleas of the crown, such as indictments or informations and for suits in the Court of Chancery or in the Admiralty or ecclesiastical courts. The English action was a proceeding commenced by writ original at the common law. The remedy was of right and not of grace. The history of actions is the history of civil procedure in the courts of common law. As a result of the reform of civil procedure by the Judicature Acts the term "action" in English law now means at the High Court of Justice "a civil proceeding commenced by writ of summons or in such other manner as may be prescribed by rules of court" (*e.g.* by *originating summons*). The proceeding thus commenced ends by judgment and execution. This definition includes proceedings under the Chancery, Admiralty and Probate jurisdiction of the High Court, but excludes proceedings commenced by petition, such as divorce suits and bankruptcy and winding-up matters, as well as criminal proceedings in the High Court or applications for the issue of the writs of *mandamus*, *prohibition*, *habeas corpus* or *certiorari*. The Judicature Acts and Rules have had the effect of abolishing all the forms of "action" used at the common law and of creating one common form of legal proceeding for all ordinary controversies between subjects in whatever division of the High Court. The stages in an English action are the *writ*, by which the persons against whom relief is claimed are summoned before the court; the *pleadings* and interlocutory steps, by which the issues between the parties are adjusted; the *trial*, at which the issues of fact and law involved are brought before the tribunal; the *judgment*, by which the relief sought is granted or refused; and *execution*, by which the law gives to the successful party the fruits of the judgment.

The procedure varies according as the action is in the High Court, a county court or one of the other local courts of record which still survive; but there is no substantial difference in the incidents of trial, judgment and execution in any of these courts. The initial difference between actions in the High Court and the county court is that the latter are commenced by plaint lodged in the court, on which a summons is prepared by the court and served by its bailiff, whereas in the High Court the party prepares the writ and lodges it in court for sealing, and when it is sealed, himself effects the service.

An action is said to "lie" when the law provides a remedy for some particular act or omission by a subject which infringes the legal rights of another subject. An act of such a character is said to give a "cause of action." In the action the person who alleges himself aggrieved claims a judgment of the court in his favour giving an adequate and appropriate remedy for the injury or damage which he has sustained by the infraction of his rights. As to the time within which an action must be brought, see LIMITATION, STATUTES OF. When the rights of a subject are infringed by the illegal action of the state, an action lies in England against the officers who have done the wrong, unless the claim be one arising out of breach of a contract with the state, or out of an "Act of State." For a breach by the state of a contract made between the state and a subject the remedy of the subject is, as a general rule, not by action against the agents of the state who acted for the state with reference to the making or breach of the contract, but against the Crown itself by the proceeding called Petition of Right (see PETITION).

While as a generic term "action" in its proper legal sense includes suits by the Crown and "criminal actions" (see Co. Litt. 284b; Bracton, *de Legibus Angliae*, bk. iii. ch. v. f. 1046; *Bradlaugh* v. *Clarke*, 1883, 8 App. Cas. 354, 361, 374), in popular language it is taken to mean a proceeding by a subject and is now rarely applied in England even by lawyers to criminal proceedings. What are now known as "penal actions," *i.e.* proceedings in which an individual who has not suffered personally by a breach of the law sues as a common informer for the statutory penalty either on his own benefit or on behalf also of the Crown (*qui tam pro rege quam pro se ipso*), bear some analogy to the *actio popularis* of Roman law, from which they are derived (see the statute 4 Hen. VII. 1488); but they are now treated for most purposes as civil and not as criminal proceedings. The law of Scotland follows the lines of the civil law, and the expression "criminal action" is in use to distinguish proceedings to punish offences against the public as distinguished from civil action, brought to enforce a private right.

In the United States, and the British colonies in which English law runs by settlement, charter, proclamation or statute, the nature of an action is substantially the same as in England. The differences between one state of the Union and another, and one colony and another, depend mainly on the extent to which the old procedure of the common law has been abolished, simplified or reformed by local legislation.

AUTHORITIES.—Roman Law: Sohm, *Institutes of Roman Law*, W. G. Ledlie (2nd ed., 1901). English Law: Pollock and Maitland, *English Law*; Holmes, *The Common Law*; Bullen and Leake, *Prec. Pleadings* (3rd ed.; 6th ed. 1905).

ACTIUM (mod. *Punta*), the ancient name of a promontory in the north of Acarnania (Greece) at the mouth of the Sinus Ambracius (Gulf of Arta) opposite Nicopolis, built by Augustus on the north side of the strait. On the promontory was an ancient temple of Apollo Actius, which was enlarged by Augustus, who also, in memory of the battle, instituted or renewed the quinquennial games called *Actia* or *Ludi Actiaci*. *Actiaca Aera* was a computation of time from the battle of Actium. There was on the promontory a small town, or rather village, also called *Actium*.

History.—Actium belonged originally to the Corinthian colonists of Anactorium, who probably founded the worship of Apollo Actius and the *Actia* games; in the 3rd century it fell to the Acarnanians, who subsequently held their synods there. Actium is chiefly famous as the site of Octavian's decisive victory over Mark Antony (2nd of September 31 B.C.). This battle ended a long series of ineffectual operations. The final conflict was provoked by Antony, who is said to have been persuaded by Cleopatra to retire to Egypt and give battle to mask his retreat; but lack of provisions and the growing demoralization of his army would sufficiently account for his decision. The fleets met outside the gulf, each over 200 strong (the totals given by ancient authorities are very conflicting). Antony's heavy battleships endeavoured to close and crush the enemy with their artillery; Octavian's light and mobile craft made skilful use of skirmishing tactics. During the engagement Cleopatra suddenly withdrew her squadron and Antony slipped away behind her. His flight escaped notice, and the conflict remained undecided, until Antony's fleet was set on fire and thus annihilated.

AUTHORITIES.—Dio Cassius, 50.12-51.3; Plutarch, *Antonius*, 62-68; Velleius Paterculus, ii. 84-85. C. Merivale, *History of the Romans under the Empire*, iii. pp. 313-325 (London, 1851); V. Gardthausen, *Augustus und seine Zeit*, i. pp. 369-386, ii. pp. 189-201 (Leipzig, 1891); G. Ferrero in the *Revue de Paris*, Mar. 15, 1906, pp. 225-243; J. Kromayer, in *Hermes*, xxxiv. (1899), pp. 1-54. (M. O. B. C.)

ACT OF PARLIAMENT. An act of parliament may be regarded as a declaration of the legislature, enforcing certain rules of conduct, or defining rights and conferring them upon or withholding them from certain persons or classes of persons. The collective body of such declarations constitutes the statutes of the realm or written law of the British nation, in the widest sense, from Anglo-Saxon times to the present day. It is not, however, till the earlier half of the 13th century that, in a more limited constitutional sense, the statute-book is generally held to open, and the parliamentary records only begin to assume distinct outlines late in the reign of Edward I. It gradually became a fixed constitutional principle that an act of parliament, to be valid, must express concurrently the will of the entire legislature. It was not, however, till the reign of Henry VI. that it became customary, as now, to introduce bills into parliament in the form of finished acts; and the enacting clause, regarded by constitutionalists as the first perfect assertion, in words, of popular right, came into general use as late as the reign of Charles II. It is thus expressed in the case of all acts other than those granting money to the crown:—"Be it enacted by the King's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal and Commons in this present Parliament assembled, and by the authority of the same." Where the act is a money grant the enacting clause is prefaced by the words, "Most gracious Sovereign, we, Your Majesty's most dutiful and loyal subjects, the Commons of the United Kingdom of Great Britain and Ireland, in Parliament assembled, towards making good the supply[1] which we have cheerfully granted to Your Majesty in this session of Parliament, have resolved to grant unto Your Majesty the sums hereinafter mentioned; and do therefore most humbly beseech Your Majesty that it may be enacted, &c." The use of the preamble with which acts are usually prefaced is thus quaintly set forth by Lord Coke: "The rehearsal or preamble of the statute is a good meane to find out the meaning of the statute, and, as it were, a key to open the understanding thereof" (Co. Litt. 79a). Originally the collective acts of each session formed but one statute, to which a general title was attached, and for this reason an act of parliament was up to 1892 generally cited as the chapter of a particular statute, *e.g.* 24 and 25 Vict. c. 101. Titles were, however, prefixed to individual acts as early as 1488. Now, by the Short Titles Act 1892, it is optional to cite most important acts up to that date by their short titles, either individually or collectively. Most modern acts have borne short titles independently of the act of 1892. (See PARLIAMENT; STATUTE.)

ACTON (JOHN EMERICH EDWARD DALBERG ACTON), 1ST BARON (1834–1902), English historian, only son of Sir Richard Acton, 7th baronet, and grandson of the Neapolitan admiral, Sir J. F. E. Acton, 6th baronet (*q.v.*), was born at Naples on the 10th of January 1834. His grandfather, who had succeeded in 1791 to the baronetcy and family estates in Shropshire, previously held by the English branch of the Acton family, represented a younger branch which had transferred itself first to France and then to Italy, but by the extinction of the elder branch the admiral became head of the family; his eldest son, Richard, had married Marie Louise Pelline, the daughter and heiress of Emerich Joseph, duc de Dalberg (*q.v.*), a naturalized French noble of ancient German lineage who had entered the French service under Napoleon and represented Louis XVIII. at the congress of Vienna in 1814, and after Sir Richard Acton's death in 1837 she became (1840) the wife of the 2nd Earl Granville. Coming of a Roman Catholic family, young Acton was educated at Oscott till 1848 under Dr (afterwards Cardinal) Wiseman, and then at Edinburgh, and at Munich under Döllinger, whose lifelong friend he became. He had wished to go to Cambridge, but for a Roman Catholic this was then impossible. By Döllinger he was inspired with a deep love of historical research and a profound conception of its functions as a critical instrument. He was a master of the chief foreign languages, and began at an early age to collect a magnificent historical library, with the object, never in fact realized, of writing a great History of Liberty. In politics he was always an ardent Liberal.

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[1] Where the grant is not of supply, the preamble varies a little, *e.g.* in the Prince of Wales's Children Act 1889.

Without being a notable traveller, he spent much time in the chief intellectual centres of Europe, and in the United States, and numbered among his friends such men as Montalembert, De Tocqueville, Fustel de Coulanges, Bluntschli, von Sybel and Ranke. He was attached to Lord Granville's mission to Moscow, as British representative at the coronation of Alexander II. in 1856. In 1859 Sir John Acton settled in England, at his country house, Aldenham, in Shropshire. He was returned to the House of Commons in that year for the Irish borough of Carlow, and became a devoted admirer and adherent of Mr Gladstone; but he was practically a silent member, and his parliamentary career came to an end after the general election of 1865, when, having headed the poll for Bridgnorth, he was unseated on a scrutiny; he contested Bridgnorth again in 1868, but without success. Meanwhile he had become editor of the Roman Catholic monthly paper, the *Rambler*, in 1859, on J. H. Newman's retirement from the editorship; and in 1862 he merged this periodical in the *Home and Foreign Review*. His contributions at once gave evidence of his remarkable wealth of historical knowledge. But though a sincere Roman Catholic, his whole spirit as a historian was hostile to ultramontane pretensions, and his independence of thought and liberalism of view speedily brought him into conflict with the Roman Catholic hierarchy. As early as August 1862, Cardinal Wiseman publicly censured the *Review*; and when in 1864, after Döllinger's appeal at the Munich Congress for a less hostile attitude towards historical criticism, the pope issued a declaration that the opinions of Catholic writers were subject to the authority of the Roman congregations, Acton felt that there was only one way of reconciling his literary conscience with his ecclesiastical loyalty, and he stopped the publication of his monthly periodical. He continued, however, to contribute articles to the *North British Review*, which, previously a Scottish Free Church organ, had been acquired by friends in sympathy with him, and which for some years (until 1872, when it ceased to appear) actively promoted the interests of a high-class Liberalism in both temporal and ecclesiastical matters; he also did a good deal of lecturing on historical subjects. In 1865 he married the Countess Marie, daughter of the Bavarian Count Arco-Valley, by whom he had one son and three daughters. In 1869 he was raised to the peerage by Gladstone as Baron Acton; he was an intimate friend and constant correspondent of the Liberal leader, and the two men had the very highest regard for one another. Matthew Arnold used to say that "Gladstone influences all round him but Acton; it is Acton who influences Gladstone."

In 1870 came the great crisis in the Roman Catholic world over the promulgation by Pius IX. of the dogma of papal infallibility. Lord Acton, who was in complete sympathy on this subject with Döllinger (*q.v.*), went to Rome in order to throw all his influence against it, but the step he so much dreaded was not to be averted. The Old Catholic separation followed, but Acton did not personally join the seceders, and the authorities prudently refrained from forcing the hands of so competent and influential an English layman. In 1874, when Gladstone published his pamphlet on *The Vatican Decrees*, Lord Acton wrote during November and December a series of remarkable letters to *The Times*, illustrating Gladstone's main theme by numerous historical examples of papal inconsistency, in a way which must have been bitter enough to the ultramontane party, but demurring nevertheless to Gladstone's conclusion and insisting that the Church itself was better than its premisses implied. Acton's letters led to another storm in the English Roman Catholic world, but once more it was considered prudent by the Vatican to leave him alone. In spite of his reservations, he regarded "communion with Rome as dearer than life." Thenceforth he steered clear of theological polemics. He devoted himself to persistent reading and study, combined with congenial society. With all his capacity for study he was a man of the world, and a man of affairs, not a bookworm. Little indeed came from his pen, his only notable publications being a masterly essay in the *Quarterly Review* of January 1878 on "Democracy in Europe"; two lectures delivered at Bridgnorth in 1877 on "The History of Freedom in Antiquity" and "The History of Freedom in Christianity"—these last the only tangible portions put together by him of his long-projected "History of Liberty"; and an essay on modern German historians in the first number of the *English Historical Review*, which he helped to found (1886). After 1879 he divided his time between London, Cannes and Tegernsee in Bavaria, enjoying and reciprocating the society of his friends. In 1872 he had been given the honorary degree of doctor of philosophy by Munich University; in 1888 Cambridge gave him the honorary degree of LL.D., and in 1889 Oxford the D.C.L.; and in 1890 he was made a fellow of All Souls. His reputation for learning had gradually been spread abroad, largely through Gladstone's influence. The latter found him a valuable political adviser, and in 1892, when the Liberal government came in, Lord Acton was made a lord-in-waiting. Finally, in 1895, on the death of Sir John Seeley, Lord Rosebery appointed him to the Regius Professorship of Modern History at Cambridge. The choice was an excellent one. His inaugural lecture on "The Study of History," afterwards published with notes displaying a vast erudition, made a great impression in the university, and the new professor's influence on historical study was felt in many important directions. He delivered two valuable courses of lectures, on the French Revolution and on Modern History, but it was in private that the effects of his teaching were most marked. The great *Cambridge Modern History*, though he did not live to see it, was planned under his editorship, and all who came in contact with him testified to his stimulating powers and his extraordinary range of knowledge. He was taken ill, however, in 1901, and died on the 19th of June 1902, being succeeded in the title by his son, Richard Maximilian Dalberg Acton, 2nd Baron Acton (b. 1870). Lord Acton has left too little completed original work to rank among the great historians; his very learning seems to have stood in his way; he knew too much and his literary conscience was too acute for him to write easily, and his copiousness of information overloads his literary style. But he was one of the most deeply learned men of his time, and he will certainly be remembered for his influence on others. His extensive library, formed for use and not for display, and composed largely of books full of his own annotations, was bought immediately after his death by Mr Andrew Carnegie, and presented to Mr John Morley, by whom it was forthwith given to the university of Cambridge.

See Mr Herbert Paul's excellent Introductory Memoir to the interesting volume of *Lord Acton's Letters to Mrs Drew* (1904), and the authorities cited there; also Dom Gasquet's *Lord Acton and his Circle* (1906). A *Bibliography of the Works of Lord Acton*, by W. A. Shaw, was published by the Royal Historical Society in 1903. The *Edinburgh Review* of April 1903 contains a luminous essay; and Mr Bryce has a chapter on Acton in his *Studies of Contemporary Biography* (1903). Lord Acton's *Lectures on Modern History*, edited by J. N. Figgis and R. V. Laurence, appeared in 1906; and his *History of Freedom and other Essays* and *Historical Essays and Studies* (by the same editors) in 1907. (H. Ch.)

ACTON, SIR JOHN FRANCIS EDWARD, Bart. (1736–1811), prime minister of Naples under Ferdinand IV., was the son of Edward Acton, a physician at Besançon, and was born there in 1736, succeeding to the title and estates in 1791, on the death of his cousin in the third degree, Sir Richard Acton of Aldenham Hall, Shropshire. He served in the navy of Tuscany, and in 1775 commanded a frigate in the joint expedition of Spain and Tuscany against Algiers, in which he displayed such courage and resource that he was promoted to high command. In 1779 Queen Maria Carolina of Naples persuaded her brother the Grand-Duke Leopold of Tuscany to allow Acton, who had been recommended to her by Prince Caramenico, to undertake the reorganization of the Neapolitan navy. The ability displayed by him in this led to his rapid advancement. He became commander-in-chief of both services minister of finance, and finally prime minister. His policy was devised in concert with the English ambassador, Sir William Hamilton, and aimed at substituting the influence of Austria and Great Britain for that of Spain, at Naples, and consequently involved open opposition to France and the French party in Italy. The financial and administrative measures which were the outcome of a policy which necessitated a great increase of armament made him intensely unpopular, and in December 1798 he shared the flight of the king and queen. For the reign of terror which followed the downfall of the Parthenopean Republic, five months later, Acton has been held responsible. In 1804 he was for a short time deprived of the reins of government at the demand of France; but he was speedily restored to his former position, which he held till, in February 1806, on the entry of the French into Naples, he had to flee with the royal family into Sicily. He died at Palermo on the 12th of August 1811.

He had married, by papal dispensation, the eldest daughter of his brother, General Joseph Edward Acton (b. 1737), who was in the Neapolitan service, and left three children, the elder son, Sir Richard, being the father of the first Lord Acton. The second son, Charles Januarius Edward (1803–1847), after being educated in England and taking his degree at Magdalene College, Cambridge, in 1823, entered the Academia Ecclesiastica at Rome. He left this with the rank of prelate, in 1828 was secretary to the nuncio at Paris and was made vice-legate of Bologna shortly afterwards. He became secretary of the congregation of the Disciplina Regolare, and auditor of the Apostolic Chamber under Gregory XVI., by whom he was made a cardinal in 1842. Cardinal Acton was protector of the English College at Rome, and had been mainly instrumental in the increase, in 1840, of the English vicariates-general to eight, which paved the way for the restoration of the hierarchy by Pius IX. in 1850. He died on the 23rd of June 1847.

ACTON, an urban district in the Ealing parliamentary division of Middlesex, England, suburban to London, 9 m. W. of St. Paul's Cathedral. Pop. (1861) 3151; (1901) 37,744. Its appearance is now wholly that of a modern residential suburb. The derivation offered for its name is from Oak-town, in reference to the extensive forest which formerly covered the locality. The land belonged from early times to the see of London, a grant being recorded in 1220. Henry III. had a residence here. At the time of the Commonwealth Acton was a centre of Puritanism. Philip Nye (d. 1672) was rector; Richard Baxter, Sir Matthew Hale (Lord Chief-Justice), Henry Fielding the novelist and John Lindley the botanist (d. 1865) are famous names among residents here. Acton Wells, of saline waters, had considerable reputation in the 18th century.

ACT ON PETITION, the term for a part of the procedure in the Probate, Divorce and Admiralty Division, now of infrequent occurrence. It was more freely used in the old Admiralty and Divorce courts before the Judicature Acts. (See PLEADING.)

ACTS OF THE APOSTLES. This book of the Bible, which now stands fifth in the New Testament, was read at first as the companion and sequel of the Gospel of Luke. Its separation was due to growing consciousness of the Gospels as a unit of sacred records, to which *Acts* stood as a sort of appendix. Historically it is of unique interest and value: it has no fellow within the New Testament or without it. The so-called Apocryphal Acts of certain apostles, while witnessing to the impression produced by our *Acts* as a type of edifying literature, only emphasize this fact. It is the one really primitive Church history, primitive in spirit as in substance; apart from it a connected picture of the Apostolic Age would be impossible. With it, the Pauline Epistles are of priceless historical value; without it, they would remain bafflingly fragmentary and incomplete, often even misleading.

1. *Plan and Aim.*—All agree that the *Acts of the Apostles* is the work of an author of no mean skill, and that he has exercised careful selection in the use of his materials, in keeping with a definite purpose and plan. It is of moment, then, to discover from his emphasis, whether by iteration or by fulness of scale, what objects he had in mind in writing. Here it is not needful to go farther back than F. C. Baur and the Tübingen school, with its theory of sharp antitheses between Judaic and Gentile Christianity, of which they took the original apostles and Paul respectively as typical. Gradually their statement of this position underwent serious modifications, as it became realized that neither Jewish nor Gentile Christianity was a uniform genus, but included several species, and that the apostolic leaders from the first stood for mutual understanding and unity. Hence the Tübingen school did its chief work in putting the needful question, not in returning the correct answer. Their answer could not be correct, because, as Ritschl showed (in his *Altkath. Kirche*, 2nd ed., 1857), their premisses were inadequate. Still the attitude created by the Tübingen theory largely persists as a biassing element in much that is written about *Acts*. On the whole, however, there is a disposition to look at the book more objectively and to follow up the hints as to its aim given by the author in his opening verses. Thus (1) his second narrative is the natural sequel to his first. As the earlier one set forth in orderly sequence (καθεξῆς) the providential stages by which Jesus was led, "in the power of the Spirit," to begin the establishment of the consummated Kingdom of God, so the later work aims at setting forth on similar principles its extension by means of His chosen representatives or apostles. This involves emphasis on the identity of the power, Divine and not merely human, expressed in the great series of facts from first to last. Thus (2) the Holy Spirit appears as directing and energizing throughout the whole struggle with the powers of evil to be overcome in either ministry, of Master or disciples. But (3) the continuity is more than similarity of activity resting on the same Divine energy. The working of the energy in the disciples is conditioned by the continued life and volition of their Master at His Father's right hand in heaven. The Holy Spirit, "the Spirit of Jesus," is the living link between Master and disciples. Hence the pains taken to exhibit (i. 2, 4 f. 8, ii. 1 ff., cf. Luke xxiv. 49) the fact of such spiritual solidarity, whereby their activity means His continued action in the world. And (4) the scope of this action is nothing less than humanity (ii. 5 ff.), especially within the Roman empire. It was foreordained that Messiah's witnesses should be borne by Divine power through all obstacles and to ever-widening circles, until they reached and occupied Rome itself for the God of Israel—now manifest (as foretold by Israel's own prophets) as the one God of the one race of mankind. (5) Finally, as we gather from the parallel account in Luke xxiv. 46-48, the divinely appointed method of victory is through suffering (Acts xiv. 22). This explains the large space devoted to the tribulations of the witnesses, and their constancy amid them, after the type of their Lord Himself. It forms one side of the virtual *apologia* for the absence of that earthly prosperity in which the pagan mind was apt to see the token of Divine approval. Another side is the recurring exhibition of the fact that these witnesses were persecuted only by those whose action should create no bias against the persecuted. Their foes were chiefly Jews, whose opposition was due partly to a stiff-necked disinclination to bow to the wider reading of their own religion—to which the Holy Spirit had from of old been pointing (cf. the prominence given to this idea in Stephen's long speech)—and partly to jealousy of those who, by preaching the wider Messianic Evangel, were winning over the Gentiles, and particularly proselytes, in such great numbers.

Such, then, seem to be the author's main *motifs*. They make up an account fairly adequate to the manifoldness of the book; yet they may be summed up in three ideas, together constituting the moral which this history of the expansion of Christianity aims at bringing home to its readers. These are the *universality of the Gospel*, the *jealousy of national Judaism*, and the *Divine initiative* manifest in the gradual stages by which men of Jewish birth were led to recognize the Divine will in the setting aside of national restrictions, alien to the universal destiny of the Church. The practical moral is the Divine character of the Christian religion, as evinced by the manner of its extension in the empire, no less than by its original embodiment in the Founder's life and death. Thus both parts of the author's work alike tend to produce assured conviction of Christianity as of Divine origin (Luke i. 1, 4; Acts i. 1 f.).

This view has the merit of giving the book a practical religious aim—a *sine qua non* to any theory of an early Christian writing. Though meant for men of pagan birth in the first instance, it is to them as inquirers or even converts, such as "Theophilus," that the argument is addressed. In spite of all difficulties, this religion is worthy of personal belief, even though it mean opposition and suffering. Among the features of the occasion which suggested the need of such an appeal was doubtless the existence of persecution by the Roman authorites, perhaps largely at the instigation of local Judaism. To meet this special perplexity, the author holds up the picture of early days, when the great protagonist of the Gospel constantly enjoyed protection at the hands of Roman justice. It is implied that the present distress is but a passing phase, resting on some misunderstanding; meantime, the example of apostolic constancy should yield strong reassurance. The *Acts of the Apostles* is in fact an Apology for the Church as distinct from Judaism, the breach with which is accordingly traced with great fulness and care.

From this standpoint *Acts* no longer seems to end abruptly. Whether as exhibiting the Divine leading and aid, or as recording the impartial and even kindly attitude of the Roman State towards the Christians, the writer has reached a climax. "He wished," as Harnack well remarks, "to point out the might of the Holy Spirit in the apostles, Christ's witnesses; and to show how this might carried the Gospel from Jerusalem to Rome and gained for it entrance into the pagan world, whilst the Jews in growing degree incurred rejection. In keeping with this, verses 26-28 of chapter xxviii. are the solemn closing verses of the work. But verses 30, 31 are an appended observation."

Yet the writer is, in fact, ending up most fitly on one of his keynotes, in that he leaves Paul preaching in Rome itself, "unmolested." "Paulus Romae, apex Evangelii."

The full force of this is missed by those who, while rejecting the idea that the author had in reserve enough Pauline history to furnish another work, yet hold that Paul was freed from the imprisonment amid which *Acts* leaves him (see PAUL). But for those, on the other hand, who see in the writer's own words in xx. 38, uncontradicted by anything in the sequel, a broad hint that Paul never saw his Ephesian friends again, the natural view is open that the sequel to the two years' preaching was too well known to call for explicit record. Nor would such silence touching Paul's speedy martyrdom be disingenuous, any more than on the theory that martyrdom overtook him several years later. The writer views Paul's death (like the horrors of Nero's Vatican Gardens in 64) as a mere exception to the rule of Roman policy heretofore illustrated. Not even by the Roman authorities were some of Nero's acts regarded as precedents.

2. *Authorship.*—External evidence, which is relatively early and widespread (*e.g.* Muratorian Canon, Irenaeus, Tertullian, Clement and Origen), all points to Luke, the companion and fellow-worker of Paul (Philem. 24), who probably accompanied him as physician also (Col. iv. 14). It must be noted too that evidence for his authorship of the third Gospel counts also for *Acts*. This carries us back at least to the second quarter of the 2nd century (Justin, *Dial.* 103, and most probably Marcion), when Λουκᾶν no doubt stood at the head of the Gospel, especially where it was used side by side with the others. We have every reason to trust the Church's tradition at this time, particularly as Luke was not prominent enough as an associate of Paul to suggest the theory as a guess. Nor does Eusebius, who knew the ante-Nicene literature intimately, seem to know of any other view ever having been held. If, then, the traditional Lucan authorship is to be doubted, it must be on internal evidence only. The form of the book, however, in all respects favours Luke, who was of non-Jewish birth (see Col. iv. 12-14 compared with 10 f.), and as a physician presumably a man of culture. The medical cast of much of its language, which is often of a highly technical nature, points strongly the same way;[1] while the early tradition that Luke was born in the Syrian Antioch admirably suits the fulness with which the origin of the Antiochene Church and its place in the further extension of the Gospel are described (see LUKE). Again, the attitude of *Acts* towards the Roman Empire is just what would be expected from a close comrade of Paul (cf. Sir W. M. Ramsay, *St Paul the Traveller and Roman Citizen*, 1895), but was hardly likely to be shared by one of the next generation, reared in an atmosphere of resentment, first at Nero's conduct and then at the persecuting policy of the Flavian Caesars (see REVELATION). Finally, the book itself seems to claim to be written by a companion of Paul. In chap. xvi. 10 the writer, without any previous warning, passes from the third person to the first. Paul had reached Troas. There he saw a vision inviting him to go to Macedonia. "But when he saw the vision, straightway *we* sought to go forth into Macedonia." Thenceforth "we" re-emerges at certain points in the narrative until Rome is reached. Irenaeus (iii. 14. 1) quotes these passages as proof that Luke, the author, was a companion of the apostle. The minute character of the narrative, the accurate description of the various journeyings, the unimportance of some of the details, especially some of the incidents of the shipwreck, are strong reasons for believing that the narrative is that of an eye-witness. If so, we can scarcely help coming to the conclusion that this eye-witness was the author of the work; for the style of this eye-witness is exactly the style of the writer who composed the previous portions (see Harnack, *op. cit.*, reinforcing the argument as already worked out by B. Weiss, 1893, and especially by Sir J. C. Hawkins in *Horae Synopticae*, 1899, pp. 143-147). Most scholars admit that the "we" narrative is that of a personal companion of Paul, who was probably none other than Luke, in view of his traditional authorship of *Acts*. But many suppose that the tradition arose from confused remembrance of the use by a later author of Luke's "we" document or travel-diary. This supposition would compel us to believe either that the skilful writer of *Acts* was so careless as to incorporate a document without altering its form, or that "we" is introduced intentionally. In the latter case we must suppose either that the writer was an eye-witness, or that he wished to be thought an eye-witness. E. Zeller, a follower of Baur, adopted this latter alternative, and P. W. Schmiedel adheres to it. Indeed it is hard to see how it can be avoided on the theory that the author of *Acts* used a travel-document by another hand (see below, *Sources*). On the whole, then, the most tenable theory is that the writer of the "we" sections was also the author of *Acts*; and that he was Luke, Paul's companion during most of his later ministry, and also his "counterpart," "as a Hellene, who yet had personal sympathy with Jewish primitive Christianity" (Harnack, *op. cit.* p. 103; see also LUKE).

3. *Sources.*—So far from the recognition of a plan in *Acts* being inimical to a quest after the materials used in its composition, one may say that it points the way thereto, while it keeps the literary analysis within scientific limits. The more one realizes the standpoint of the mind pervading the book as a whole, the more one feels that the speeches in the first part of Acts (*e.g.* that of Stephen)—and indeed elsewhere, too—are not "free compositions" of our author, the mere outcome of dramatic idealization such as ancient historians like Thucydides or Polybius allowed themselves. The Christology, for instance, of the early Petrine speeches is such as a Gentile Christian writing *c.* 80 A.D. simply could not have imagined. Thus we are forced to assume the use of a certain amount of early Judaeo-Christian material, akin to that implied also in the special parts of the Third Gospel. Paul Feine (*Eine vorkanonische Ueberlieferung des Lukas*, 1891) suggested that a single document explains this material in both works, as far as Acts xii. Others maintain that at any rate two sources underlie Acts i.-xii., or even i.-xv. (see A. Harnack, *Die Apostelgeschichte*, p. 131 ff.). In particular we can recognize a source embodying the traditions of the largely Hellenistic Church of Antioch, a secondary gloss from which may survive in the Bezan addition to xi. 27, "when *we* were assembled." Further, if our author was a careful inquirer (Luke i. 3), especially if he was in the habit of taking down in writing what he heard from different witnesses, this may explain

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[1] This argument, first worked out by Dr W. K. Hobart, *The Medical Language of St Luke* (Dublin, 1882), but hitherto neglected by many Continental scholars, has been urged afresh by Harnack, *Lukas der Arzt* (Leipzig, 1906; Eng. trans., London, 1907), to which reference may be made for all matters connected with Lucan authorship; comp. also R. J. Knowling in *The Expositor's Greek Testament*.

some of the phenomena. Such a man as Luke would have rare facilities for collecting Palestinian materials, varying no doubt in accuracy, but all relatively primitive, whether in Antioch or in Caesarea, where he probably resided for some two years in contact with men like Philip the Evangelist (xxi. 8). There and elsewhere he might also learn a good deal from John Mark, Peter's friend (1 Pet. v. 13; Acts xii. 12). In any case the study of sources (*Quellenkritik*) is a comparatively new one, and the resources of analysis, linguistic in particular, are by no means exhausted. One important analogy exists for the way in which our author would handle any written sources he may have had by him, namely, the manner in which he uses Mark's Gospel narrative in compiling his own Gospel. Guided by this objective criterion, and safeguarded by growing insight into the author's plastic aim, we need not despair of reaching large agreement as to the nature of the sources lying behind the first half of *Acts*.

In the second or strictly Pauline half we are confronted by the so-called "we" passages. Of these two main theories are possible: (1) that which sees in them traces of an earlier document—whether entries in a travel-diary, or a more or less consecutive narrative written later; and (2) that which would regard the "we" as due to the author's breaking instinctively into the first person plural at certain points where he felt himself specially identified with the history. On the former hypothesis, it is still in debate whether the "we" document does or does not lie behind more of the narrative than is definitely indicated by the formula in question (*e.g.* cc. xiii.-xv., xxi. 19-xxvi.). On the latter, it may well be questioned whether the presence or absence of "we" be not due to psychological causes, rather than to the writer's mere presence or absence.[1] That is, he may be writing sometimes as a member of Paul's mission at the critical stages of onward advance, sometimes rather as a witness absorbed in his hero's words and deeds (so "we" ceases between xx. 15 and xxi. 1). Naturally he would fall into the former attitude mostly when recording the definitive transition of Paul and his party from one sphere of work to another (xvi. 10 ff., xx. 5 ff., xxvii. 1 ff.). At such times the whole "mission" was as one man in its movements.

4. *Historical Value.*—The question of authorship is largely bound up with that as to the quality of the contents as history. *Acts* is divided into two distinct parts. The first (i.-xii.) deals with the church in Jerusalem and Judaea, and with Peter as central figure—at any rate in cc. i.-v. "Yet in cc. vi.-xii.," as Harnack[2] observes, "the author pursues several lines at once. (1) He has still in view the history of the Jerusalem community and the original apostles (especially of Peter and his missionary labours); (2) he inserts in vi. 1 ff. a history of the Hellenistic Christians in Jerusalem and of the Seven Men, which from the first tends towards the Gentile Mission and the founding of the Antiochene community; (3) he pursues the activity of Philip in Samaria and on the coast . . .; (4) lastly, he relates the history of Paul up to his entrance on the service of the young Antiochene church. In the small space of seven chapters he pursues all these lines and tries also to connect them together, at the same time preparing and sketching the great transition of the Gospel from Judaism to the Greek world. As historian, he has here set himself the greatest task." No doubt gaps abound in these seven chapters. "But the inquiry as to whether what is narrated does not even in these parts still contain the main facts, and is not substantially trustworthy, is not yet concluded." The difficulty is that we have but few external means of testing this portion of the narrative (see below, *Date*). Some of it may well have suffered partial transformation in oral tradition before reaching our author; *e.g.* the nature of the Tongues at Pentecost does not accord with what we know of the gift of "tongues" generally. The second part pursues the history of the apostle Paul; and here we can compare the statements made in the *Acts* with the Epistles. The result is a general harmony, without any trace of direct use of these letters; and there are many minute coincidences. But attention has been drawn to two remarkable exceptions. These are, the account given by Paul of his visits to Jerusalem in *Galatians* as compared with *Acts*; and the character and mission of the apostle Paul, as they appear in his letters and in *Acts*.

In regard to the first point, the differences as to Paul's movements until he returns to his native province of Syria-Cilicia (see PAUL) do not really amount to more than can be explained by the different interests of Paul and our author respectively. But it is otherwise as regards the visits of Gal. ii. 1-10 and Acts xv. If they are meant to refer to the same occasion, as is usually assumed,[3] it is hard to see why Paul should omit reference to the public occasion of the visit, as also to the public vindication of his policy. But in fact the issues of the two visits, as given in Gal. ii. 9 f. and Acts xv. 20 f., are not at all the same.[4] Nay more, if Gal. ii. 1-10=Acts xv., the historicity of the "Relief visit" of Acts xi. 30, xii. 25, seems definitely excluded by Paul's narrative of events before the visit of Gal. ii. 1 ff. Accordingly, Sir W. M. Ramsay and others argue that the latter visit itself coincided with the Relief visit, and even see in Gal. ii. 10 witness thereto.

But why, then, does not Paul refer to the public charitable object of his visit? It seems easier therefore to admit that the visit of Gal. ii. 1 ff. is one altogether unrecorded in *Acts*, owing to its private nature as preparing the way for public developments—with which *Acts* is mainly concerned. In that case it would fall shortly before the Relief visit, to which there may be tacit explanatory allusion, in Gal. ii. 10 (see further PAUL); and it will be shown below that such a conference of leaders in Gal. ii. 1 ff. leads up excellently both to the First Mission Journey and to Acts xv.

We pass next to the Paul of *Acts*. Paul insists that he was appointed the apostle to the Gentiles, as Peter was to the Circumcision; and that circumcision and the observance of the Jewish law were of no importance to the Christian as such. His words on these points in all his letters are strong and decided. But in *Acts* it is Peter who first opens up the way for the Gentiles. It is Peter who uses the strongest language in regard to the intolerable burden of the Law as a means of salvation(xv. 10 f., cf. 1). Not a word is said of any difference of opinion between Peter and Paul at Antioch (Gal. ii. 11 ff.). The brethren in Antioch send Paul and Barnabas up to Jerusalem to ask the opinion of the apostles and elders: they state their case, and carry back the decision to Antioch. Throughout the whole of *Acts* Paul never stands forth as the unbending champion of the Gentiles. He seems continually anxious to reconcile the Jewish Christians to himself by personally observing the law of Moses. He circumcises the semi-Jew, Timothy; and he performs his vows in the temple. He is particularly careful in his speeches to show how deep is his respect for the law of Moses. In all this the letters of Paul are very different from *Acts*. In *Galatians* he claims perfect freedom in principle, for himself as for the Gentiles, from the obligatory observance of the law; and neither in it nor in *Corinthians* does he take any notice of a decision to which the apostles had come in their meeting at Jerusalem. The narrative of *Acts*, too, itself implies something other than what it sets in relief; for why should the Jews hate Paul so much, if he was not in some sense disloyal to their Law?

There is, nevertheless, no essential contradiction here, only such a difference of emphasis as belongs to the standpoints and aims of the two writers amid their respective historical conditions. Peter's function in relation to the Gentiles belongs to the early Palestinian conditions, before Paul's distinctive mission had taken shape. Once Paul's apostolate—a personal one, parallel with the more collective apostolate of "the Twelve"—has proved itself by tokens of Divine approval, Peter and his colleagues frankly recognize the distinction of the two missions, and are anxious only to arrange that the two shall not fall apart by religiously and morally incompatible usages (Acts xv.). Paul, on his side, clearly implies that Peter felt with him that the Law could not justify (Gal. ii. 15 ff.), and argues that it could not now be made obligatory in principle (cf. "a yoke," Acts xv. 10); yet for Jews it might continue for the time (pending the Parousia) to be seemly and expedient, especially for the sake of non-believing Judaism. To this he conformed his own conduct as a Jew, so far as his Gentile apostolate was not involved (1 Cor. ix. 19 ff.). There is no reason to doubt that Peter largely agreed with him, since he acted in this spirit in Gal. ii. 11 f., until coerced by Jerusalem sentiment to draw back for expediency's sake. This incident it simply did not fall within the scope of *Acts* (see below) to narrate, since it had no abiding effect on the Church's extension. As to Paul's submission of the issue in Acts xv. to the Jerusalem conference, *Acts* does not imply that Paul would have accepted a decision in favour of the Judaizers, though he saw the value of getting a decision for his own policy in the quarter to which they were most likely to defer. If the view that he already had an understanding with the "Pillar" Apostles, as recorded in Gal. ii. 1-10 (see further PAUL), be correct, it gives the best of reasons why he was ready to enter the later public Conference of Acts xv. Paul's own "free" attitude to the Law, when on Gentile soil, is just what is implied by the hostile rumours as to his conduct in Acts xxi. 21, which he would be glad to disprove as at least exaggerated (*ib.* 24 and 26). What is clear is that such lack of formal accord as here exists between *Acts* and the Epistles, tells against its author's dependence on the latter, and so favours his having been a comrade of Paul himself.

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[1] This view has received Harnack's support, *op. cit.* 89 f.

[2] *Apostelgeschichte* (1908), p. 46. Harnack finds that our sense of the trustworthiness of the book "is enhanced by a thorough study of the chronological procedure of its author, both where he speaks and where he keeps silence." In this aspect the book "as a whole is according to the aims of the author and in reality a historical work" (p. 41; cf. pp. 1-20, 222 ff.).

[3] Though this view had the support of J. B. Lightfoot, it should be remembered that this was before the "South Galatian" theory as to the date of Paul's work among the Galatians came to prevail.

[4] Harnack, indeed, argues (*op. cit.* pp. 188 ff.) that the Abstinences defined for Gentiles were in the original text of Acts xv. 20 purely moral, and had no reference to Jewish scruples as to eating blood. He regards "what is strangled" (*πνικτόν*) as originally a mistaken gloss, which crept into the text. External evidence is against this, nor does it seem demanded by the context; in fact xv. 21 rather goes against it.

Speeches.

The speeches in *Acts* deserve special notice. Did its author follow the plan adopted by all historians of his age, or is he an exception? Ancient historians (like many of modern times) used the liberty of working up in their own language the speeches recorded by them. They did not dream of verbal fidelity; even when they had more exact reports before them, they preferred to mould a speaker's thoughts to their own methods of presentation. Besides this, some did not hesitate to give to the characters of their history speeches which were never uttered. The method of direct speech, so useful in producing a vivid idea of what is supposed to have passed through the mind of the speaker, was used to give force to the narrative. Now how far has the author of *Acts* followed the practice of his contemporaries? Some of his speeches are evidently but summaries of thoughts which occurred to individuals or multitudes. Others claim to be reports of speeches really delivered. But all these speeches have to a large extent the same style, the style also of the narrative. They have been passed though one editorial mind, and some mutual assimilation in phraseology and idea may well have resulted. They are, moreover, all of them, the merest abstracts. The speech of Paul at Athens, as given by Luke, would not occupy more than a minute or two in delivery. But these circumstances, while inconsistent with verbal accuracy, do not destroy authenticity; and in most of the speeches (*e.g.* xiv. 15-17) there is a varied appropriateness as well as an allusiveness, pointing to good information (see under *Sources*). There is no evidence that any speech in *Acts* is the free composition of its author, without either written or oral basis; and in general he seems more conscientious than most ancient historians touching the essentials of historical accuracy, even as now understood.

Miracles.

Objections to the trustworthiness of *Acts* on the ground of its miracles require to be stated more discriminately than has sometimes been the case. Particularly is this so as regards the question of authorship. As Harnack observes (*Lukas der Arzt*, p. 24), the "miraculous" or supernormal element is hardly, if at all, less marked in the "we" sections, which are substantially the witness of a companion of Paul (and where efforts to dissect out the miracles are fruitless), than in the rest of the work. The scientific method, then, is to consider each "miracle" on its own merits, according as we find reason to suppose that it has reached our author more or less directly. But the record of miracle as such cannot prejudice the question of authorship. Even the form in which the gift of Tongues at Pentecost is conceived does not tell against a companion of Paul, since it may have stood in his source, and the first outpouring of the Messianic Spirit may soon have come to be thought of as unique in some respects, parallel in fact to the Rabbinic tradition as to the inauguration of the Old Covenant at Sinai (cf. Philo, *De decem oraculis*, 9, 11, and the Midrash on Ps. lxviii. 11).

Finally as to such historical difficulties in *Acts* as still perplex the student of the Apostolic age, one must remember the possibilities of mistake intervening between the facts and the accounts reaching its author, at second or even third hand. Yet it must be strongly emphasized, that recent historical research at the hands of experts in classical antiquity has tended steadily to verify such parts of the narrative as it can test, especially those connected with Paul's missions in the Roman Empire. That is no new result; but it has come to light in greater degree of recent years, notably through Sir W. M. Ramsay's researches. The proofs of trustworthiness extend also to the theological sphere. What was said above of the Christology of the Petrine speeches applies to the whole conception of Messianic salvation, the eschatology, the idea of Jesus as equipped by the Holy Spirit for His Messianic work, found in these speeches, as also to titles like "Jesus the Nazarene" and "the Righteous One" both in and beyond the Petrine speeches. These and other cases in which we are led to discern very primitive witness behind *Acts*, do not indeed give to such witness the value of shorthand notes or even of abstracts based thereon. But they do support the theory that our author meant to give an unvarnished account of such words and deeds as had come to his knowledge. The perspective of the whole is no doubt his own; and as his witnesses probably furnished but few hints for a continuous narrative, this perspective, especially in things chronological, may sometimes be faulty. Yet when one remembers that by 70-80 A.D. it must have been a matter of small interest by what tentative stages the Messianic salvation first extended to the Gentiles, it is surely surprising that *Acts* enters into such detail on the subject, and is not content with a summary account of the matter such as the mere logic of the subject would naturally suggest. In any case, the very difference of the perspective of *Acts* and of *Galatians*, in recording the same epochs in Paul's history, argues such an independence in the former as is compatible only with an early date.

Quellenkritik, then, a distinctive feature of recent research upon *Acts*, solves many difficulties in the way of treating it as an honest narrative by a companion of Paul. In addition, we may also count among recent gains a juster method of judging such a book. For among the results of the Tübingen criticism was what Dr W. Sanday calls "an unreal and artificial standard, the standard of the 19th century rather than the 1st, of Germany rather than Palestine, of the lamp and the study rather than of active life." This has a bearing, for instance, on the differences between the three accounts of Paul's conversion in *Acts*. In the recovery of a more real standard, we owe much to men like Mommsen, Ramsay, Blass and Harnack, trained amid other methods and traditions than those which had brought the constructive study of *Acts* almost to a deadlock.

5. *Date.*—External evidence now points to the existence of *Acts* at least as early as the opening years of the 2nd century. As evidence for the Third Gospel holds equally for *Acts*, its existence in Marcion's day (120-140) is now assured. Further, the traces of it in Polycarp[1] and Ignatius,[2] when taken together, are highly probable; and it is even widely admitted that the resemblance of Acts xiii. 22, and 1 Clem. xviii. 1, in features not

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[1] Polyc. *ad Philipp.* i. 2, Acts ii. 24; ii. 1, Acts x. 42; ii. 3, Acts xx. 35; vi. 3, Acts vii. 52.

[2] Ign. *ad Magn.* v. 1, Acts i. 25; *ad Smyrn.* iii. 3, Acts x. 41.

found in the Psalm (lxxxix. 20) quoted by each, can hardly be accidental. That is, *Acts* was probably current in Antioch and Smyrna not later than *c.* A.D. 115, and perhaps in Rome as early as *c.* A.D. 96.

With this view internal evidence agrees. In spite of some advocacy of a date prior to A.D. 70, the bulk of critical opinion is decidedly against it. The prologue to Luke's Gospel itself implies the dying out of the generation of eye-witnesses as a class. A strong consensus of opinion supports a date about A.D. 80; some prefer 75 to 80; while a date between 70 and 75 seems no less possible. Of the reasons for a date in one of the earlier decades of the 2nd century, as argued by the Tübingen school and its heirs, several are now untenable. Among these are the supposed traces of 2nd-century Gnosticism and "hierarchical" ideas of organization; but especially the argument from the relation of the Roman state to the Christians, which Ramsay has reversed and turned into proof of an origin prior to Pliny's correspondence with Trajan on the subject. Another fact, now generally admitted, renders a 2nd-century date yet more incredible; and that is the failure of a writer devoted to Paul's memory to make palpable use of his Epistles. Instead of this he writes in a fashion that seems to traverse certain things recorded in them. If, indeed, it were proved that *Acts* uses the later works of Josephus, we should have to place the book about A.D. 100. But this is far from being the case.

Three points of contact with Josephus in particular are cited. (1) The circumstances attending the death of Herod Agrippa I. in A.D. 44. Here Acts xii. 21-23 is largely parallel to Jos. *Antt.* xix. 8. 2; but the latter adds an omen of coming doom, while *Acts* alone gives a circumstantial account of the occasion of Herod's public appearance. Hence the parallel, when analysed, tells against dependence on Josephus. So also with (2) the cause of the Egyptian pseudo-prophet in Acts xxi. 37 f., Jos. *Jewish War*, ii. 13. 5, *Antt.* xx. 8. 6; for the numbers of his followers do not agree with either of Josephus's rather divergent accounts, while *Acts* alone calls them *Sicarii*. With these instances in mind, it is natural to regard (3) the curious resemblance as to the (non-historical) order in which Theudas and Judas of Galilee are referred to in both as accidental, the more so that again there is difference as to numbers. Further, to make out a case for dependence at all, one must assume the mistaken order (as it may be) in Gamaliel's speech as due to gross carelessness in the author of *Acts*—an hypothesis unlikely in itself. Such a mistake was far more likely to arise in oral transmission of the speech, before it reached Luke at all.

6. *Place.*—The place of composition is still an open question. For some time Rome and Antioch have been in favour; and Blass combined both views in his theory of two editions (see below, *Text*). But internal evidence points strongly to the Roman province of Asia, particularly the neighbourhood of Ephesus. Note the confident local allusion in xix. 9 to "the school of Tyrannus"—not "a certain Tyrannus," as in the inferior text—and in xix. 33 to "Alexander"; also the very minute topography in xx. 13-15. At any rate affairs in that region, including the future of the church of Ephesus (xx. 28-30), are treated as though they would specially interest "Theophilus" and his circle; also an early tradition makes Luke die in the adjacent Bithynia. Finally it was in this region that there arose certain early glosses (*e.g.* on xix. 9, xx. 15), probably the earliest of those referred to below. How fully in correspondence with such an environment the work would be, as *apologia* for the Church against the Synagogue's attempts to influence Roman policy to its harm, must be clear to all familiar with the strength of Judaism in "Asia" (cf. Rev. ii. 9, iii. 9, and see Sir W. M. Ramsay, *The Letters to the Seven Churches*, ch. xii.).

7. *Text.*—The *apparatus criticus* of *Acts* has grown considerably of recent years; yet mainly in one direction, that of the so-called "Western text." This term, which our growing knowledge, especially of the Syriac and other Eastern versions, is rendering more and more unsatisfactory, stands for a text which used to be connected almost exclusively with the "eccentric" *Codex Bezae*, and is comparable to a Targum on an Old Testament book. But it is now recognized to have been very widespread, in both east and west, for some 200 years or more from as early as the middle of the 2nd century. The process, however, of sifting out the readings of all our present witnesses—MSS., versions, Fathers—has not yet gone far enough to yield any sure or final result as to the history of this text, so as to show what in its extant forms is primary, secondary, and so on. Beginnings have been made towards grouping our authorities; but the work must go on much further before a solid basis for the reconstruction of its primitive form can be said to exist. The attempts made at such a reconstruction, as by Blass (1895, 1897) and Hilgenfeld (1899), are quite arbitrary. The like must be said even of the contribution to the problem made by August Pott,[1] though he has helped to define one condition of success—the classification of the strata in "Western" texts—and has taken some steps in the right direction, in connexion with the complex phenomena of one witness, the Harklean Syriac.

Assuming, however, that the original form of the "Western" text had been reached, the question of its historical value, *i.e.* its relation to the original text of *Acts*, would yet remain. On this point the highest claims have been made by Blass. Ever since 1894 he held that both the "Western" text of *Acts* (which he styles the β text) and its rival, the text of the great uncials (which he styles the α text), are due to the author's own hand. Further, that the former (Roman) is the more original of the two, being related to the latter (Antiochene) as fuller first draft to severely pruned copy. But even in its later form, that "β stands nearer the *Grundschrift* than α, but yet is, like α, a copy from it," the theory is really untenable. In sober contrast of Blass's sweeping theory stand the views of Sir W. M. Ramsay. Already in *The Church in the Roman Empire* (1893) he held that the *Codex Bezae* rested on a recension made in Asia Minor (somewhere between Ephesus and S. Galatia), not later than about the middle of the 2nd century. Though "some at least of the alterations in *Codex Bezae* arose through a gradual process, and not through the action of an individual reviser," the revision in question was the work of a single reviser, who in his changes and additions expressed the local interpretation put upon *Acts* in his own time. His aim, in suiting the text to the views of his day, was partly to make it more intelligible to the public, and partly to make it more complete. To this end he "added some touches where surviving tradition seemed to contain trustworthy additional particulars," such as the statement that Paul taught in the lecture-room of Tyrannus "from the fifth to the tenth hour." In his later work, on *St Paul the Traveller and the Roman Citizen* (1895), Ramsay's views gain both in precision and in breadth. The gain lies chiefly in seeing beyond the Bezan text to the "Western" text as a whole.

Generally speaking, then, the text of *Acts* as printed by Westcott and Hort, on the basis of the earliest MSS. (ℵB), seems as near the autograph as that of any other part of the New Testament; whereas the "Western" text, even in its earliest traceable forms, is secondary. This does not mean that it has no historical value of its own. It may well contain some true supplements to the original text, derived from local tradition or happy inference—a few perhaps from a written source used by Luke. Certain of these may even date from the end of the 1st century, and the larger part of them are probably not later than the middle of the 2nd. But its value lies mainly in the light cast on ecclesiastical thought in certain quarters during the epoch in question. The nature of the readings themselves, and the distribution of the witness for them, alike point to a process involving several stages and several originating centres of diffusion. The classification of groups of "Western" witnesses has already begun. When completed, it will cast light, not only on the origin and growth of this type of text, but also on the exact value of the remaining witnesses to the original text of *Acts*—and further on the early handling of New Testament writings generally. *Acts*, from its very scope, was least likely to be viewed as sacrosanct as regards its text. Indeed there are signs that its undogmatic nature caused it to be comparatively neglected at certain times and places, as, *e.g.*, Chrysostom explicitly witnesses.

LITERATURE.—An account of the extensive and varied literature that has gathered round *Acts* may be found in two representative commentaries, viz., H. H. Wendt's edition of Meyer (1899), and that by R. J. Knowling in *The Expositor's Greek Testament*, vol. ii. (1900), supplemented by his *Testimony of St Paul to Christ* (1905). See also J. Moffatt, *The Historical New Testament* (1901). 412 ff., 655 ff.; C. Clemen, *Die Apostelgesch. im Lichte der neueren Forschungen* (Giessen, 1905); and A. Harnack, *Die Apostelgeschichte* (1908). (J. V. B.)

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[1] *Der abendländische Text der Apostelgeschichte u. die Wir-quelle* (Leipzig, 1900). See a review in the *Journal of Theol. Studies*, ii. 439 ff.

ACTUARY. The name of *actuarius*, sc. *scriba*, in ancient Rome, was given to the clerks who recorded the *Acta Publica* of the senate, and also to the officers who kept the military accounts and enforced the due fulfilment of contracts for military supplies. In its English form the word has undergone a gradual limitation of meaning. At first it seems to have denoted any clerk or registrar; then more particularly the secretary and adviser of any joint-stock company, but especially of an insurance company; and it is now applied specifically to one who makes those calculations as to the probabilities of human life, on which the practice of life assurance and the valuation of reversionary interests, deferred annuities, &c., are based. The first mention of the word in law is in the Friendly Societies Act of 1819, where it is used in the vague sense, "actuaries, or persons skilled in calculation," but it has received still further recognition in the Friendly Societies Act of 1875 and the Life Assurance Companies Act of 1870. The word has been used with precision since the establishment of the "Institute of Actuaries of Great Britain and Ireland" in 1848. The *Quarterly Journal*, *Charter of Incorporation*, and by-laws of this society may be usefully consulted for particulars as to the requirements for membership (see also ANNUITY). The registrar in the Lower House of Convocation is also called the actuary.

ACUMINATE (from Lat. *acumen*, point), sharpened or pointed, a word used principally in botany and ornithology, to denote the narrowing or lance-shaping of a leaf or of a bird's feather into a point, generally at the tip, though sometimes (with regard to a leaf) at the base. The poet William Cowper used the word to denote sharp and keen despair, but other authors, Sir T. Browne, Bacon, Bulwer, &c., use it to explain a material pointed shape.

ACUÑA, CHRISTOVAL DE (1597–*c.* 1676), Spanish missionary and explorer, was born at Burgos in 1597. He was admitted a Jesuit in 1612, and afterwards sent on mission work to Chile and Peru, where he became rector of the college of Cuenca. In 1639 he accompanied Pedro Texiera in his second exploration of the Amazon, in order to take scientific observations, and draw up a report for the Spanish government. The journey lasted ten months; and on the explorer's arrival in Peru, Acuña prepared his narrative, while awaiting a ship for Europe. The king of Spain, Philip IV., received the author coldly, and it is said even tried to suppress his book, fearing that the Portuguese, who had just revolted from Spain (1640), would profit by its information. After occupying the positions of procurator of the Jesuits at Rome and censor (*calificador*) of the Inquisition at Madrid, Acuña returned to South America, where he died, probably soon after 1675. His *Nuevo Descubrimiento del Gran Rio de las Amasonas* was published at Madrid in 1641; French and English translations (the latter from the French, appeared in 1682 and 1698.

ACUPRESSURE (from Lat. *acus*, a needle, and *premere*, to press), the name given to a method of restraining haemorrhage, introduced by Sir J. Y. Simpson, the direct pressure of a metallic needle, either alone or assisted by a loop of wire, being used to close the vessel near the bleeding point.

ACUPUNCTURE (from Lat. *acus*, a needle, and *pungere*, to prick), a form of surgical operation, performed by pricking the part affected with a needle. It has long been used by the Chinese in cases of headaches, lethargies, convulsions, colics, &c. (See SURGERY.)

ADABAZÁR, an important commercial town in the Khoja Ili sanjak of Asia Minor, situated on the old military road from Constantinople to the east, and connected by a branch line with the Anatolian railway. Pop. 18,000 (Moslems, 10,000; Christians, 8000). It was founded in 1540 and enlarged in 1608 by the settlement in it of an Armenian colony. There are silk and linen industries, and an export of tobacco, walnut-wood, cocoons and vegetables for the Constantinople market. Imports are valued at £80,000 and exports at £480,000.

See V. Cuinet, *Turquie d'Asie* (Paris, 1890–1900).

ADAD, the name of the storm-god in the Babylonian-Assyrian pantheon, who is also known as Ramman ("the thunderer"). The problem involved in this double name has not yet been definitely solved. Evidence seems to favour the view that Ramman was the name current in Babylonia, whereas Adad was more common in Assyria. To judge from analogous instances of a double nomenclature, the two names revert to two different centres for the cult of a storm-god, though it must be confessed that up to the present it has been impossible to determine where these centres were. A god Hadad who was a prominent deity in ancient Syria is identical with Adad, and in view of this it is plausible to assume—for which there is also other evidence—that the name Adad represents an importation into Assyria from Aramaic districts. Whether the same is the case with Ramman, identical with Rimmon, known to us from the Old Testament as the chief deity of Damascus, is not certain though probable. On the other hand the cult of a specific storm-god in ancient Babylonia is vouched for by the occurrence of the sign Im—the "Sumerian" or ideographic writing for Adad-Ramman—as an element in proper names of the old Babylonian period. However this name may have originally been pronounced, so much is certain,—that through Aramaic influences in Babylonia and Assyria he was identified with the storm-god of the western Semites, and a trace of this influence is to be seen in the designation Amurru, also given to this god in the religious literature of Babylonia, which as an early name for Palestine and Syria describes the god as belonging to the Amorite district.

The Babylonian storm-god presents two aspects in the hymns, incantations and votive inscriptions. On the one hand he is the god who, through bringing on the rain in due season, causes the land to become fertile, and, on the other hand, the storms that he sends out bring havoc and destruction. He is pictured on monuments and seal cylinders with the lightning and the thunderbolt, and in the hymns the sombre aspects of the god on the whole predominate. His association with the sun-god, Shamash, due to the natural combination of the two deities who alternate in the control of nature, leads to imbuing him with some of the traits belonging to a solar deity. In Syria Hadad is hardly to be distinguished from a solar deity. The process of assimilation did not proceed so far in Babylonia and Assyria, but Shamash and Adad became in combination the gods of oracles and of divination in general. Whether the will of the gods is determined through the inspection of the liver of the sacrificial animal, through observing the action of oil bubbles in a basin of water or through the observation of the movements of the heavenly bodies, it is Shamash and Adad who, in the ritual connected with divination, are invariably invoked. Similarly in the annals and votive inscriptions of the kings, when oracles are referred to, Shamash and Adad are always named as the gods addressed, and their ordinary designation in such instances is *bēlē biri*, "lords of divination." The consort of Adad-Ramman is Shala, while as Amurru his consort is called Aschratum. (See BABYLONIAN AND ASSYRIAN RELIGION.) (M. JA.)

ADAGIO (Ital. *ad agio*, at ease), a term in music to indicate slow time; also a slow movement in a symphony, sonata, &c., or an independent piece, such as Mozart's pianoforte "Adagio in B minor."

ADAIR, JOHN (d. 1722), Scottish surveyor and map-maker of the 17th century. Nothing is known of his parentage, birthplace or early life. His name first came before the public in 1683, when a prospectus was published in Edinburgh entitled *An Account of the Scottish Atlas*, stating that "the Privy Council of Scotland has appointed John Adair, mathematician and skilfull mechanick, to survey the shires." In 1686 an act of tonnage was passed in Adair's favour. He was then employed on a survey of the Scottish coast and two years later was made a fellow of the Royal Society. Two other acts of tonnage were passed for

Adair, one in 1695 and the other in 1705. In 1703 he published the first part of his *Description of the Sea Coasts and Islands of Scotland*, for the use of seamen. The second part never appeared. He is thought to have died in London about the end of 1722. He must have lost a considerable amount of money in the execution of his work, and in 1723 some remuneration was made to his widow by the government. Some of his work is preserved in the Advocates' Library at Edinburgh and in the King's Library of the British Museum, London.

ADALBERON, or ASCELIN (d. 1030 or 1031), French bishop and poet, studied at Reims and became bishop of Laon in 977. When Laon was taken by Charles, duke of Lorraine, in 988, he was put into prison, whence he escaped and sought the protection of Hugh Capet, king of France. Winning the confidence of Charles of Lorraine and of Arnulf, archbishop of Reims, he was restored to his see; but he soon took the opportunity to betray Laon, together with Charles and Arnulf, into the hands of Hugh Capet. Subsequently he took an active part in ecclesiastical affairs, and died on the 19th of July 1030 or 1031. Adalberon wrote a satirical poem in the form of a dialogue dedicated to Robert, king of France, in which he showed his dislike of Odilo, abbot of Cluny, and his followers, and his objection to persons of humble birth being made bishops. The poem was first published by H. Valois in the *Carmen panegyricum in laudem Berengarii* (Paris, 1663), and in modern times by J. P. Migne in the *Patrologia Latina*, tome cxli. (Paris, 1844). Adalberon must not be confounded with his namesake, Adalberon, archbishop of Reims (d. 988 or 989).

See Richer, *Historiarum libri III. et IV.*, which appears in the *Monumenta Germaniae historica. Scriptores.* Band iii. (Hanover and Berlin, 1826–1892); A. Olleris, *Œuvres de Gerbert pape sous le nom de Sylvestre II.* (Paris, 1867); *Histoire littéraire de la France*, tome vii. (Paris, 1865–1869).

ADALBERT, or ADELBERT (*c.* 1000–1072), German archbishop, the most famous ecclesiastic of the 11th century, was the son of Frederick, count of Goseck, a member of a noble Saxon family. He was educated for the church, and began his clerical career at Halberstadt, where he attained to the dignity of provost. Having attracted the notice of the German king, Henry III., Adalbert probably served as chancellor of the kingdom of Italy, and in 1045 was appointed archbishop of Hamburg-Bremen, his province including the Scandinavian countries, as well as a larger part of North Germany. In 1046 he accompanied Henry to Rome, where he is said to have refused the papal chair; and in 1052 he was made legate by Pope Leo IX., and given the right to nominate bishops in his province. He sought to increase the influence of his archbishopric, sent missionaries to Finland, Greenland and the Orkney Islands, and aimed at making Bremen a patriarchal see for northern Europe, with twelve suffragan bishoprics. He consolidated and increased the estates of the church, exercised the powers of a count, denounced simony and initiated financial reforms. The presence of this powerful and active personality, who was moreover a close friend of the emperor, was greatly resented by the Saxon duke, Bernard II., who regarded him as a spy sent by Henry into Saxony. Adalbert, who wished to free his lands entirely from the authority of the duke, aroused further hostility by an attack on the privileges of the great abbeys, and after the emperor's death in 1056 his lands were ravaged by Bernard. He took a leading part in the government of Germany during the minority of King Henry IV., and was styled *patronus* of the young king, over whom he appears to have exercised considerable influence. Having accompanied Henry on a campaign into Hungary in 1063, he received large gifts of crown estates, and obtained the office of count palatine in Saxony. His power aroused so much opposition that in 1066 the king was compelled to assent to his removal from court. In 1069 he was recalled by Henry, when he made a further attempt to establish a northern patriarchate, which failed owing to the hostility of the papacy and the condition of affairs in the Scandinavian kingdoms. He died at Goslar on the 16th or 17th of March 1072, and was buried in the cathedral which he had built at Bremen. Adalbert was a man of proud and haughty bearing, with large ideas and a strong energetic character. He made Bremen a city of importance, and it was called by his biographer, Adam of Bremen, the *New Rome*.

See Adam of Bremen, *Gesta Hammenburgensis ecclesiae pontificum*, edited by J. M. Lappenberg, in the *Monumenta Germaniae historica. Scriptores.* Band vii. (Hanover and Berlin, 1826–1892); C. Grünhagen, *Adalbert Erzbischof von Hamburg und die Idee eines Nordischen Patriarchats* (Leipzig, 1854).

ADALBERT (originally VOYTECH), (*c.* 950–997), known as the apostle of the Prussians, the son of a Bohemian prince, was born at Libice (Lobnik, Lubik), the ancestral seat near the junction of the Cidlina and the Elbe. He was educated at the monastery of Magdeburg; and in 983 was chosen bishop of Prague. The extreme severity of his rule repelled the Bohemians, whom he vainly strove to wean from their national customs and pagan rites. Discouraged by the ill-success of his ministry, he withdrew to Rome until 993, when, in obediance to the command of the pope, he returned to his own people. Finding little amendment, however, in their course of living, he soon afterwards went again to Rome, and obtained permission from the pope to devote himself to missionary labours, which he carried on chiefly in North Germany and Poland. While preaching in Pomerania (997) he was assassinated by a heathen priest.

See U. Chevalier, *Répertoire des sources historiques du moyen âge*, Bio.-Bibl. (1905); Bolland, *Acta Sanctorum*, April 23; H. G. Voigt, *Adalbert von Prag* (1898), a thoroughly exhaustive monograph.

ADALIA (med. *Antaliyah*; the crusaders' *Satalia*), the ancient *Attalia* (*q.v.*), the largest seaport on the south coast of Asia Minor, though in point of trade it is now second to Mersina. The unsuitability of the harbour for modern steamers, the bad anchorage outside and the extension of railways from Smyrna have greatly lessened its former importance as an emporium for west central Anatolia. It is not connected by a *chaussée* with any point outside its immediate province, but it has considerable importance as the administrative capital of a rich and isolated *sanjak*. Adalia played a considerable part in the medieval history of the Levant. Kilij Arslan had a palace there. The army of Louis VII. sailed thence for Syria in 1148, and the fleet of Richard of England rallied there before the conquest of Cyprus. Conquered by the Seljuks of Konia, and made the capital of the province of Tekké, it passed after their fall through many hands, including those of the Venetians and Genoese, before its final occupation by the Ottoman Turks under Murad II. (1432). In the 18th century, in common with most of Anatolia, its actual lord was a Dere Bey. The family of Tekké Oglu, domiciled near Perga, though reduced to submission in 1812 by Mahmud II., continued to be a rival power to the Ottoman governor till within the present generation, surviving by many years the fall of the other great Beys of Anatolia. The records of the Levant (Turkey) Company, which maintained an important agency here till 1825, contain curious information as to the local Dere Beys. The present population of Adalia, which includes many Christians and Jews, still living, as in the middle ages, in separate quarters, the former round the walled mina or port, is about 25,000. The port is served by coasting steamers of the local companies only. Adalia is an extremely picturesque, but ill-built and backward place. The chief thing to see is the city wall, outside which runs a good and clean promenade. The government offices and the houses of the better class are all outside the walls.

See C. Lanckoronski, *Villes de la Pamphylie et de la Pisidie*, i. (1890). (D. G. H.)

ADAM, the conventional name of the first created man according to the Bible.

1. *The Name.*—The use of " Adam " (אָדָם) as a proper name is an early error. Properly the word *ādām* designated man as a species; with the article prefixed (Gen. ii. 7, 8, 16, iv. 1; and doubtless ii. 20, iii. 17) it means the first man. Only in Gen. iv. 25 and v. 3-5 is *ādām* a quasi-proper name, though LXX. and Vulgate use " Adam " (Ἀδαμ) in this way freely. Gen. ii. 7 suggests a popular Hebrew derivation from *ădāmah*, " the ground." Into the question whether the original story did not give a proper name which was afterwards modified into " Adam " —important as this question is —we cannot here enter.

2. *Creation of Adam.*—For convenience, we shall take " Adam "

as a symbol for "the first man," and inquire first, what does tradition say of his creation? In Gen. ii. 4*b*-8 we read thus:—"At the time when Yahweh-Elohim[1] made earth and heaven,—earth was as yet without bushes, no herbage was as yet sprouting, because Yahweh-Elohim had not caused it to rain upon the earth, and no men were there to till the ground, but a stream[2] used to go up from the earth, and water all the face of the ground,—then Yahweh-Elohim formed the man of dust of the ground,[3] and blew into his nostrils breath of life,[4] and the man became a living being. And Yahweh-Elohim planted a garden[5] in Eden, eastward; and there he put the man whom he had formed." (See EVE.)

How greatly this simple and fragmentary tale of Creation differs from that in Gen. i. 1–ii. 4*a* (see COSMOGONY) need hardly be mentioned. Certainly the priestly writer who produced the latter could not have said that God modelled the first man out of moistened clay, or have adopted the singular account of the formation of Eve in ii. 21-23. The latter story in particular (see EVE) shows us how childlike was the mind of the early men, whose God is not "wonderful in counsel" (Isa. xxviii. 29), and fails in his first attempt to relieve the loneliness of his favourite. For no beast however mighty, no bird however graceful, was a fit companion for God's masterpiece, and, apart from the serpent, the animals had no faculty of speech. All therefore that Adam could do, as they passed before him, was to name them, as a lord names his vassals. But here arises a difficulty. How came Adam by the requisite insight and power of observation? For as yet he had not snatched the perilous boon of wisdom. Clearly the Paradise story is not homogeneous.

3. *How the Animals were named.*—Some moderns, *e.g.* von Bohlen, Ewald, Driver (in *Genesis*, p. 55, but cp. p. 42), have found in ii. 19, 20 an early explanation of the origin of language. This is hardly right. The narrator assumes that Adam and Eve had an innate faculty of speech.[6] They spoke just as the birds sing, and their language was that of the race or people which descended from them. Most probably the object of the story is, not to answer any curious question (such as, how did human speech arise, or how came the animals by their names?), but to dehort its readers or hearers from the abominable vice referred to in Lev. xviii. 23.[7] There may have been stories in circulation like that of Ea-bani (§ 8), and even such as those of the Skidi Pawnee, in which "people" marry animals, or become animals. Against these it is said (ver. 20*b*) that "for Adam he found no helper (qualified) to match him."

4. *Three Riddles.*—Manifold are the problems suggested by the Eden-story (see EDEN; PARADISE). For instance, did the original story mention two trees, or only one, of which the fruit was taboo? In iii. 3 (cp. vv. 6, 11) only "the tree in the midst of the garden" is spoken of, but in ii. 9 and iii. 22 two trees are referred to, the fruit of both of which would appear to be taboo. To this we must add that in ii. 17 "the tree of the knowledge of good and evil" appears to have the qualities of a "tree of life," except indeed to Adam. This passage seems to give us the key to the mystery. There was only one tree whose fruit was forbidden; it might be called either "the tree of life" or "the tree of knowledge," but certainly not "the tree of knowledge of good and evil."[8] The words "life" and "knowledge" (="wisdom") are practically equivalent; perfect knowledge (so primitive man believed) would enable any being to escape death (an idea spiritualized in Prov. iii. 18).

Next, which of the trees is the "tree of life"? Various sacred trees were known to the Semitic peoples, such as the fig-tree (cp. iii. 7), which sometimes appears, conventionalized, as a sacred tree.[9] But clearly the tree referred to was more than a "sacred tree"; it was a tree from whose fruit or juice, as culture advanced, some intoxicating drink was produced. The Gaokerena of the Iranians[10] is exactly parallel. At the resurrection, those who drink of the life-giving juice of this plant will obtain "perfect welfare," including deathlessness. It is not, however, either from Iran or from India that the Hebrew tree of life is derived, but from Arabia and Babylonia, where date-wine (cp. Enoch xxiv. 4) is the earliest intoxicant. Of this drink it may well have been said in primitive times (cp. *Rig Veda*, ix. 90. 5, of Soma) that it "cheers the heart of gods" (in the speech of the vine, Judg. ix. 13). Later writers spoke of a "tree of mercy," distilling the "oil of life,"[11] *i.e.* the oil that heals, but 4 Esdr. ii. 12 (cp. viii. 53) speaks of the "tree of life," and Rev. xxii. 2 (virtually) of "trees of life," whose leaves have a healing virtue (cp. Ezek. xlvii. 12). The oil-tree should doubtless be grouped with the river of oil in later writings (see PARADISE). Originally it was enough that there should be one tree of life, *i.e.* that heightened and preserved vitality.

A third enigma—why no "*fountain* of life"? The references to such a fountain in Proverbs (xiii. 14, &c.) prove that the idea was familiar,[12] and in Rev. xxii. 1 we are told that the river of Paradise was a "river of water of life" (see PARADISE). The serpent, too, in mythology is a regular symbol of water. Possibly the narrator, or redactor, desired to tone down the traces of mythology. Just as the Gâthas (the ancient Zoroastrian hymns) omit Gaokerena, and the Hebrew prophets on the whole avoid mythological phrases, so this old Hebrew thinker prunes the primitive exuberance of the traditional myth.

5. *The Serpent.*—The keen-witted, fluently speaking serpent gives rise to fresh riddles. How comes it that Adam's ruin is effected by one of those very "beasts of the field" which he had but lately named (ii. 19), that in speech he is Adam's equal and in wisdom his superior? Is he a pale form of the Babylonian chaos-dragon, or of the serpent of Iranian mythology who sprang from heaven to earth to blight the "good creation"? It is true that the serpent of Eden has mythological affinities. In iii. 14, 15, indeed, he is degraded into a mere typical snake, but iii. 1-5 shows that he was not so originally. He is perhaps best regarded, in the light of Arabian folk-lore, as the manifestation of a demon residing in the tree with the magic fruit.[13] He may have been a prince among the demons, as the magic tree was a prince among the plants. Hence perhaps his strange boldness. For some unknown reason he was ill disposed towards Yahweh-Elohim (see iii. 3*b*), which has suggested to some that he may be akin to the great enemy of Creation. To Adam and Eve, however, he is not unkind. He bids them raise themselves in the scale of being by eating the forbidden fruit, which he declares to be not fatal to life but an opener of the eyes, and capable of equalizing men with gods (iii. 4, 5). To the phrase "ye shall be as gods" a later writer may have added "knowing good and evil," but "to be as gods" originally meant "to live the life of gods—wise, powerful, happy." The serpent was in the main right, but there is one point which he did not mention, viz. that for any being to retain this intensified vitality the eating of the

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[1] The English Bible gives "the LORD GOD." This, however, does not adequately represent the Hebrew.

[2] See commentaries of Gunkel and Cheyne. As in v. 10, the ocean-stream is meant. (See EDEN.)

[3] A widely spread mythic representation. (Cp. COSMOGONY.)

[4] See an illustration from Naville's *Book of the Dead* (Egyptian) in *Jewish Cyclopaedia*, i. 174a.

[5] Or park. (See PARADISE.)

[6] The later Jews, however, supposed that before the Fall the animals could speak, and that they had all one language (*Jubilees*, iii. 28; Jos. *Antiquities*, i. 1, 4).

[7] Cheyne, *Genesis and Exodus*, referring to Dorsey, *Traditions of the Skidi Pawnee*, pp. 2, 80 ff.

[8] "Good and evil" may be a late marginal gloss. See further *Ency. Bib.* col. 3578, and the commentaries (Driver leaves the phrase); also Jastrow, *Relig. of Bab. and Ass.* p. 553; Sayce, *Hibbert Lectures*, p. 242.

[9] See illustration in Toy's *Ezekiel* (*Sacred Books of the Old Testament*), p. 182.

[10] Gaokerena is the mythic white haoma plant (*Zendavesta*, *Vendidad*, xx. 4; *Bundahish*, xxvii. 4). It is an idealization of the yellow haoma of the mountains which was used in sacrifices (*Yasna*, x. 6-10). It corresponds to the soma plant (*Asclepias acida*) of the ancient Aryans of India. On the illustrative value of Gaokerena see Cheyne, *Origin of the Psalter*, pp. 400-439.

[11] See *Life of Adam and Eve* (apocryphal), §§ 36, 40; *Apocal. Mos.* § 9; *Secrets of Enoch*, viii. 7, xxii. 8, 9. "Oil of life," in a Bab. hymn, *Die Keilinschriften und das Alte Testament*, ed. 3, p. 526.

[12] Cp. the Bab. myths of Adapa and of the Descent of Ishtar.

[13] W. R. Smith, *Relig. of Semites*, pp. 133, 442; *Ency. Bib.*, "Serpent." §§ 3, 4.

fruit would have to be constantly renewed. Only thus could even the gods escape death.[1]

6. *The Divine Command broken.*—The serpent has gone the right way to work; he comprehends woman's nature better than Adam comprehends that of the serpent. By her curiosity Eve is undone. She looks at the fruit; then she takes and eats; her husband does the same (iii. 6). The consequence (ver. 7) may *seem* to us rather slight: "they knew (became sensible) that they were naked, and sewed fig-leaves together, and made themselves girdles (aprons)." But the real meaning is not slight; the sexual distinction has been discovered, and a new sense of shame sends the human pair into the thickest shades, when Yahweh-Elohim walks abroad. The God of these primitive men is surprised: "Where art thou?" By degrees, he obtains a full confession—not from the serpent, whose speech might not have been edifying, but from Adam and Eve. The sentences which he passes are decisive, not only for the human pair and the serpent, but for their respective races. Painful toil shall be the lot of man; subjection and pangs that of woman.[2] The serpent too (whose unique form preoccupied the early men) shall be humiliated, as a perpetual warning to man—who is henceforth his enemy—of the danger of reasoning on and disobeying the will of God.

7. *Versions of the Adam-story.*—Theologians in all ages have allegorized this strange narrative.[3] The serpent becomes the inner voice of temptation, and the saying in iii. 15 becomes an anticipation of the final victory of good over evil—a view which probably arose in Jewish circles directly or indirectly affected by the Zoroastrian eschatology. But allegory was far from the thoughts of the original narrators. Another version of the Adam-story is given by Ezekiel (xxviii. 11-19), for underneath the king of Tyre (or perhaps Miṣṣor)[4] we can trace the majestic figure of the first man. *This* Adam, indeed, is not like the first man of Gen. ii.-iii., but more like the "bright angel" who is the first man in the Christian *Book of Adam* (i. 10; Malan, p. 12). He dwells on a glorious forest-mountain (cp. Ezekiel xxxi. 8, 18), and is led away by pride to equalize himself with Elohim (cp. xxviii. 2, 2 Thess. ii. 4), and punished. And with this passage let us group Job xv. 7, 8, where Job is ironically described as vying with the first man, who was "brought forth before the hills" (cp. Prov. viii. 25) and "drew wisdom to himself" by "hearkening in the council of Elohim." No reference is made in Job to this hero's fall. The omission, however, is repaired, not only in Ezek. xxviii. 16, but also in Isa. xiv. 12-15, where the king, whose name is given in the English Bible as "Lucifer" (or margin, "day-star"), "son of the morning," and who, like the other king in Ezekiel, is threatened with death, is a copy of the mythical Adam.

The two conceptions of the first man are widely different. The passages last referred to harmonize with the account given in Gen. i. 26, for "in our image" certainly suggests a being equal in brightness and in capacities to the angels—a view which, as we know, became the favourite one in apocryphal and Haggadic descriptions of the Adam before the Fall. And though the priestly writer, to whom the first Creation-story in its present form is due, says nothing about a sacred mountain as the dwelling-place of the first-created man, yet this mountain belongs to the type of tradition which the passage, Gen. i. 26-28, imperfectly but truly represents. The glorious first man of Ezekiel, and the god-like first men of the cosmogony (cp. Ps. viii. 5) who held the regency of the earth,[5] require a dwelling-place as far above the common level of the earth as they are themselves above the child-like Adam of the second creation-narrative (Gen. ii.). On this sacred mountain, see COSMOGONY.

8. *Origin of the Adam-story.*—That the Hebrew story of the first man in both its forms is no mere recast of a Babylonian myth, is generally admitted. The holy mountain is no doubt Babylonian, and the plantations of sacred trees, one of which at least has magic virtue, can be paralleled from the monuments (see EDEN). But there is no complete parallel to the description of Paradise in Gen. ii., or to the story of the rib, or to that of the serpent. The first part of the latter has definite Arabian affinities; the second is as definitely Hebrew. We may now add that the insertion of iii. 7 (from "were opened") to 19—a passage which has probably supplanted a more archaic and definitely mythological passage—may well have been the consequence of the change in the conception of the first man referred to above. Still there are four Babylonian stories which may serve as partial illustrations of the Hebrew Adam-story.

The first is contained in a fragment of a cosmogony in Berossus, now confirmed in the main by the sixth tablet of the Creation-epic. It represents the creation of man as due to one of the inferior gods who (at Bel's command) mingled with clay the blood which flowed from the severed head of Bel (see COSMOGONY). The three others are the myths of Adapa,[6] Ea-bani and Etana. As to Adapa, it may be mentioned here that Fossey has shown reason for holding that the true reading of the name is Adamu. It thus becomes plausible to hold that "Adam" in Gen. ii.-iii. was originally a proper name, and that it was derived from Babylonia. More probably, however, this is but an accidental coincidence; both *adam* and *adamu* may come from the same Semitic root meaning "to make." Certainly Adamu (if it is not more convenient to write "Adapa") was not regarded as the progenitor of the human race, like the Hebrew Adam. He was, however, certainly a man—one of those men who were not, of course, rival first-men, but were specially created and endowed. Adamu or Adapa, we are told, received from his divine father the gift of wisdom,[7] but not that of everlasting life. He had a chance, however, of obtaining the gift, or at least of eating the food and drinking the water which makes the gods ageless and immortal. But through a deceit practised upon him by his divine father Ea, he supposed the food and drink offered to him on a certain occasion by the gods to be "food of death," "water of death," just as Adam and Eve at first believed that the fruit of the magic tree would produce death (Gen. iii. 4, 5).

The second story is that of Ea-bani,[8] who was formed by the goddess Arusu (= the mother-goddess Ishtar) of a lump of clay (cp. Gen. ii. 7). This human creature, long-haired and sensual, was drawn away from a savage mode of life by a harlot, and Jastrow, followed by G. A. Barton, Worcester and Tennant, considers this to be parallel to the story which may underlie the account of the failure of the beasts, and the success of the woman Eve, as a "help-meet" for Adam. This, however, is most uncertain.

The third is that of Etana.[9] Here the main points are that Etana is induced by an eagle to mount up to heaven, that he may win a boon from the kindly goddess Ishtar. Borne by the eagle, he soared high up into the ether, but became afraid. Downward the eagle and his burden fell, and in the epic of Gilgamesh we find Etana in the nether world. According to Jastrow, this attempted ascension was an offence against the gods, and his fall was his punishment. We are not told, however, that Etana had the impious desire of Ezekiel's first man, and if he fell, it was through his own timidity (contrast Ezek. xxviii. 16). But certainly the myth does help us to imagine a story in which, for some sin against the gods, some favoured hero was hurled down from the divine abode, and such a story may some day be discovered.

To these illustrations it is unsafe to add the scene on a cylinder preserved in the British Museum, representing two figures, a man (with horns) and *perhaps* a woman, both clothed, on either side of a fruit-tree, towards which they stretch out their hands.[1] For the meaning of this is extremely problematical. Some better monumental illustration may some day be found, for it is clear that the Babylonian sacred literature had much to tell of offences against the gods in the primeval age.

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[1] Note the food and drink of the gods in the Babylonian Adapa (or Adamu?) myth.

[2] The mortality of man forms no part of the curse (cp. iii. 19, "dust thou art").

[3] See H. Schultz, *Alttest. Theologie*, ed. 4, pp. 679 ff., 720; Driver, *Genesis*, p. 44.

[4] See Cheyne, *Genesis and Exodus*.

[5] Cp. the "fair shepherd" Yima of the Avesta (*Vend.* ii.), the first man and the founder of civilization to the Iranians, though not like the Yama of the Vedas.

[6] See Jastrow, *Rel. of Bab. and Ass.* pp. 548-554; R. J. Harper, in *Academy*, May 30, 1891; Jensen, *Keilinschr. Bibliothek*, vi. 93 ff.

[7] The wisdom was probably to qualify him as a ruler. It is too much to say with Hommel that "Adapa is the archetype of the Johannine Logos."

[8] Jastrow, *op. cit.* p. 474 ff.; Jensen, *Keil. Bibl.* vi. 120 ff.

[9] Jastrow, p. 522 f.; Jensen, vi. 112 ff.

The student may naturally ask, Whence did the Israelites (a comparatively young people) obtain the original myth? It is most probable that they obtained it through the mediation either of the Canaanites or of the North Arabians. Babylonian influence, as is now well known, was strongly felt for many centuries in Canaan, and even the cuneiform script was in common use among the high officials of the country. When the Israelites entered Canaan, they would learn myths partly of Babylonian origin. North Arabian influence must also have been strong among the Israelites, at least while they sojourned in North Arabia. From the Kenites, at any rate, they may have received, not only a strong religious impulse, but a store of tales of the primitive age, and these stories too may have been partly influenced by Babylonian traditions. We must allow for stages of development both among the Israelites and among their tutors.

9. *Biblical References to the Adam-story.*—It is remarkable how little influence the Adam-story has had on the earlier parts of the Old Testament. The garden of Eden is referred to in Isa. li. 3, Ezek. xxxvi. 35, Joel ii. 5; cp. Ezek. xxviii. 13, xxxi. 8, 9, 16, 18, all of which are later. And it is mostly in the "humanistic" book of Proverbs that we find allusions to the "tree of life" (Prov. iii. 18, xi. 30, xiii. 12, xv. 4), and to the "fountain of life"—perhaps (see § 4) an omitted portion of the old Paradise-story (Prov. x. 11, xiii. 14, xiv. 27, xvi. 22),—the only other Biblical reference (apart from Rev. xxi. 6) being in that exquisite passage, Ps. xxxvi. 9. One can hardly be surprised at this. The Adam-story is plainly of foreign origin, and could not please the greater pre-exilic prophets. In late post-exilic times, however, foreign tales, even if of mythical origin, naturally came into favour, especially as religious symbols. If even now philosophers and theologians cannot resist the temptation to allegorize, how inevitable was it that this course should be pursued by early Jewish theologians!

10. *Incipient Reflexion on the Story.*—Let us give some instances of this. In Enoch lxix. 6 we find the story of Eve's temptation read in the light of that of the fallen angels (Gen. vi. 1, 2, 4) who conveyed an evil knowledge to men, and so subjected mankind to mortality. Evidently the writer fears culture. Elsewhere eating the fruit of the "tree of wisdom" is given as the cause of the expulsion of the human pair. In the Wisdom of Solomon (x. 1, 2) we find another view. Here, as in Ezekiel, the first man is pre-eminently wise and strong; though he transgressed, wisdom rescued him, *i.e.* taught him repentance (cp. *Life of Adam and Eve*, §§ 1-8). Elsewhere (ii. 24; cp. Jos. *Ant.* i. 1, 4) death is traced to the envy of the devil, still implying an exalted view of Adam. It is held that, but for his sin, Adam would have been immortal. Clearly the Jewish mind is exposed to some fresh foreign influences. As in the Talmud and the Jerusalem Targum, the serpent has even become the devil, *i.e.* Satan. The period of syncretism has fully come, and Zoroastrianism in particular, more indirectly than directly, is exercising an attractive power upon the Jews. For all that, the theological thinking is characteristically Jewish, and such guidance as Jewish thinkers required was mainly given by Greek culture. On this subject see further Eve, § 5.

11. *Growth of a Theology.*—Let us now turn to the Apocalypses of Baruch and of Ezra (both about 70 A.D.). Different views are here expressed. According to one (xvii. 3, xix. 8, xxiii. 4) the sin of Adam was the cause of physical death; according to another (liv. 15, lvi. 6), only of premature physical death, while according to a third (xlviii. 42, 43) it is spiritual death which is to be laid to his account. Of these three views, it is only the second which harmonizes with Gen. ii.-iii. In one of the two passages which express it we are also told that each member of the human race is "the Adam of his own soul." Adam, like Satan in Ecclus. xxi. 27, has become a psychological symbol. Truly, a worthy development of the seed-thoughts of the original narrator, and (must we not add?) entirely opposed to any doctrine of Original Sin.

In 4 Ezra, too, we find no real endorsement of such a doctrine. It is true, not only physical death (iii. 7), but spiritual, is traced to the act of Adam (iii. 21, 22, iv. 30, 31, vii. 118-121). But two modifying facts should be noticed. One is that Adam is said to have had from the first a wicked heart, owing to which he fell, and his posterity likewise, into sin and guilt. All men have the same seed of evil in them that Adam had; they sin and die, like him. The other is that, according to iii. 7-12, there are at least two ages of the world. The first ended with the Flood, so that any consequences of Adam's sin were, strictly speaking, of limited duration. The second began with righteous Noah and his household, "of whom came all righteous men." It was the descendants of these who "began again to do ungodliness more than the former ones." Doubtless the problem of evil is most imperfectly treated, even from the writer's point of view. But it would be cruel to pick holes in a writer whose thinking, like that of St Paul, is coloured by emotion.

At this point we might well make more than a passing reference to St Paul (Rom. v. 14; 1 Cor. xv. 22, 45, 47), whose doctrine of sin is evidently of mixed origin. But we cannot find space for this here. In compensation let it be mentioned that in Rev. xii. 9 (cp. xx. 2) the "great dragon," who persecuted the woman "clothed with the sun," is identified with "the old serpent, that is called the Devil and Satan." The identification is incorrect. But it may be noticed here that the phrase "the old serpent" sheds some light on the Pauline phrases "the first man Adam" and "the last Adam" (1 Cor. xv. 45, 47). The underlying idea is that the new age (that of the new heaven and earth) will be opened by events parallel to those which opened the first age. As the old serpent deceived man of old, so shall it be again. And as at the head of the first age stands the first Adam, whose doings affected all his descendants to their harm, so at the head of the second shall stand the second Adam, whose actions shall be potent for good. There is reason to suspect that the expression "the second Adam" is the coinage either of St Paul or of some one closely connected with him (as Prof. G. F. Moore has shown), for there is no proof that such terms as "the last," or "the second Adam," were generally current among the Jews.

12. *Jewish Legends.*—The parallelism between the first and second Adam in 1 Cor. xv. 45 is a parallelism of contrast. Jewish legends, however, suggest another sort of parallelism. The Haggadah gives the most extravagant descriptions of the glory of Adam before his fall. The most prominent idea is that being in the image of God—the God whose essence is light—he must have had a luminous body (like the angels). "I made thee of the light," says God in the *Book of Adam and Eve* (Malan, p. 16), "and I willed to bring children of light from thee." Similarly in *Baba batra*, 58*a*, we read, "he was of extraordinary beauty and sun-like brightness." So glorious was he that even the angels were commanded through Michael to pay homage to Adam. Satan, disobeying, was cast out of heaven; hence his ill-will towards Adam (*Life of Adam and Eve*, §§ 13-17; cp. *Koran*, xvii. 63, xx. 115, xxxviii. 74).

It only remains to give due honour to one of the most beautiful of legends, that of the deliverance of Adam's spirit from the nether world by the Christ, the earliest form of which is a Christian interpolation in *Apoc. Moses*, § 42 (cp. Malan, *Adam and Eve*, iv. 15, end). We may compare a partly parallel passage in § 37, where the agent is Michael, and notice that such legendary developments were equally popular among Jews and Christians.

Authorities.—On the apocryphal Books of Adam, see Hort, *Dict. of Chr. Biography*, i. 37 ff. In English we have Malan's translation of the Ethiopic *Book of Adam* (1882), and Issaverden's translation of another Book of Adam from the Armenian (Venice, 1901). In German, see Fuchs's translations in Kautzsch's *Die Apokryphen*, ii. 506 ff. For full bibliography see Schürer, *Gesch.*

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[1] See Smith and Sayce, *Chaldaean Genesis*, p. 88; Delitzsch, *Wo lag das Paradies?* p. 90; *Babel and Bible*, Eng. trans., p. 56, with note on pp. 114-118; Zimmern, *Die Keilinschr. und das A.T.*, ed. 3, p. 529; Jeremias, *Das Alte Test. im Lichte d. Alten Orient.* pp. 104-106.

des jüd. Volkes, ed. 3, iii. 288 f. On Jewish and Mahommedan legends, see *Jewish Cyclopaedia*, "Adam." On the belief in the Fall, see Tennant, *The Sources of the Doctrine of the Fall and Original Sin* (1903). (T. K. C.)

ADAM OF BREMEN, historian and geographer, was probably born in Upper Saxony (at Meissen, according to one tradition) before 1045. He came to Bremen about 1067–1068, most likely on the invitation of Archbishop Adalbert, and in the 24th year of the latter's episcopate (1043?–1072); in 1069 he appears as a canon of this cathedral and master of the cathedral school. Not long after this he visited the king of Denmark, Sweyn Estrithson, in Zealand; on the death of Adalbert, in 1072, he began the *Historia Hammaburgensis Ecclesiae*, which he finished about 1075. He died on the 12th of October of a year unknown, perhaps 1076. Adam's *Historia*—known also as *Gesta Hammaburgensis Ecclesiae Pontificum*, *Bremensium praesulum Historia*, and *Historia ecclesiastica*—is a primary authority, not only for the great diocese of Hamburg-and-Bremen, but for all North German and Baltic lands (down to 1072), and for the Scandinavian colonies as far as America. Here occurs the earliest mention of Vinland, and here are also references of great interest to Russia and Kiev, to the heathen Prussians, the Wends and other Slav races of the South Baltic coast, and to Finland, Thule or Iceland, Greenland and the Polar seas which Harald Hardrada and the nobles of Frisia had attempted to explore in Adam's own day (before 1066). Adam's account of North European trade at this time, and especially of the great markets of Jumne at the mouth of the Oder, of Birka in Sweden and of Ostrogard (Old Novgorod?) in Russia, is also of much value. His work, which places him among the first and best of German annalists, consists of four books or parts, and is compiled partly from written records and partly from oral information, the latter mainly gathered from experience or at the courts of Adalbert and Sweyn Estrithson. Of his minor informants he names several, such as Adelward, dean of Bremen, and William the Englishman, "bishop of Zealand," formerly chancellor of Canute the Great, and an intimate of Sweyn Estrithson. The fourth (perhaps the most important) book of Adam's *History*, variously entitled *Libellus de Situ Daniae et reliquarum quae trans Daniam sunt regionum*, *Descriptio Insularum Aquilonis*, &c., has often been considered, but wrongly, as a separate work.

Ten MSS. exist, of which the chief are (1-2) Copenhagen, Royal Library, Old Royal Collection, No. 2296, of 12th to 13th cents.; No. 718, of 15th cent.; (3) Leyden University, Voss. Lat. 123, of 11th cent.; (4) Rome, Vatican Library, 2010; (5) Vienna, Hof- u. Staatsbibliothek, 413, of 13th cent.; (6) Wolfenbüttel, Ducal Library, Gud. 83, of 15th cent.

There are 15 editions of the *Historia*, in whole or part; the first published at Copenhagen, 1579 (the first of the *Libellus* or *Descriptio Ins. Aquil.* appeared at Stockholm in 1615), the best at Hanover, 1846 (by Lappenberg, in *Scriptores Rerum Germanicarum*; reissued by L. Weiland, 1876), and at Paris, 1884 (in Migne's *Patrologia Latina*, cxlvi.). There are also three German versions, and one Danish; the best is by J. C. M. Laurent (and W. Wattenbach) in *Geschichtsschreiber d. deutsch. Vorzeit*, part vii. (1850 and 1888). See also J. Asmussen, *De fontibus Adami Bremensis*, 1834; Lappenberg in Pertz, *Archiv*, vi. 770; Aug. Bernard, *De Adamo Bremensi* (Paris, 1895); Beazley, *Dawn of Modern Geography*, ii. 514-548 (1901).

ADAM (or ADAN) **DE LE HALE** (died *c.* 1288), French trouvère, was born at Arras. His patronymic is generally modernized to La Halle, and he was commonly known to his contemporaries as Adam d'Arras or Adam le Bossu, sometimes simply as Le Bossu d'Arras. His father, Henri de le Hale, was a well-known citizen of Arras, and Adam studied grammar, theology and music at the Cistercian abbey of Vaucelles, near Cambrai. Father and son had their share in the civil discords in Arras, and for a short time took refuge in Douai. Adam had been destined for the church, but renounced this intention, and married a certain Marie, who figures in many of his songs, rondeaux, motets and *jeux-partis*. Afterwards he joined the household of Robert II., count of Artois; and then was attached to Charles of Anjou, brother of Charles IX., whose fortunes he followed in Egypt, Syria, Palestine and Italy. At the court of Charles, after he became king of Naples, he wrote his *Jeu de Robin et Marion*, the most famous of his works. He died between 1285 and 1288. Adam's shorter pieces are accompanied by music, of which a transcript in modern notation, with the original score, is given in Coussemaker's edition. His *Jeu de Robin et Marion* is cited as the earliest French play with music on a secular subject. The pastoral, which tells how Marion resisted the knight, and remained faithful to Robert the shepherd, is based on an old *chanson*, *Robin m'aime*, *Robin m'a*. It consists of dialogue varied by refrains already current in popular song. The melodies to which these are set have the character of folk-music, and are more spontaneous and melodious than the more elaborate music of his songs and motets. A modern adaptation, by Julien Tiersot, was played at Arras by a company from the Paris Opéra Comique on the occasion of a festival in 1896 in honour of Adam de le Hale. His other play, *Le jeu Adan* or *Le jeu de la Feuillée* (*c.* 1262), is a satirical drama in which he introduces himself, his father and the citizens of Arras with their peculiarities. His works include a *Congé*, or satirical farewell to the city of Arras, and an unfinished *chanson de geste* in honour of Charles of Anjou, *Le roi de Sicile*, begun in 1282; another short piece, *Le jeu du pèlerin*, is sometimes attributed to him.

The only MS. which contains the whole of Adam's work is the La Vallière MS. (No. 25,566) in the Bibliothèque Nationale, Paris, dating from the latter half of the 13th century. Many of his pieces are also contained in Douce MS. 308, in the Bodleian Library, Oxford. His *Œuvres complètes* (1872) were edited by E. de Coussemaker. See also an article by Paulin Paris in the *Histoire littéraire de la France* (vol. xx. pp. 638-675); G. Raynaud, *Recueil des motets français des XII*^{e} *et XIII*^{e} *siècles* (1882); *Canchons et Partures des . . . Adan delle Hale* (Halle, 1900), a critical edition by Rudolf Berger; an edition of Adam's two *jeux* in Monmerqué and Michel's *Théâtre français au moyen âge* (1842); E. Langlois, *Le jeu de Robin et Marion* (1896), with a translation in modern French; A. Guesnon, *La Satire à Arras au XIII*^{e} *siècle* (1900); and a full bibliography of works on the subject in No. 6 of the *Bibliothèque de bibliographies critiques*, by Henri Guy.

ADAM, ALEXANDER (1741–1809), Scottish writer on Roman antiquities, was born on the 24th of June 1741, near Forres, in Morayshire. From his earliest years he showed uncommon diligence and perseverance in classical studies, notwithstanding many difficulties and privations. In 1757 he went to Edinburgh, where he studied at the university. His reputation as a classical scholar secured him a post as assistant at Watson's Hospital and the headmastership in 1761. In 1764 he became private tutor to Mr Kincaid, afterwards Lord Provost of Edinburgh, by whose influence he was appointed (in 1768) to the rectorship of the High School on the retirement of Mr Matheson, whose substitute he had been for some time before. From this period he devoted himself entirely to the duties of his office and to the preparation of his numerous works on classical literature. His popularity and success as a teacher are strikingly illustrated by the great increase in the number of his pupils, many of whom subsequently became distinguished men, among them being Sir Walter Scott, Lord Brougham and Jeffrey. He succeeded in introducing the study of Greek into the curriculum of the school, notwithstanding the opposition of the university headed by Principal Robertson. In 1780 the university of Edinburgh conferred upon him the honorary degree of Doctor of Laws. He died on the 18th of December 1809, after an illness of five days, during which he occasionally imagined himself still at work, his last words being, "It grows dark, boys, you may go." Dr Adam's first publication was his *Principles of Latin and English Grammar* (1772), which, being written in English instead of Latin, brought down a storm of abuse upon him. This was followed by his *Roman Antiquities* (1791), *A Summary of Geography and History* (1794) and a *Compendious Dictionary of the Latin Tongue* (1805). The MS. of a projected larger Latin dictionary, which he did not live to complete, lies in the library of the High School. His best work was his *Roman Antiquities*, which has passed through a large number of editions and received the unusual compliment of a German translation.

See *An Account of the Life and Character of A. A.*, by A. Henderson (1810).

ADAM, SIR FREDERICK (1781–1853), British general, was the son of the Rt. Hon. W. Adam of Blair-Adam, lord-lieutenant of Kinross-shire. He was gazetted an ensign at the age of fourteen and was subsequently educated at Woolwich. He became captain in 1799, and served with the Coldstream Guards in Egypt (1801). In 1805, having purchased the intermediate steps of promotion, he obtained command of the 21st Foot, with which regiment he served in the Mediterranean from 1805 to 1813, taking part in the battle of Maida in 1806. In 1813 he accompanied the British corps sent to Catalonia, in which he commanded a brigade. He fought a gallant action at Biar (April 12, 1813), and on the following day won further distinction at Castalla. In the action of Ordal, on the 12th of September, Adam received two severe wounds. He returned to England to recover, and was made a major-general in 1814. At Waterloo, Adam's brigade, of which the 52nd under Colborne (see Seaton, Lord) formed part, shared with the Guards the honour of repulsing the Old Guard. For his services he was made a K.C.B., and received also Austrian and Russian orders. During the long peace which followed, Sir Frederick Adam was successively employed at Malta, in the Ionian Islands as lord high commissioner (1824–1831) and from 1832 to 1837 as governor of Madras. He became K.C.M.G. in 1820, G.C.M.G. four years later, lieutenant-general in 1830, a privy councillor in 1831, G.C.B. in 1840, and full general in 1846. He died suddenly on the 17th of August 1853.

ADAM, JULIETTE (1836–), French writer, known also by her maiden name of Juliette Lamber, was born at Verberie (Oise) on the 4th of October 1836. She has given an account of her childhood, rendered unhappy by the dissensions of her parents, in *Le roman de mon enfance et de ma jeunesse* (Eng. trans., London and New York, 1902). In 1852 she married a doctor named La Messine, and published in 1858 her *Idées antiproudhoniennes sur l'amour, la femme et le mariage*, in defence of Daniel Stern (Mme. d'Agoult) and George Sand. On her husband's death she married in 1868 Antoine Edmond Adam (1816–1877), prefect of police in 1870, and subsequently life-senator; and she established a salon which was frequented by Gambetta and the other republican leaders against the conservative reaction of the 'seventies. In the same interest she founded in 1879 the *Nouvelle Revue*, which she edited for the first eight years, and in the administration of which she retained a preponderating influence until 1899. She wrote the notes on foreign politics, and was unremitting in her attacks on Bismarck and in her advocacy of a policy of *revanche*. Mme. Adam was also generally credited with the authorship of papers on various European capitals signed "Paul Vasili," which were in reality the work of various writers. The most famous of her numerous novels is *Païenne* (1883). Her reminiscences, *Mes premières armes littéraires et politiques* (1904) and *Mes sentiments et nos idées avant* 1870 (1905), contain much interesting gossip about her distinguished contemporaries.

ADAM, LAMBERT SIGISBERT (1700–1759), French sculptor, known as Adam *l'aîné*, was born in Nancy, son of Jacob Sigisbert Adam, a sculptor of little repute. Adam was thirty-seven when, on his election to the Academy, he exhibited at the Salon the model of the group of "Neptune and Amphitrite" for the centre of the fountain at Versailles, and thereafter found much employment in the decoration of the royal residences. Among his more important works are "Nymphs and Tritons," "The Triumph of Neptune stilling the Waves," "Hunter with Lion in his Net," a relief for the chapel of St Adelaide, "The Seine and the Marne" in stone for St Cloud, "Hunting" and "Fishing," marble groups for Berlin, "Mars embraced by Love" and "The enthusiasm of Poetry." Adam restored with much ability the twelve statues (Lycomedes) found in the so-called Villa of Marius at Rome, and was elected a member of the Academy of St Luke. Several of his most important works were executed for Frederick the Great in Prussia.

His brother, also a sculptor, Nicolas Sébastien Adam (1705–1778), known as Adam *le jeune*, born in Nancy, worked under equal encouragement. His first work of importance was his "Prometheus chained, devoured by a Vulture," executed in plaster in 1738, and carved in marble in 1763 as his "reception piece" when he was elected into the Academy. He produced the reliefs of the "Birth" and "Agony of Christ" for the Oratory in Paris, but his chief works are the "Mausoleum of Cardinal de Fleury" and, in particular, the tomb of Catherine Opalinska, queen of Poland (wife of King Stanislaus), at Nancy.

A third brother, François Gaspard Balthasar Adam (1710–1761), born in Nancy, became the first sculptor of Frederick the Great and the head of the atelier of sculpture founded by that monarch, and passed the greater part of his life in Berlin. His chief works adorn the gardens and palaces of Sans Souci and Potsdam.

The work of the brothers Adam was too ornate in style to win the approval of the school that immediately followed them, and found its principal opponents in Bouchardon and Pigalle.

See Dussieux, *Artistes français à l'étranger* (Paris, 1855, 8vo); *Archives de l'art français, documents*, vol. i. pp. 117-180, chiefly for; works executed for the king of Prussia; Mariette, *Abecedario*; Emile de la Chavignerie and Auvray, *Dictionnaire général des artistes de l'école française* (Paris, 1882), mainly for works executed; Lady Dilke, *French Architects and Sculptors of the 18th century* (London, 4to, 1900).

ADAM, MELCHIOR (d. 1622), German divine and biographer, was born at Grotkau in Silesia after 1550, and educated in the college of Brieg, where he became a Protestant. In 1598 he went to Heidelberg, where he held various scholastic appointments. He wrote the biographies of a number of German scholars of the 16th century, mostly theologians, which were published in Heidelberg and Frankfort (5 vols., 1615–1620). He dealt with only twenty divines of other countries. All his divines are Protestants. His industry as a biographer is commended by P. Bayle, who acknowledges his obligations to Adam's labours; and his biographies, though they have faults, are still useful.

ADAM, PAUL (1862–), French novelist, was born in Paris on the 7th of December 1862. He was prosecuted for his first novel, *Chair molle* (1885), but was acquitted. He collaborated with Jean Moréas in *Le thé chez Miranda* (1886), and with Moréas and Gustave Kahn he founded the *Symboliste*, coming forward as one of the earliest defenders of symbolism. Among his numerous novels should be noted *Le mystère des foules* (2 vols., 1895), a study in Boulangism, *Lettres de Malaisie* (1897), a fantastic romance of imaginary future politics. In 1899 he began a novel-sequence, giving the history of the Napoleonic campaigns, the restoration and the government of Louis Philippe, comprising *La force* (1899), *L'enfant d'Austerlitz* (1901), *La ruse* (1902), and *Au soleil de Juillet* (1903). In 1900 he wrote a Byzantine romance, *Basile et Sophia*.

ADAM, ROBERT (1728–1792), British architect, the second son of William Adam of Maryburgh, in Fife, and the most celebrated of four brothers, John, Robert, James and William Adam, was born at Kirkcaldy in 1728. For few famous men have we so little biographical material, and contemporary references to him are sparse. He certainly studied at the university of Edinburgh, and probably received his first instruction in architecture from his father, who gave proofs of his own skill and taste in the Edinburgh Royal Infirmary (now demolished). His mother was the aunt of Dr W. Robertson, the first English historian of Charles V., and in 1750 we find Robert Adam living with her in Edinburgh, and making one of the brilliant literary coterie which adorned it at that period. Somewhere between 1750 and 1754 he visited Italy, where he spent three years studying the remains of Roman architecture. There he was struck with the circumstance that practically nothing had survived of the Greek and Roman masterpieces except public buildings, and that the private palaces, which Vitruvius and Pliny esteemed so highly, had practically vanished. One example of such work, however, was extant in the ruins of Diocletian's palace at Spalato, in Dalmatia, and this he visited in July 1757, taking with him the famous French architect and antiquary, C. L. Clérisseau, and two experienced draughtsmen, with whose assistance, after being arrested as a spy, he managed in five weeks to accumulate a sufficient number of measurements and careful plans and surveys to produce a restoration of the entire building in a fine work which he published in 1764, *The Ruins of the Palace of Diocletian, &c.* Considering the shortness of the time occupied and the obstacles placed in his way by the Venetian governor and the population of the place, the result was amazing. The influence of these studies was apparent directly and indirectly in much of his subsequent work, which, indeed, was in great measure founded upon them.

After his return to England he seems to have come rapidly to the front, and in 1762 he was appointed sole architect to the king and the Board of Works. Six years later he resigned this office, in which he was succeeded by his brother James,—who however, held the office jointly with another,—and entered parliament as member for the county of Kinross. In 1768 he and his three brothers leased the ground fronting the Thames, upon which the Adelphi now stands, for £1200 on a ninety-nine years' lease, and having obtained, with the assistance of Lord Bute, the needful act of parliament, proceeded, in the teeth of public opposition, to erect the ambitious block of buildings which is imperishably associated with their name, indicating its joint origin by the title Adelphi, from the Greek ἀδελφοί, the Brothers. The site presented attractive possibilities. A steep hill led down Buckingham Street to the river-side, and the plan was to raise against it, upon a terrace formed of massive arches and vaults and facing the river, a dignified quarter of fine streets and stately buildings, suggestive of the Spalato ruins. In spite of many difficulties, pecuniary and otherwise (the undertaking was completed from the proceeds of a lottery), money was raised and the work pushed on; in five years the Adelphi terrace stood complete, and the fine houses were eagerly sought after by artists and men of letters. Splendid, however, as the terrace and its houses are, both in conception and execution, the underground work which upholds them is perhaps more remarkable still. The vast series of arched vaults has been described by a modern writer as a very town, which, during the years that they were open, formed subterranean streets leading to the river and its wharves. In many places the arches stand in double tiers. In time these "streets" obtained a bad name as the haunt of suspicious characters, and they have long been enclosed and let as cellars. Between 1773 and 1778 the brothers issued a fine series of folio engravings and descriptions of the designs for many of their most important works, which included several great public buildings and numberless large private houses; a fine volume was published in 1822. For the remaining years of Robert's life the practice of the firm was the most extensive in the country; his position was unquestioned, and when he died in 1792 he was laid to rest in Westminster Abbey almost as a matter of course.

The art of Robert Adam was extraordinarily many-sided and prolific, and it is difficult to give a condensed appreciation of it. As an architect he was strongly under Roman and Italian influences, and his style and aims were exotic rather than native. But this does not detract from their merit, nor need it diminish our estimate of his genius. It was, indeed, the most signal triumph of that genius that he was able so to mould and adapt classical models as to create a new manner of the highest charm and distinction. Out of simple curvilinear forms, of which he principally preferred the oval, he evolved combinations of extraordinary grace and variety, and these entered into every detail of his work. In his view the architect was intimately concerned with the furniture and the decorations of a building, as well as with its form and construction, and this view he carried rigorously into practice, and with astonishing success. Nothing was too small and unimportant for him—summer-houses and dog-kennels came as readily to him as the vast façades of a terrace in town or a great country house. But he never permitted minute details to obscure the main lines of a noble design. Whatever care he might have expended upon the flowing curves of a moulding or a decoration, it was strictly kept in its place; it contributed its share and no more to the total effect. He made a distinct step forward in giving shape to the idea of imparting the unity of a single imposing structure to a number of private houses grouped in a block which is so characteristic a feature of modern town building, and though at times he failed in the breadth of grasp needful to carry out such an idea on a large scale, he has left us some fine examples of what can be accomplished in this direction. A delightful but theoretically undesirable characteristic of his work is the use of stucco. Upon it he moulded delicate forms in subtle and beautiful proportions. His "compo" was used so successfully that the patent was infringed: many of his moulds still exist and are in constant use. That most difficult feature, the column, he handled with enthusiasm and perfect mastery; he studied and wrote of it with minute pains, while his practice showed his grasp of the subject by all avoidance of bare imitation of the classic masters who first brought it to perfection. His work might be classic in form, but it was independently developed by himself. It would be impossible here to give a list of the innumerable works which he executed. In London, of course, the Adelphi stands pre-eminent; the screen and gate of the Admiralty and part of Fitzroy Square are by him, Portland Place, and much of the older portion of Finsbury Circus, besides whole streets of houses in the west end. There are the famous country houses of Lord Mansfield at Caen Wood, Highgate and Luton Hoo, and decorations and additions to many more.

Robert Adam—with, there is reason to suspect, some help from his brother James—has left as deep and enduring a mark upon English furniture as upon English architecture. Down to his time carving was the dominant characteristic of the mobiliary art, but thenceforward the wood-worker declined in importance. French influence disposed Robert Adam to the development of painted furniture with inlays of beautiful exotic woods, and many of his designs, especially for sideboards, are extremely attractive, mainly by reason of their austere simplicity. Robert Adam was no doubt at first led to turn his thoughts towards furniture by his desire to see his light, delicate, graceful interiors, with their large sense of atmosphere and their refined and finished detail, filled with plenishings which fitted naturally into his scheme. His own taste developed as he went on, but he was usually extremely successful, and cabinetmakers are still reproducing his most effective designs. In his furniture he made lavish use of his favourite decorative motives—wreaths and paterae, the honeysuckle, and that fan ornament which he used so constantly. Thus an Adam house is a unique product of English art. From façade to fire-irons, from the chimneys to the carpets, everything originated in the same order of ideas, and to this day an Adam drawing-room is to English what a Louis Seize room is to French art. In nothing were the Adams more successful than in mantelpieces and doors. The former, by reason of their simplicity and the readiness with which the "compo" ornaments can be applied and painted, are still made in cheap forms in great number. The latter were most commonly executed in a rich mahogany and are now greatly sought after. The extent to which the brothers worked together is by no means clear—indeed, there is an astonishing dearth of information regarding this remarkable family, and it is a reproach to English art literature that no biography of Robert Adam has ever been published. John Adam succeeded to his father's practice as an architect in Edinburgh. James Adam studied in Rome, and eventually was closely associated with Robert; William is variously said to have been a banker and an architect. (J. P.-B.)

ADAM, WILLIAM (1751–1839), British lawyer and politician, eldest son of John Adam of Blair-Adam, Kinross-shire, and nephew of the architect noticed above, was born on the 2nd of August 1751, studied at the universities of Edinburgh and Glasgow, and passed at the Scottish bar in 1773. Soon afterwards he removed to England, where he entered parliament in 1774, and in 1782 was called to the common law bar. He withdrew from parliament in 1795, entered it again in 1806 as representative of the united counties of Clackmannan and Kinross, and continued a member, with some interruptions, till 1811. He was a Whig and a supporter of the policy of Fox. At the English bar he obtained a very considerable practice. He was successively attorney and solicitor-general to the prince of Wales, one of the managers of the impeachment of Warren Hastings, and one of the counsel who defended the first Lord Melville when impeached. During his party's brief tenure of office in 1806 he was chancellor of the duchy of Cornwall, and was afterwards a privy councillor and lord-lieutenant of Kinross-shire. In 1814 he became a baron of Exchequer in Scotland, and was chief commissioner of the newly established jury-court for the trial of civil causes, from 1815 to 1830, when it was merged in the permanent supreme tribunal. He died at Edinburgh on the 17th of February 1839.

ADAMANT (from Gr. ἀδάμας, untameable), the modern *diamond* (*q.v.*), but also a name given to any very hard substance. The Greek word is used by Homer as a personal epithet, and by Hesiod for the hard metal in armour, while Theophrastus applies it to the hardest crystal. By an etymological confusion with the Lat. *adamare*, to have an attraction for, it also came to be associated with the loadstone; but since the term was displaced by "diamond" it has had only a figurative and poetical use.

ADAMAWA, a country of West Africa, which lies roughly between 6° and 11° N., and 11° and 15° E., about midway between the Bight of Biafra and Lake Chad. It is now divided between the British protectorate of Nigeria (which includes the chief town Yola, *q.v.*) and the German colony of Cameroon. This region is watered by the Benue, the chief affluent of the Niger, and its tributary the Faro. Another stream, the Yedseram, flows north-east to Lake Chad. The most fertile parts of the country are the plains near the Benue, about 800 ft. above the sea. South and east of the river the land rises to an elevation of 1600 ft., and is diversified by numerous hills and groups of mountains. These ranges contain remarkable rock formations, towers, battlements and pinnacles crowning the hills. Chief of these formations is a gigantic pillar some 450 ft. high and 150 ft. thick at the base. It stands on the summit of a high conical hill. Mount Alantika, about 25 miles south-south-east of Yola, rises from the plain, an isolated granite mass, to the height of 6000 ft. The country, which is very fertile and is covered with luxuriant herbage, has many villages and a considerable population. Durra, ground-nuts, yams and cotton are the principal products, and the palm and banana abound. Elephants are numerous and ivory is exported. In the eastern part of the country the rhinoceros is met with, and the rivers swarm with crocodiles and with a curious mammal called the *ayu*, bearing some resemblance to the seal.

Adamawa is named after a Fula Emir Adama, who in the early years of the 19th century conquered the country. To the Hausa and Bornuese it was previously known as Fumbina (or South-land). The inhabitants are mainly pure negroes such as the Durra, Batta and Dekka, speaking different languages, and all fetish-worshippers. They are often of a very low type, and some of the tribes are cannibals. Slave-trading was still active among them in the early years of the 20th century. The Fula (*q.v.*), who first came into the country about the 15th century as nomad herdsmen, are found chiefly in the valleys, the pagan tribes holding the mountainous districts. There are also in the country numbers of Hausa, who are chiefly traders, as well as Arabs and Kanuri from Bornu. The emir of Yola, in the period of Fula lordship, claimed rights of suzerainty over the whole of Adamawa, but the country, since the subjection of the Fula (*c.* 1900), has consisted of a number of small states under the control of the British and Germans. Garua on the upper Benue, 65 m. east of Yola, is the headquarters of the German administration for the region and the chief trade centre in the north of Adamawa. Yoko is one of the principal towns in the south of the country, and in the centre is the important town of Ngaundere. After Heinrich Barth, who explored the country in 1851, the first traveller to penetrate Adamawa was the German, E. R. Flegel (1882). It has since been traversed by many expeditions, notably that of Baron von Uechtritz and Dr Siegfried Passarge (1893–1894).

An interesting account of Adamawa, its peoples and history, is given by Heinrich Barth in his *Travels in North and Central Africa* (new edition, London, 1890), and later information is contained in S. Passarge's *Adamawa* (Berlin, 1895). (See also CAMEROON and NIGERIA, and the bibliographies there given.)

ADAMITES, or ADAMIANS, a sect of heretics that flourished in North Africa in the 2nd and 3rd centuries. Basing itself probably on a union of certain gnostic and ascetic doctrines, this sect pretended that its members were re-established in Adam's state of original innocency. They accordingly rejected the form of marriage, which, they said, would never have existed but for sin, and lived in absolute lawlessness, holding that, whatever they did, their actions could be neither good nor bad. During the middle ages the doctrines of this obscure sect, which did not itself exist long, were revived in Europe by the Brethren and Sisters of the Free Spirit.

ADAMNAN, or ADOMNAN (*c.* 624–704), Irish saint and historian, was born at Raphoe, Donegal, Ireland, about the year 624. In 679 he was elected abbot of Hy or Iona, being ninth in succession from the founder, St Columba. While on a mission to the court of King Aldfrith of Northumberland in 686, he was led to adopt the Roman rules with regard to the time for celebrating Easter and the tonsure, and on his return to Iona he tried without success to enforce the change upon the monks. He died on the 23rd of September 704. Adamnan wrote a *Life of St Columba*, which, though abounding in fabulous matter, is of great interest and value. The best editions are those published by W. Reeves (1857, new edit. Edinburgh, 1874) and by J. T. Fowler (Oxford, 1894). Adamnan's other well-known work, *De Locis Sanctis* (edited by P. Geyer, *Itinera Hierosolymitana saeculi*, iii.-viii., &c., 1898; vol. 39 of Bienna *Corpus Script. Ecc. Latin*) was based, according to Bede, on information received from Arculf, a French bishop, who, on his return from the Holy Land, was wrecked on the west coast of Britain, and was entertained for a time at Iona. This was first published at Ingolstadt in 1619 by J. Gretser, who also defended Baronius' acceptance of Arculf's narrative against Casaubon. An English translation by G. J. R. Macpherson, *Arculfus' Pilgrimage in the Holy Land*, was published by the Pilgrim's Text Society (London, 1889).

For full bibliography see U. Chevalier, *Répert. des sources historiques* (1903), p. 40.

ADAMS, ANDREW LEITH (1827–1882), Scottish naturalist and palaeontologist, the second son of Francis Adams of Banchory, Aberdeen, was born on the 21st of March 1827, and was educated to the medical profession. As surgeon in the Army Medical Department from 1848 to 1873, he utilized his opportunities for the study of natural history in India and Kashmir, in Egypt, Malta, Gibraltar and Canada. His observations on the fossil vertebrata of the Maltese Islands led him eventually to give special study to fossil elephants, on which he became an acknowledged authority. In 1872 he was elected F.R.S. In 1873 he was chosen professor of zoology in the Royal College of Science, Dublin, and in 1878 professor of natural history in Queen's College, Cork, a post which he held until the close of his life. He died at Queenstown on the 20th of July 1882.

PUBLICATIONS.—*Notes of a Naturalist in the Nile Valley and Malta* (London, 1870); other works of travel; *Monograph on the British Fossil Elephants* (Palaeontographical Soc.), (London, 1877-1881).

ADAMS, CHARLES FRANCIS (1807–1886), American diplomatist, son of John Quincy Adams, and grandson of John Adams, was born in Boston on the 18th of August 1807. His father, having been appointed minister to Russia, took him in 1809 to St Petersburg, where he acquired a perfect familiarity with French, learning it as his native tongue. After eight years spent in Russia and England, he attended the Boston Latin School for four years, and in 1825 graduated at Harvard. He lived two years in the executive mansion, Washington, during his father's presidential term, studying law and moving in a society where he met Webster, Clay, Jackson and Randolph. Returning to Boston, he devoted ten years to business and study, and wrote for the *North American Review*. He also undertook the management of his father's pecuniary affairs, and actively supported him in his contest in the House of Representatives for the right of petition and the anti-slavery cause. In 1835 he wrote an effective and widely read political pamphlet, entitled, after Edmund Burke's more famous work, *An Appeal from the New to the Old Whigs*. He was a member of the Massachusetts general court from 1840 to 1845, sitting for three years in the House of Representatives and for two years in the Senate; and in 1846–1848 he edited a party journal, the *Boston Whig*. In 1848 he was prominent in politics as a "Conscience Whig," presiding over the Buffalo Convention which formed the Free Soil party and nominated Martin Van Buren for president and himself for vice-president. He was a Republican member of the Thirty-Sixth Congress, which assembled on the 5th of December 1859, and during the second session, from the 3rd of December 1860 to the 4th of March 1861, he represented Massachusetts in the Congressional Committee of Thirty-three at the time of the secession of seven of the Southern states. His selection by the chairman of this committee, Thomas Corwin, to present to the full committee certain propositions agreed upon by two-thirds of the Republican members, and his calm and able speech of the 31st of January 1861 in the House, served to make him conspicuous before congress and the country. Together with William H. Seward, he stood for the Republican policy of concession; and, while he was criticized severely and charged with inconsistency in view of his record as a "Conscience Whig," he was of the same mind as President Lincoln, willing to concede non-essentials, but holding rigidly to the principle, properly understood, that there must be no extension of slavery. He believed that as the Republicans were the victors they ought to show a spirit of conciliation, and that the policy of righteousness was likewise one of expediency, since it would have for its result the holding of the border slave states with the North until the 4th of March, when the Republicans could take possession of the government at Washington. With the incoming of the new administration Secretary Seward secured for Adams the appointment of minister to Great Britain. So much sympathy was shown in England for the South that his path was beset with difficulties; but his mission was to prevent the interference of Great Britain in the struggle; and while the work of Lincoln, Seward and Sumner, and the cause of emancipation, tended to this end, the American minister was insistent and unyielding, and knew how to present his case forcibly and with dignity. He laboured with energy and discretion to prevent the sailing of the "Alabama"; and, when unsuccessful in this, he persistently urged upon the British government its responsibility for the destruction of American merchant vessels by the privateer. In his own diary he shows that underneath his calm exterior were serious trouble and keen anxiety; and, in fact, the strain which he underwent during the Civil War made itself felt in later years. Adams was instrumental in getting Lord John Russell to stop the "Alexandra," and it was his industry and pertinacity in argument and remonstrance that induced Russell to order the detention in September 1863 of the two ironclad rams intended for the Confederate States. Adams remained in England until May 1868. His last important work was as a member, in 1871–1872, of the tribunal of arbitration at Geneva which disposed of the "Alabama" claims. His knowledge of the subject and his fairness of mind enabled him to render his country and the cause of international arbitration valuable service. He died at Boston on the 21st of November 1886.

He edited the works of *John Adams* (10 vols., 1850–1856), and the *Memoirs of John Quincy Adams* (12 vols., 1874–1877). See the excellent biography (Boston, 1900), in the "American Statesmen Series," by his son, Charles Francis Adams, Jr. (J. F. R.)

ADAMS, HENRY (1838–), American historian, son of Charles Francis Adams and grandson of John Quincy Adams, was born in Boston, Massachusetts, on the 16th of February 1838. He graduated at Harvard in 1858, and from 1861 to 1868 was private secretary to his father. From 1870 to 1877 he was assistant professor of history at Harvard and from 1870 to 1876 was editor of the *North American Review*. He is considered to have been the first (in 1874–1876) to conduct historical seminary work in the United States. His great work is his *History of the United States* (1801 to 1817) (9 vols., 1889–1891), which is incomparably the best work yet published dealing with the administrations of Presidents Jefferson and Madison. It is particularly notable for its account of the diplomatic relations of the United States during this period, and for its essential impartiality. Adams also published: *Life of Albert Gallatin* (1879), *John Randolph* (1882) in the "American Statesmen Series," and *Historical Essays* (1891); besides editing *Documents Relating to New England Federalism* (1877), and the *Writings of Albert Gallatin* (3 volumes, 1879). In collaboration with his elder brother Charles Francis Adams, Jr., he published *Chapters of Erie and Other Essays* (1871), and, with H. C. Lodge, Ernest Young and J. L. Laughlin, *Essays in Anglo-Saxon Law* (1876).

His elder brother, JOHN QUINCY ADAMS (1833–1894), a graduate of Harvard (1853), practised law, and was a Democratic member for several terms of the Massachusetts general court. In 1872 he was nominated for vice-president by the Democratic faction that refused to support Horace Greeley.

Another brother, CHARLES FRANCIS ADAMS, Jr. (1835–), born in Boston on the 27th of May 1835, graduated at Harvard in 1856, and served on the Union side in the Civil War, receiving in 1865 the brevet of brigadier-general in the regular army. He was president of the Union Pacific railroad from 1884 to 1890, having previously become widely known as an authority on the management of railways. In 1900–1901 he was president of the American Historical Association. Among his writings are: *Railroads, Their Origin and Problems* (1878); *Three Episodes of Massachusetts History* (1892); a biography of his father, *Charles Francis Adams* (1900); *Lee at Appomattox and Other Papers* (1902); *Theodore Lyman and Robert Charles Winthrop, Jr., Two Memoirs* (1906); and *Three Phi Beta Kappa Addresses* (1907).

Another brother, BROOKS ADAMS (1848–), born in Quincy, Massachusetts, on the 24th of June 1848, graduated at Harvard in 1870, and until 1881 practised law. His writings include: *The Emancipation of Massachusetts* (1887); *The Law of Civilisation and Decay* (1895); *America's Economic Supremacy* (1900); and *The New Empire* (1902).

ADAMS, HENRY CARTER (1852–), American economist, was born at Davenport, Iowa, on the 31st of December 1852. He was educated at Iowa College and Johns Hopkins University, of which latter he was fellow and lecturer (1880–1882). He was afterwards a lecturer in Cornell University, and in 1887 became professor of political economy and finance in the university of Michigan. He also became statistician to the Interstate Commerce Committee and was in charge of the transportation department in the 1900 census. His principal works are *The State in Relation to Industrial Action* (1887); *Taxation in the United States, 1787 to 1816* (1884); *Public Debts* (1887); *The Science of Finance* (1888); *Economics and Jurisprudence* (1897).

ADAMS, HERBERT (1858–), American sculptor, was born at West Concord, Vermont, on the 28th of January 1858. He was educated at the Worcester (Massachusetts) Institute of Technology, and at the Massachusetts Normal Art School, and in 1885–1890 he was a pupil of Antonin Mercié in Paris. In 1890–1898 he was an instructor in the art school of Pratt Institute, Brooklyn, New York. In 1906 he was elected vice-president of the National Academy of Design, New York. He experimented successfully with some polychrome busts and tinted marbles, notably in the "Rabbi's Daughter" and a portrait of Miss Julia Marlowe, the actress; and he is at his best in his portrait busts of women, the best example being the study, completed in 1887, of Miss A. V. Pond, whom he afterwards married. Among his other productions are a fountain for Fitchburg, Massachusetts (1888); a number of works for the Congressional Library, Washington, including the bronze doors ("Writing") begun by Olin Warner, and the statue of Professor Joseph Henry; memorial tablets for the Boston State House; a memorial to Jonathan Edwards, at Northampton, Mass.; statues of Richard Smith, the type-founder, in Philadelphia, and of William Ellery Channing, in Boston (1902); and the Vanderbilt memorial bronze doors for St Bartholomew's Church, New York.

ADAMS, HERBERT BAXTER (1850–1901), American historian and educationalist, was born at Shutesbury (near Amherst), Massachusetts, on the 16th of April 1850. He graduated at Amherst, at the head of his class, in 1872; and between 1873 and 1876 he studied political science, history and economics at Göttingen, Berlin and Heidelberg, Germany, receiving the degree of Ph.D. at Heidelberg in 1876, with the highest honours (*summa cum laude*). From 1876 almost until his death he was connected with the Johns Hopkins University, Baltimore, Maryland, being in turn a fellow, an associate in history (1878–1883), an associate professor (1883–1891) and after 1891 professor of American and institutional history. In addition he was lecturer on history in Smith College, Northampton, Massachusetts, in 1878–1881, and for many years took an active part in Chautauqua work. In 1884, also, he was one of the founders of the American Historical Association, of which he was secretary until 1900. In 1882 he founded the "Johns Hopkins University Studies in Historical and Political Science," and at the time of his death some forty volumes had been issued under his editorship. After 1887 he also edited for the United States Bureau of Education the series of monographs entitled "Contributions to American Educational History," he himself preparing the *College of William and Mary* (1887), and *Thomas Jefferson and the University of Virginia* (1888). It was as a teacher, however, that Adams rendered his most valuable services, and many American historical scholars owe their training and to a considerable extent their enthusiasm to him. He died at Amherst, Massachusetts, on the 30th of July 1901.

In addition to the monographs mentioned above, he published: *Maryland's Influence in Founding a National Commonwealth* (1877); *Methods of Historical Study* (1884); *Maryland's Influence upon Land Cessions to the United States* (1885); and the *Life and Writings of Jared Sparks* (2 vols., Boston, 1893), his most important work.

See *Herbert B. Adams: Tributes of Friends* (Baltimore, 1902), extra volume (xxiii.) of "Studies in Historical and Political Science."

ADAMS, JOHN (1735–1826), second president of the United States of America, was born on the 30th of October 1735 in what is now the town of Quincy, Massachusetts. His father, a farmer, also named John, was of the fourth generation in descent from Henry Adams, who emigrated from Devonshire, England, to Massachusetts about 1636; his mother was Susanna Boylston Adams. Young Adams graduated from Harvard College in 1755, and for a time taught school at Worcester and studied law in the office of Rufus Putnam. In 1758 he was admitted to the bar. From an early age he developed the habit of writing descriptions of events and impressions of men. The earliest of these is his report of the argument of James Otis in the superior court of Massachusetts as to the constitutionality of writs of assistance. This was in 1761, and the argument inspired him with zeal for the cause of the American colonies. Years afterwards, when an old man, Adams undertook to write out at length his recollections of this scene; it is instructive to compare the two accounts. John Adams had none of the qualities of popular leadership which were so marked a characteristic of his second cousin, Samuel Adams; it was rather as a constitutional lawyer that he influenced the course of events. He was impetuous, intense and often vehement, unflinchingly courageous, devoted with his whole soul to the cause he had espoused; but his vanity, his pride of opinion and his inborn contentiousness were serious handicaps to him in his political career. These qualities were particularly manifested at a later period—as, for example, during his term as president. He first made his influence widely felt and became conspicuous as a leader of the Massachusetts Whigs during the discussions with regard to the Stamp Act of 1765. In that year he drafted the instructions which were sent by the town of Braintree to its representatives in the Massachusetts legislature, and which served as a model for other towns in drawing up instructions to their representatives; in August 1765 he contributed anonymously four notable articles to the *Boston Gazette* (republished separately in London in 1768 as *A Dissertation on the Canon and Feudal Law*), in which he argued that the opposition of the colonies to the Stamp Act was a part of the never-ending struggle between individualism and corporate authority; and in December 1765 he delivered a speech before the governor and council in which he pronounced the Stamp Act invalid on the ground that Massachusetts being without representation in parliament, had not assented to it. In 1768 he removed to Boston. Two years later, with that degree of moral courage which was one of his distinguishing characteristics, as it has been of his descendants, he, aided by Josiah Quincy, Jr., defended the British soldiers who were arrested after the "Boston Massacre," charged with causing the death of four persons, inhabitants of the colony. The trial resulted in an acquittal of the officer who commanded the detachment, and most of the soldiers; but two soldiers were found guilty of manslaughter. These claimed benefit of clergy and were branded in the hand and released. Adams's upright and patriotic conduct in taking the unpopular side in this case met with its just reward in the following year, in the shape of his election to the Massachusetts House of Representatives by a vote of 418 to 118.

John Adams was a member of the Continental Congress from 1774 to 1778. In June 1775, with a view to promoting the union of the colonies, he seconded the nomination of Washington as commander-in-chief of the army. His influence in congress was great, and almost from the beginning he was impatient for a separation of the colonies from Great Britain. On the 7th of June 1776 he seconded the famous resolution introduced by Richard Henry Lee (*q.v.*) that "these colonies are, and of a right ought to be, free and independent states," and no man championed these resolutions (adopted on the 2nd of July) so eloquently and effectively before the congress. On the 8th of June he was appointed on a committee with Jefferson, Franklin, Livingston and Sherman to draft a Declaration of Independence; and although that document was by the request of the committee written by Thomas Jefferson, it was John Adams who occupied the foremost place in the debate on its adoption. Before this question had been disposed of, Adams was placed at the head of the Board of War and Ordnance, and he also served on many other important committees.

In 1778 John Adams sailed for France to supersede Silas Deane in the American commission there. But just as he embarked that commission concluded the desired treaty of alliance, and soon after his arrival he advised that the number of commissioners be reduced to one. His advice was followed and he returned home in time to be elected a member of the convention which framed the Massachusetts constitution of 1780, still the organic law of that commonwealth. With James Bowdoin and Samuel Adams, he formed a sub-committee which drew up the first draft of that instrument, and most of it probably came from John Adams's pen. Before this work had been completed he was again sent to Europe, having been chosen on the 27th of September 1779 as minister plenipotentiary for negotiating a treaty of peace and a treaty of commerce with Great Britain. Conditions were not then favourable for peace, however; the French government, moreover, did not approve of the choice, inasmuch as Adams was not sufficiently pliant and tractable and was from the first suspicious of Vergennes; and subsequently Benjamin Franklin, Thomas Jefferson, John Jay and Henry Laurens were appointed to co-operate with Adams. Jefferson, however, did not cross the Atlantic, and Laurens took little part in the negotiations. This left the management of the business to the other three. Jay and Adams distrusted the good faith of the French government. Outvoting Franklin, they decided to break their instructions, which required them to "make the most candid confidential communications on all subjects to the ministers of our generous ally, the king of France; to undertake nothing in the negotiations for peace or truce without their knowledge or concurrence; and ultimately to govern yourself by their advice and opinion"; and, instead, they dealt directly with the British commissioners, without consulting the French ministers. Throughout the negotiations Adams was especially determined that the right of the United States to the fisheries along the British-American coast should be recognized. Political conditions in Great Britain, at the moment, made the conclusion of peace almost a necessity with the British ministry, and eventually the American negotiators were able to secure a peculiarly favourable treaty. This preliminary treaty was signed on the 30th of November 1782. Before these negotiations began, Adams had spent some time in the Netherlands. In July 1780 he had been authorized to execute the duties previously assigned to Henry Laurens, and at the Hague was eminently successful, securing there recognition of the United States as an independent government (April 19, 1782), and negotiating both a loan and, in October 1782, a treaty of amity and commerce, the first of such treaties between the United States and foreign powers after that of February 1778 with France.

In 1785 John Adams was appointed the first of a long line of able and distinguished American ministers to the court of St James's. When he was presented to his former sovereign, George III. intimated that he was aware of Mr Adams's lack of confidence in the French government. Replying, Mr Adams admitted it, closing with the outspoken sentiment: "I must avow to your Majesty that I have no attachment but to my own country"—a phrase which must have jarred upon the monarch's sensibilities. While in London Adams published a work entitled *A Defence of the Constitution of Government of the United States* (1787). In this work he ably combated the views of Turgot and other European writers as to the viciousness of the framework of the state governments. Unfortunately, in so doing, he used phrases savouring of aristocracy which offended many of his countrymen,—as in the sentence in which he suggested that "the rich, the well-born and the able" should be set apart from other men in a senate. Partly for this reason, while Washington had the vote of every elector in the first presidential election of 1789, Adams received only thirty-four out of sixty-nine. As this was the second largest number he was declared vice-president, but he began his eight years in that office (1789–1797) with a sense of grievance and of suspicion of many of the leading men. Differences of opinion with regard to the policies to be pursued by the new government gradually led to the formation of two well-defined political groups—the Federalists and the Democratic-Republicans—and Adams became recognized as one of the leaders, second only to Alexander Hamilton, of the former.

In 1796, on the refusal of Washington to accept another election, Adams was chosen president, defeating Thomas Jefferson; though Alexander Hamilton and other Federalists had asked that an equal vote should be cast for Adams and Thomas Pinckney, the other Federalist in the contest, partly in order that Jefferson, who was elected vice-president, might be excluded altogether, and partly, it seems, in the hope that Pinckney should in fact receive more votes than Adams, and thus, in accordance with the system then obtaining, be elected president, though he was intended for the second place on the Federalist ticket. Adams's four years as chief magistrate (1797–1801) were marked by a succession of intrigues which embittered all his later life; they were marked, also, by events, such as the passage of the Alien and Sedition Acts, which brought discredit on the Federalist party. Moreover, factional strife broke out within the party itself; Adams and Hamilton became alienated, and members of Adams's own cabinet virtually looked to Hamilton rather than to the president as their political chief. The United States was, at this time, drawn into the vortex of European complications, and Adams, instead of taking advantage of the militant spirit which was aroused, patriotically devoted himself to securing peace with France, much against the wishes of Hamilton and of Hamilton's adherents in the cabinet. In 1800, Adams was again the Federalist candidate for the presidency, but the distrust of him in his own party, the popular disapproval of the Alien and Sedition Acts and the popularity of his opponent, Thomas Jefferson, combined to cause his defeat. He then retired into private life. On the 4th of July 1826, on the fiftieth anniversary of the adoption of the Declaration of Independence, he died at Quincy. Jefferson died on the same day. In 1764 Adams had married Miss Abigail Smith (1744–1818), the daughter of a Congregational minister at Weymouth, Massachusetts. She was a woman of much ability, and her letters, written in an excellent English style, are of great value to students of the period in which she lived. President John Quincy Adams was their eldest son.

AUTHORITIES.—C. F. Adams, *The Works of John Adams, with Life* (10 vols., Boston, 1850–1856); John and Abigail Adams, *Familiar Letters during the Revolution* (Boston, 1875); J. T. Morse, *John Adams* (Boston, 1885; later edition, 1899), in the "American Statesmen Series"; and Mellen Chamberlain, *John Adams, the Statesman of the Revolution; with other Essays and Addresses* (Boston, 1898). (E. Ch.)

ADAMS, JOHN COUCH (1819–1892), British astronomer, was born at Lidcot farmhouse, Laneast, Cornwall, on the 5th of June 1819. His father, Thomas Adams, was a tenant farmer; his mother, Tabitha Knill Grylls, inherited a small estate at Badharlick. From the village school at Laneast he went, at the age of twelve, to Devonport, where his mother's cousin, the Rev. John Couch Grylls, kept a private school. His promise as a mathematician induced his parents to send him to the university of Cambridge, and in October 1839 he entered as a sizar at St John's College. He graduated B.A. in 1843 as the senior wrangler and first Smith's prizeman of his year. While still an undergraduate he happened to read of certain unexplained irregularities in the motion of the planet Uranus, and determined to investigate them as soon as possible, with a view to ascertaining whether they might not be due to the action of a remote undiscovered planet. Elected fellow of his college in 1843, he at once proceeded to attack the novel problem. It was this: from the observed perturbations of a known planet to deduce by calculation, assuming only Newton's law of gravitation, the mass and orbit of an unknown disturbing body. By September 1845 he obtained his first solution, and handed to Professor Challis, the director of the Cambridge Observatory, a paper giving the elements of what he described as "the new planet."

On the 21st of October 1845 he left at Greenwich Observatory, for the information of Sir George Airy, the astronomer-royal, a similar document, still preserved among the archives. A fortnight afterwards Airy wrote asking for information about a point in the solution. Adams, who thought the query unessential, did not reply, and Airy for some months took no steps to verify by telescopic search the results of the young mathematician's investigation. Meanwhile, Leverrier, on the 10th of November 1845, presented to the French Academy a memoir on Uranus, showing that the existing theory failed to account for its motion. Unaware of Adams's work, he attempted a like inquiry, and on the 1st of June 1846, in a second memoir, gave the position, but not the mass or orbit, of the disturbing body whose existence was presumed. The longitude he assigned differed by only 1° from that predicted by Adams in the document which Airy possessed. The latter was struck by the coincidence, and mentioned it to the Board of Visitors of the Observatory, James Challis and Sir John Herschel being present. Herschel, at the ensuing meeting of the British Association early in September, ventured accordingly to predict that a new planet would shortly be discovered. Meanwhile Airy had in July suggested to Challis that the planet should be sought for with the Cambridge equatorial. The search was begun by a laborious method at the end of the month. On the 4th and 12th of August, as afterwards appeared, the planet was actually observed; but owing to the want of a proper star-map it was not then recognized as planetary. Leverrier, still ignorant of these occurrences, presented on the 31st of August 1846 a third memoir, giving for the first time the mass and orbit of the new body. He communicated his results by letter to Dr Galle, of the Berlin Observatory, who at once examined the suggested region of the heavens. On the 23rd of September he detected near the predicted place a small star unrecorded in the map, and next evening found that it had a proper motion. No doubt remained that "Leverrier's planet" had been discovered. On the announcement of the fact, Herschel and Challis made known that Adams had already calculated the planet's elements and position. Airy then at length published an account of the circumstances, and Adams's memoir was printed as an appendix to the *Nautical Almanac*. A keen controversy arose in France and England as to the merits of the two astronomers. In the latter country much surprise was expressed at the apathy of Airy; in France the claims made for an unknown Englishman were resented as detracting from the credit due to Leverrier's achievement. As the indisputable facts became known, the world recognized that the two astronomers had independently solved the problem of Uranus, and ascribed to each equal glory. The new planet, at first called *Leverrier* by F. Arago, received by general consent the neutral name of *Neptune*. Its mathematical prediction was not only an unsurpassed intellectual feat; it showed also that Newton's law of gravitation, which Airy had almost called in question, prevailed even to the utmost bounds of the solar system.

The honour of knighthood was offered to Adams when Queen Victoria visited Cambridge in 1847; but then, as on a subsequent occasion, his modesty led him to decline it. The Royal Society awarded him its Copley medal in 1848. In the same year the members of St John's College commemorated his success by founding in the university an Adams prize, to be given biennially for the best treatise on a mathematical subject. In 1851 he became president of the Royal Astronomical Society. His lay fellowship at St John's College came to an end in 1852, and the existing statutes did not permit of his re-election. But Pembroke College, which possessed greater freedom, elected him in the following year to a lay fellowship, and this he held for the rest of his life. In 1858 he became professor of mathematics at St Andrews, but lectured only for a session, when he vacated the chair for the Lowndean professorship of astronomy and geometry at Cambridge. Two years later he succeeded Challis as director of the Observatory, where he resided until his death.

Although Adams's researches on Neptune were those which attracted widest notice, the work he subsequently performed in relation to gravitational astronomy and terrestrial magnetism was not less remarkable. Several of his most striking contributions to knowledge originated in the discovery of errors or fallacies in the work of his great predecessors in astronomy. Thus in 1852 he published new and accurate tables of the moon's parallax, which superseded J. K. Burckhardt's, and supplied corrections to the theories of M. C. T. Damoiseau, G. A. A. Plana and P. G. D. de Pontécoulant. In the following year his memoir on the secular acceleration of the moon's mean motion partially invalidated Laplace's famous explanation, which had held its place unchallenged for sixty years. At first, Leverrier, Plana and other foreign astronomers controverted Adams's result; but its soundness was ultimately established, and its fundamental importance to this branch of celestial theory has only developed further with time. For these researches the Royal Astronomical Society awarded him its gold medal in 1866. The great meteor shower of 1866 turned his attention to the Leonids, whose probable path and period had already been discussed by Professor H. A. Newton. Using a powerful and elaborate analysis, Adams ascertained that this cluster of meteors, which belongs to the solar system, traverses an elongated ellipse in 33¼ years, and is subject to definite perturbations from the larger planets, Jupiter, Saturn and Uranus. These results were published in 1867. Ten years later, when Mr. G. W. Hill of Washington expounded a new and beautiful method for dealing with the problem of the lunar motions, Adams briefly announced his own unpublished work in the same field, which, following a parallel course had confirmed and supplemented Hill's. In 1874–1876 he was president of the Royal Astronomical Society for the second time, when it fell to him to present the gold medal of the year to Leverrier. The determination of the constants in Gauss's theory of terrestrial magnetism occupied him at intervals for over forty years. The calculations involved great labour, and were not published during his lifetime. They were edited by his brother, Professor W. Grylls Adams, and appear in the second volume of the collected *Scientific Papers*. Numerical computation of this kind might almost be described as his pastime. The value of the constant known as Euler's, and the Bernoullian numbers up to the 62nd, he worked out to an unimagined degree of accuracy. For Newton and his writings he had a boundless admiration; many of his papers, indeed, bear the cast of Newton's thought. He laboured for many years at the task of arranging and cataloguing the great collection of Newton's unpublished mathematical writings, presented in 1872 to the university by Lord Portsmouth, and wrote the account of them issued in a volume by the University Press in 1888. The post of astronomer-royal was offered him in 1881, but he preferred to pursue his peaceful course of teaching and research in Cambridge. He was British delegate to the International Prime Meridian Conference at Washington in 1884, when he also attended the meetings of the British Association at Montreal and of the American Association at Philadelphia. Five years later his health gave way, and after a long illness he died at the Cambridge Observatory on the 21st of January 1892, and was buried in St Giles's cemetery, near his home. He married in 1863 Miss Eliza Bruce, of Dublin, who survived him. An international committee was formed for the purpose of erecting a monument to his memory in Westminster Abbey; and there, in May 1895, a portrait medallion, by Albert Bruce Joy, was placed near the grave of Newton, and adjoining the memorials of Darwin and of Joule. His bust, by the same sculptor, stands opposite that of Sir John Herschel in the hall of St John's College, Cambridge. Herkomer's portrait is in Pembroke College; and Mogford's, painted in 1851, is in the combination room of St John's. Another bust, taken in his youth, belongs to the Royal Astronomical Society. A memorial tablet, with an inscription by Archbishop Benson, is placed in the Cathedral at Truro; and Mr Passmore Edwards erected a public institute in his honour at Launceston, near his birthplace.

The Scientific Papers of John Couch Adams, 4to, vol. i. (1896), and vol. ii. (1900), edited by William Grylls Adams and Ralph Allen Sampson, with a memoir by Dr J. W. L. Glaisher, were published by the Cambridge University Press. The first volume contains his previously published writings; the second those left in manuscript, including the substance of his lectures on the Lunar Theory. A collection, virtually complete, of Adams's papers regarding the discovery of Neptune was presented by Mrs Adams to the library of St John's College. A description of them by Professor Sampson was inserted in the *Memoirs* of the Royal Astronomical Society (vol. liv. p. 143). Consult: *Month. Notices Roy. Astr. Soc.*, liii. 184; *Observatory*, xv. 174; *Nature*, xxxiv. 565, xlv. 301; *Astr. Journal*, No. 254; R. Grant, *Hist. of Physical Astronomy*, p. 168; *Edinburgh Review*, No. 381, p. 72.

ADAMS, JOHN QUINCY (1767–1848), eldest son of President John Adams, sixth president of the United States, was born on the 11th of July 1767, in that part of Braintree that is now Quincy, Massachusetts, and was named after John Quincy (1689–1767), his mother's grandfather, who was for many years a prominent member of the Massachusetts legislature. In 1778, and again in 1780, young Adams accompanied his father to Europe; studying in Paris in 1778–1779 and at the university of Leiden in 1780. In 1780, also, he began to keep that diary which forms so conspicuous a record of the doings of himself and his contemporaries. In 1781, at the age of fourteen, he accompanied Francis Dana (1743–1811), American envoy to Russia, as his private secretary; but Dana was not received by the Russian government, and in 1782 Adams joined his father at Paris, where he acted as "additional secretary" to the American commissioners in the negotiation of the treaty of peace which concluded the War of American Independence. Instead of accompanying his father to London, he, of his own choice, returned to Massachusetts, graduated at Harvard College in 1787, three years later was admitted to practise at the bar and at once opened an office in Boston. A series of papers written by him in which he controverted some of Thomas Paine's doctrines in the *Rights of Man*, and later another series in which he ably supported the neutral policy of the administration toward France and England, led to his appointment by Washington as minister to the Netherlands in May 1794. There was little for him to do at the Hague, but in the absence of a minister at London, he transacted certain public business with the English foreign secretary. In 1796 Washington appointed him minister to Portugal, but before his departure thither his father John Adams became president and changed his destination to Berlin (1797). While there, he negotiated (1799) a treaty of amity and commerce with Prussia. On Thomas Jefferson's election to the presidency in 1800, the elder Adams recalled his son, who returned home in 1801. The next year, he was elected to the Massachusetts senate, and in 1803 was sent to Washington as a member of the Senate of the United States.

Up to this time, John Quincy Adams was regarded as belonging to the Federalist party, but he now found its general policy displeasing to him, was frowned upon, as the son of his father, by the followers of Alexander Hamilton, and found himself nearly powerless as an unpopular member of an unpopular minority. He was not now, and indeed never was, a strict party man. On the first important question that came before him in the Senate, the acquisition of Louisiana, he voted with the Republicans, regardless of the opposition of his own section. In December 1807 he warmly seconded Jefferson's suggestion of an embargo and vigorously urged instant action, saying: "The president has recommended the measure on his high responsibility. I would not consider, I would not deliberate; I would act!" Within five hours the Senate had passed the Embargo Bill and sent it to the House. The support of a measure so unpopular in New England caused him to be hated by the Federalists there and cost him his seat in the Senate; his successor was chosen on the 3rd of June 1808, several months before the usual time of filling the vacancy, and five days later Adams resigned. In the same year he attended the Republican congressional caucus which nominated Madison for the presidency, and thus definitely joined the Republicans. From 1806 to 1809 Adams was professor of rhetoric and oratory at Harvard.

In 1809 President Madison sent Adams to Russia to represent the United States. He arrived at St Petersburg at the psychological moment when the tsar had made up his mind to break with Napoleon. Adams therefore met with a favourable reception and a disposition to further the interests of American commerce in every possible way. On the outbreak of the war between the United States and England in 1812, he was still at St Petersburg. In September of that year, the Russian government suggested that the tsar was willing to act as mediator between the two belligerents. Madison precipitately accepted this proposition and sent Albert Gallatin and James Bayard to act as commissioners with Mr Adams; but England would have nothing to do with it. In August 1814, however, these gentlemen, with Henry Clay and Jonathan Russell, began negotiations with English commissioners which resulted in the signature of the treaty of Ghent on the 24th of December of that year. After this Adams visited Paris, where he witnessed the return of Napoleon from Elba, and then went to London, where, with Henry Clay and Albert Gallatin, he negotiated (1815) a "Convention to Regulate Commerce and Navigation." Soon afterwards he became U.S. minister to Great Britain, as his father had been before him, and as his son, Charles Francis Adams, was after him. After accomplishing little in London, he returned to the United States in the summer of 1817 to become secretary of state in the cabinet of President Monroe.

As secretary of state, Adams played the leading part in two most important episodes,—the acquisition of Florida and the promulgation of the Monroe Doctrine. Ever since the acquisition of Louisiana successive administrations had sought to include a part at least of Florida in that purchase. In 1819, after long negotiations, Adams succeeded in bringing the Spanish minister to the point of signing a treaty in which the Spaniards abandoned all claims to territory east of the Mississippi, and the United States relinquished all claim to what is now known as Texas. Before the Spanish government ratified the treaty in 1820, Mexico, including Texas, had thrown off allegiance to the mother country, and the United States had occupied Florida by force of arms. The Monroe Doctrine (*q.v.*) rightly bears the name of the president who in 1823 assumed the responsibility for its promulgation; but it was primarily the work of John Quincy Adams. The eight years of Monroe's presidency (1817–1825) are known as the "Era of Good Feeling." As his second term drew to a close, there was a great lack of good feeling among his official advisers, three of whom—Adams, secretary of state, Calhoun, secretary of war, and Crawford, secretary of the treasury—aspired to succeed him in his high office. In addition, Henry Clay and Andrew Jackson were also candidates. Calhoun was nominated for the vice-presidency. Of the other four, Jackson received 99 electoral votes, Adams 84, Crawford 41, and Clay 37; as no one had a majority, the decision was made by the House of Representatives, which was confined in its choice to the three candidates who had received the largest number of votes. Clay, who was speaker of the House of Representatives, and had for years assumed a censorious attitude toward Jackson, cast his influence for Adams and thereby secured his election on the first ballot. A few days later Adams offered Clay the secretaryship of state, which was accepted. The wholly unjust and baseless charge of "bargain and corruption" followed, and the feud thus created between Adams and Jackson greatly influenced the history of the United States.

Up to this point Adams's career had been almost uniformly successful, but his presidency (1825–1829) was in most respects a failure, owing to the virulent opposition of the Jacksonians; in 1828 Jackson was elected president over Adams. It was during his administration that irreconcilable differences developed between the followers of Adams and the followers of Jackson, the former becoming known as the National Republicans, who with the Anti-Masons were the precursors of the Whigs. In 1829 Adams retired to private life in the town of Quincy; but only for a brief period, for in 1830, largely by Anti-Masonic votes, he was elected a member of the national House of Representatives. On its being suggested to him that his acceptance of this position would degrade an ex-president, Adams replied that no person could be degraded by serving the people as a representative in congress or, he added, as a selectman of his town. His service in congress from 1831 until his death is, in some respects, the most noteworthy part of his career. Throughout he was conspicuous as an opponent of the extension of slavery, though he was never technically an abolitionist, and in particular he was the champion in the House of Representatives of the right of petition at a time when, through the influence of the Southern members, this right was, in practice, denied by that body. His prolonged fight for the repeal of the so-called "Gag Laws" is one of the most dramatic contests in the history of congress. The agitation for the abolition of slavery, which really began in earnest with the establishment of the *Liberator* by William Lloyd Garrison in 1831, soon led to the sending of innumerable petitions to congress for the abolition of slavery in the District of Columbia, over which the Federal government had jurisdiction, and for other action by congress with respect to that institution. These petitions were generally sent to Adams for presentation. They aroused the anger of the pro-slavery members of congress, who, in 1836, brought about the passage of the first "Gag Rule," the Pinckney Resolution, presented by Henry L. Pinckney, of South Carolina. It provided that all petitions relating to slavery should be laid on the table without being referred to committee or printed; and, in substance, this resolution was re-adopted at the beginning of each of the immediately succeeding sessions of congress, the Patton Resolution being adopted in 1837, the Atherton Resolution, or "Atherton Gag," in 1838, and the Twenty-first Rule in 1840 and subsequently until repealed. Adams contended that these "Gag Rules" were a direct violation of the First Amendment to the Federal Constitution, and refused to be silenced on the question, fighting for repeal with indomitable courage, in spite of the bitter denunciation of his opponents. Each year the number of anti-slavery petitions received and presented by him increased; perhaps the climax was in 1837, when Adams presented a petition from twenty-two slaves, and, when threatened by his opponents with censure, defended himself with remarkable keenness and ability. At each session, also, the majority against him decreased until in 1844 his motion to repeal the Twenty-first Rule was carried by a vote of 108 to 80 and his battle was won. On the 21st of February 1848, after having suffered a previous stroke of apoplexy, he fell insensible on the floor of the Representatives' chamber, and two days later died. Few men in American public life have possessed more intrinsic worth, more independence, more public spirit and more ability than Adams, but throughout his political career he was handicapped by a certain reserve, a certain austerity and coolness of manner, and by his consequent inability to appeal to the imaginations and affections of the people as a whole. He had, indeed, few intimate political or personal friends, and few men in American history have, during their lifetime, been regarded with so much hostility and attacked with so much rancour by their political opponents.

Authorities.—J. T. Morse, *John Quincy Adams* (Boston, 1883; new edition, 1899); Josiah Quincy, *Memoir of the Life of John Quincy Adams* (Boston, 1858); C. F. Adams (ed.), *Memoirs of John Quincy Adams*, comprising portions of his diary from 1795 to 1848 (12 vols., Philadelphia, 1874–1877). (E. Ch.)

ADAMS, SAMUEL (1722–1803), American statesman, was born at Boston, Massachusetts, on the 27th of September 1722. He was a second cousin to the elder John Adams. His father, whose Christian name was also Samuel, was a wealthy and prominent citizen of Boston, who took an active part in the politics of the town, and was a member of the Caucus (or Caulker's) Club, with which the political term "caucus" is said to have originated; his mother was Mary Fifield. Young Adams graduated from Harvard College in 1740, and three years later, on attaining the degree of A.M., chose for his thesis, "Whether it be Lawful to resist the Supreme Magistrate, if the Commonwealth cannot otherwise be preserved." Which side he took, and how the argument proceeded, is not known, but the subject was one which well forecasted his career. He began the study of law in response to his father's advice; he discontinued it in response to his mother's disapproval. He repeatedly failed in business, notably as manager of a malt-house, largely because of his incessant attention to politics; but in the Boston town-meeting he became a conspicuous example of the efficiency of that institution for training in statecraft. He has, indeed, been called the "Man of the Town Meeting." About 1748 he began to take an important part in the affairs of the town, and became a leader in the debates of a political club which he was largely instrumental in organizing, and to whose weekly publication, the *Public Advertiser*, he contributed numerous articles. From 1756 to 1764 he was one of the town's tax-collectors, but in this office he was unsuccessful, his easy business methods resulting in heavy arrears.

Samuel Adams first came into wider prominence at the beginning of the Stamp Act episode, in 1764, when as author of Boston's instructions to its representatives in the general court of Massachusetts he urged strenuous opposition to taxation by act of parliament. The next year he was for the first time elected to the lower house of the general court, in which he served until 1774, after 1766 as clerk. As James Otis's vigour and influence declined, Adams took a more and more prominent place in the revolutionary councils; and, contrary to the opinion of Otis and Benjamin Franklin, he declared that colonial representation in parliament was out of the question and advised against any form of compromise. Many of the Massachusetts revolutionary documents, including the famous "Massachusetts Resolves" and the circular letter to the legislatures of the other colonies, are from his pen; but owing to the fact that he usually acted as clerk to the House of Representatives and to the several committees of which he was a member, documents were written by him which expressed the ideas of the committee as a whole. There can be no question, however, that Samuel Adams was one of the first, if not the first, of American political leaders to deny the legislative power of parliament and to desire and advocate separation from the mother country.

To promote the ends he had in view he suggested non-importation, instituted the Boston committees of correspondence, urged that a Continental Congress be called, sought out and introduced into public service such allies as John Hancock, Joseph Warren and Josiah Quincy, and wrote a vast number of articles for the newspapers, especially the *Boston Gazette*, over a multitude of signatures. He was, in fact, one of the most voluminous and influential political writers of his time. His style is clear, vigorous and epigrammatic; his arguments are characterized by strength of logic, and, like those of other patriots, are, as the dispute advances, based less on precedent and documentary authorities and more on "natural right." Although he lacked oratorical fluency, his short speeches, like his writings, were forceful; his plain dress and unassuming ways helped to make him extremely popular with the common people, in whom he had much greater faith than his cousin John had; and, above all, he was an eminently successful manager of men. Shrewd, wily, adroit, unfailingly tactful, an adept in all the arts of the politician, he is considered to have done more than any other one man, in the years immediately preceding the War of Independence, to mould and direct public opinion in his community.

The intense excitement which followed the "Boston Massacre" Adams skilfully used to secure the removal of the soldiers from the town to a fort in the harbour. He it was, also, who managed the proceedings of the "Boston Tea Party," and later he was moderator of the convention of Massachusetts towns called to protest against the Boston Port Bill. One of the objects of the expedition sent by Governor Thomas Gage to Lexington (*q.v.*) and Concord on April 18-19, 1775, was the capture of Adams and John Hancock, temporarily staying in Lexington, and when Gage issued his proclamation of pardon on June 12 he excepted these two, whose offences, he said, were "of too flagitious a Nature to admit of any other Consideration than that of condign Punishment."

As a delegate to the Continental Congress, from 1774 to 1781, Samuel Adams continued vigorously to oppose any concession to the British government; strove for harmony among the several colonies in the common cause; served on numerous committees, among them that to prepare a plan of confederation; and signed the Declaration of Independence. But he was rather a destructive than a constructive statesman, and his most important service was in organizing the forces of revolution before 1775. In 1779 he was a member of the convention which framed the constitution of Massachusetts that was adopted in 1780, and is still, with some amendments, the organic law of the commonwealth and one of the oldest fundamental laws in existence. He was one of the three members of the sub-committee which actually drafted that instrument; and although John Adams is generally credited with having performed the principal part of that task, Samuel Adams was probably the author of most of the bill of rights. In 1788, Samuel Adams was a member of the Massachusetts convention to ratify the Constitution of the United States. When he first read that instrument he was very much opposed to the consolidated government which it provided, but was induced to befriend it by resolutions which were passed at a mass meeting of Boston mechanics or "tradesmen"—his own firmest supporters—and by the suggestion that its ratification should be accompanied by a recommendation of amendments designed chiefly to supply the omission of a bill of rights. Without his aid it is probable that the constitution would not have been ratified by Massachusetts. From 1789 to 1794 Adams was lieutenant-governor of his state, and from 1794 to 1797 was governor. After the formation of parties he became allied with the Democratic-Republicans rather than with the Federalists. He died on the 2nd of October 1803, at Boston.

Authorities.—*Life and Public Services of Samuel Adams* (3 vols., Boston, 1865), by W. V. Wells, Adams's great-grandson—a valuable biography, containing a mass of information, but noticeably biassed; J. K. Hosmer's *Samuel Adams* (Boston, 1885), an excellent short biography in the "American Statesmen Series"; M. C. Tyler's *Literary History of the American Revolution* (2 vols., New York, 1897); and H. A. Cushing (ed.), *The Writings of Samuel Adams* (4 vols., New York, 1904–1908). (E. Ch.)

ADAMS, THOMAS (d. *c.* 1655), English divine, was, in 1612, "a preacher of the gospel at Willington," in Bedfordshire, where he is found until 1614, and whence issued his *Heaven and Earth Reconciled*, *The Devil's Banquet* and other works. In 1614–1615 he was at Wingrave, in Buckinghamshire, probably as vicar, and published a number of works in quick succession; in 1618 he held the preachership at St Gregory's, under St Paul's Cathedral, and was "observant chaplain" to Sir Henry Montague, the lord chief justice of England. These bare facts we gather from epistles-dedicatory and epistles to the reader, and title-pages.

These epistles show him to have been on the most friendly terms with some of the foremost men in state and church, though his ardent protestantism offended Laud and hindered his preferment. His "occasionally" printed sermons, when collected in 1629, placed him beyond all comparison in the van of the preachers of England, and had something to do with shaping John Bunyan. He equals Jeremy Taylor in brilliance of fancies, and Thomas Fuller in wit. Robert Southey calls him "the prose Shakespeare of Puritan theologians." His numerous works display great learning, classical and patristic, and are unique in their abundance of stories, anecdotes, aphorisms and puns.

His works were edited in J. P. Nichol's *Puritan Divines*, by J. Angus and T. Smith (3 vols. 8vo, 1862).

ADAMS, WILLIAM (d. 1620), English navigator, was born at Gillingham, near Chatham, England. When twelve years old he was apprenticed to the seafaring life, afterwards entering the British navy, and later serving the company of Barbary merchants for a number of years as master and pilot. Attracted by the Dutch trade with India, he shipped as pilot major with a little fleet of five ships despatched from the Texel in 1598 by a company of Rotterdam merchants. The vessels, boats ranging from 75 to 250 tons and crowded with men, were driven to the coast of Guinea, where the adventurers attacked the island of Annabon for supplies, and finally reached the straits of Magellan. Scattered by stress of weather the following spring the "Charity," with Adams on board, and the "Hope," met at length off the coast of Chile, where the captains of both vessels lost their lives in an encounter with the Indians. In fear of the Spaniards, the remaining crews determined to sail across the Pacific. On this voyage the "Hope" was lost, but in April 1600 the "Charity," with a crew of sick and dying men, was brought to anchor off the island of Kiushiu, Japan. Adams was summoned to Osaka and there examined by Iyeyasu, the guardian of the young son of Taiko Sama, the ruler, who had just died. His knowledge of ships and shipbuilding, and his nautical smattering of mathematics, raised him in the estimation of the shogun, and he was subsequently presented with an estate at Hémi near Yokosuka; but was refused permission to return to England. In 1611 news came to him of an English settlement in Bantam, and he wrote asking for help. In 1613 Captain John Saris arrived at Hirado in the ship "Clove" with the object of establishing a trading factory for the East India Company, and after obtaining the necessary concessions from the shogun, Adams postponed his voyage home (permission for which had now been given him) in order to take a leading part, under Richard Cocks, in the organization of this new English settlement. He had already married a Japanese woman, by whom he had a family, and the latter part of his life was spent in the service of the English trading company, for whom he undertook a number of voyages to Siam in 1616, and Cochin China in 1617 and 1618. He died on the 16th of May 1620, some three years before the dissolution of the English factory. His Japanese title was Anjin Sama, and his memory was preserved in the naming of a street in Yedo, Anjin Cho (Pilot Street), and by an annual celebration on June 15 in his honour.

See *England's Earliest Intercourse with Japan*, by C. W. Hillary (1905); *Letters written by the English Residents in Japan*, ed. by N. Murakami (1900, containing Adams's Letters reprinted from *Memorials of the Empire of Japan*, ed. by T. Rundall, Hakluyt Society, 1850); *Diary of Richard Cocks*, with preface by N. Murakami (1899, reprinted from the Hakluyt Society ed. 1883); R. Hildreth's *Japan* (1855); J. Harris's *Navigantium atque Itinerantium Bibliotheca* (1764), i. 856; *Voyage of John Saris*, ed. by Sir E. M. Satow (Hakluyt Society, 1900); *Asiatic Society of Japan Transactions*, xxvi. (sec. 1898) pp. 1 and 194, where four more hitherto unpublished letters of Adams are given; *Collection of State Papers; East Indies, China and Japan*. The MS. of his logs written during his voyages to Siam and China is in the Bodleian Library at Oxford.

ADAMS, a township in the extreme N. of Berkshire county, N.W. Massachusetts, U.S.A., having an area of 23 sq. m. Pop. (1880) 5591; (1890) 9213; (1900) 11,134, of whom 4376 were foreign-born; (1910, census) 13,026. It includes a portion of the valley of the Hoosac river, extending to the Hoosac Range on the E., and on the W. to Mt. Williams (3040 ft.), and Greylock Mountain (3535 ft.), partly in Williamstown, and the highest point in the state. The valley portion is level and contains several settlement centres, the largest of which, a busy industrial village (manufactures of cotton and paper), bears the same name as the township, and is on a branch of the Boston and Albany railroad. The village is the nearest station to Greylock, which can be easily ascended, and affords fine views of the Hoosac and Housatonic valleys, the Berkshire Hills and the Green Mountains; the mountain has been a state timber reservation since 1898. The township's principal industry is the manufacture of cotton goods, the value of which in 1905 ($4,621,261) was 84·1% of the value of the township's total factory products; in 1905 no other place in the United States showed so high a degree of specialization in this industry. The township (originally "East Hoosuck") was surveyed and defined in 1749. Fort Massachusetts, at one time within its bounds, was destroyed in 1746 by the French. An old Indian trail between the Hudson and Connecticut valley ran through the township, and was once a leading outlet of the Berkshire country. Adams was incorporated in 1778, and was named in honour of Samuel Adams, the revolutionary leader. Part of Adams was included in the new township of Cheshire in 1793, and North Adams was set off as a separate township in 1878.

ADAM'S APPLE, the movable projection, more prominent in males than females, formed in the front part of the throat by the thyroid cartilage of the larynx. The name was given from a legend that a piece of the forbidden fruit lodged in Adam's throat. The "Adam's apple" is one of the particular points of attack in the Japanese system of self-defence known as jiu-jitsu.

ADAM'S BRIDGE, or Rama's Bridge, a chain of sandbanks extending from the island of Manaar, near the N.W. coast of Ceylon to the island of Rameswaram, off the Indian coast, and lying between the Gulf of Manaar on the S.W. and Palk Strait on the N.E. It is more than 30 m. long and offers a serious impediment to navigation. Some of the sandbanks are dry; and no part of the shoal has a greater depth than 3 or 4 ft. at high water, except three tortuous and intricate channels which have recently been dredged to a sufficient depth to admit the passage of vessels, so as to obviate the long journey round the island of Ceylon which was previously necessary. Geological evidence shows that this gap was once bridged by a continuous isthmus which according to the temple records was breached by a violent storm in 1480. Operations for removing the obstacles in the channel and for deepening and widening it were begun as long ago as 1838. A service of the British India Steam Navigation Company's steamers has been established between Negapatam and Colombo through Palk Strait and this narrow passage.

ADAM SCOTUS (fl. 1180), theological writer, sometimes called Adam Anglicus or Anglo-Scotus, was born in the south of Scotland in the first half of the 12th century. About 1150 he was a Premonstratensian canon at St Andrews, and some twenty years later abbot and bishop of Candida Casa (Whithorn) in Galloway. He gained a European reputation for his writings, which are of mystico-ascetic type, and include an account of the Premonstratensian order, a collection of festival sermons, and a *Soliloquia de instructione discipuli*, formerly attributed to his contemporary, Adam of St Victor.

ADAMSON, PATRICK (1537–1592), Scottish divine, archbishop of St Andrews, was born at Perth. He studied philosophy, and took the degree of M.A. at St Andrews. After being minister of Ceres in Fife for three years, in 1566 he set out for Paris as tutor to the eldest son of Sir James Macgill, the clerk-general. In June of the same year he wrote a Latin poem on the birth of the young prince James, whom he described as *serenissimus princeps* of France and England. The French court was offended, and he was confined for six months. He was released only through the intercession of Queen Mary of Scotland and some of the principal nobility, and retired with his pupil to Bourges. He was in this city at the time of the massacre of St Bartholomew at Paris, and lived concealed for seven months in a public-house, the aged master of which, in reward for his charity to a heretic, was thrown from the roof. While in this

"Sepulchre," he wrote his Latin poetical version of the book of Job, and his tragedy of Herod in the same language. In 1572 or 1573 he returned to Scotland, and became minister of Paisley. In 1575 he was appointed by the General Assembly one of the commissioners to settle the jurisdiction and policy of the church; and the following year he was named, with David Lindsay, to report their proceedings to the earl of Morton, then regent. In 1576 his appointment as archbishop of St Andrews gave rise to a protracted conflict with the Presbyterian party in the Assembly. He had previously published a catechism in Latin verse dedicated to the king, a work highly approved even by his opponents, and also a Latin translation of the Scottish Confession of Faith. In 1578 he submitted himself to the General Assembly, which procured him peace for a little time, but next year fresh accusations were brought against him. He took refuge in St Andrews Castle, where "a wise woman," Alison Pearson, who was ultimately burned for witchcraft, cured him of a serious illness. In 1583 he went as James's ambassador to the court of Elizabeth, and is said to have behaved rather badly. On his return he took strong parliamentary measures against Presbyterians, and consequently, at a provincial synod held at St Andrews in April 1586, he was accused of heresy and excommunicated, but at the next General Assembly the sentence was remitted as illegal. In 1587 and 1588, however, fresh accusations were brought against him, and he was again excommunicated, though afterwards on the inducement of his old opponent, Andrew Melville, the sentence was again remitted. Meanwhile he had published the Lamentations of Jeremiah, and the book of Revelation in Latin verse, which he dedicated to the king, complaining of his hard usage. But James was unmoved by his application, and granted the revenue of his see to the duke of Lennox. For the rest of his life Adamson was supported by charity; he died in 1592. His recantation of Episcopacy (1590) is probably spurious. Adamson was a man of many gifts, learned and eloquent, but with grave defects of character. His collected works, prefaced by a fulsome panegyric, in the course of which it is said that "he was a miracle of nature, and rather seemed to be the immediate production of God Almighty than born of a woman," were produced by his son-in-law, Thomas Wilson, in 1619.

ADAMSON, ROBERT (1852–1902), Scottish philosopher, was born in Edinburgh on the 19th of January 1852. His father was a solicitor, and his mother was the daughter of Matthew Buist, factor to Lord Haddington. In 1855 Mrs Adamson was left a widow with small means, and devoted herself entirely to the education of her six children. Of these, Robert was successful from the first. At the end of his school career he entered the university of Edinburgh at the age of fourteen, and four years later graduated with first-class honours in mental philosophy, with prizes in every department of the faculty of Arts. He completed his university successes by winning the Tyndall-Bruce scholarship, the Hamilton fellowship (1872), the Ferguson scholarship (1872) and the Shaw fellowship (1873). After a short residence at Heidelberg (1871), where he began his study of German philosophy, he returned to Edinburgh as assistant first to Henry Calderwood and later to A. Campbell Fraser; he joined the staff of the *Encyclopaedia Britannica* (9th ed.) (1874) and studied widely in the Advocates' Library. In 1876 he came to England as successor to W. S. Jevons in the chair of logic and philosophy, at Owens College, Manchester. In 1883 he received the honorary degree of LL.D. In 1893 he went to Aberdeen, and finally in 1895 to the chair of logic at Glasgow, which he held till his death on the 5th of February 1902. His wife, Margaret Duncan, the daughter of a Manchester merchant, was a woman of kindred tastes, and their union was entirely happy.

It is matter for regret to the student that Adamson's active labours in the lecture room precluded him from systematic production. His writings consisted of short articles, of which many appeared in the *Encyclopaedia Britannica* (9th ed.) and in *Mind*, a volume on Kant and another on Fichte. At the time of his death he was writing a *History of Psychology*, and had promised a work on *Kant and the Modern Naturalists*. Both in his life and in his writings he was remarkable for impartiality. It was his peculiar virtue that he could quote his opponents without warping their meaning. From this point of view he would have been perhaps the first historian of philosophy of his time, had his professional labours been less exacting. Except during the first few years at Manchester, he delivered his lectures without manuscripts. In 1903, under the title *The Development of Modern Philosophy and Other Essays*, his more important lectures were published with a short biographical introduction by Prof. W. R. Sorley of Cambridge University (see *Mind*, xiii. 1904, p. 73 foll.). Most of the matter is taken verbatim from the note-book of one of his students. Under the same editorship there appeared, three years later, his *Development of Greek Philosophy*. In addition to his professional work, he did much administrative work for Victoria University and the university of Glasgow. In the organization of Victoria University he took a foremost part, and, as chairman of the Board of Studies at Owens College, he presided over the general academical board of the Victoria University. At Glasgow he was soon elected one of the representatives on the court, and to him were due in large measure the extension of the academical session and the improved equipment of the university.

Throughout his lectures, Adamson pursued the critical and historical method without formulating a constructive theory of his own. He felt that any philosophical advance must be based on the Kantian methods. It was his habit to make straight for the ultimate issue, disregarding half-truths and declining compromise. He left a hypothesis to be worked out by others; this done, he would criticize with all the rigour of logic, and with a profound distrust of imagination, metaphor and the attitude known as the will-to-believe. As he grew older his metaphysical optimism waned. He felt that the increase of knowledge must come in the domains of physical science. But this empirical tendency as regards science never modified his metaphysical outlook. He has been called Kantian and Neo-Kantian, Realist and Idealist (by himself, for he held that appearance and reality are co-extensive and coincident). At the same time, in his criticism of other views he was almost typical of Hegelian idealism. All processes of reasoning or judgment (*i.e.* all units of thought) are (1) analysable only by abstraction, and (2) are compound of deduction and induction, *i.e.* rational and empirical. An illustration of his empirical tendency is found in his attitude to the Absolute and the Self. The "Absolute" doctrines he regarded as a mere disguise of failure, a dishonest attempt to clothe ignorance in the pretentious garb of mystery. The Self as a primary, determining entity, he would not therefore admit. He represented an empiricism which, so far from refuting, was actually based on, idealism, and yet was alert to expose the fallacies of a particular idealist construction (see his essay in *Ethical Democracy*, edited by Dr Stanton Coit).

ADAM'S PEAK, a mountain in Ceylon, about 45 miles E. from Colombo, in N. lat. 6° 55′, E. long. 80° 30′. It rises steeply to a height of 7352 feet, and commands a magnificent prospect. Its conical summit terminates in an oblong platform, 74 ft. by 24, on which there is a hollow, resembling the form of a human foot, 5 ft. 4 in. by 2 ft. 6 in.; and this has been consecrated as the footprint of Buddha. The margin of this supposed footprint is ornamented with gems, and a wooden canopy protects it from the weather. It is held in high veneration by the Sinhalese, and numerous pilgrims ascend to the sacred spot, where a priest resides to receive their offerings and bless them on their departure. By the Mahommedans the impression is regarded as that of the foot of Adam, who here, according to their tradition, fulfilled a penance of one thousand years; while the Hindus claim it as that of their god Siva.

ADANA. (1) A vilayet in the S.E. of Asia Minor, which includes the ancient Cilicia. The mountain districts are rich in unexploited mineral wealth, and the fertile coast-plain, which produces cotton, rice, cereals, sugar and much fruit, and affords abundant pasturage, is well watered by the rivers that descend from the Taurus range. Imports and exports pass through Mersina (*q.v.*). (2) The chief town of the vilayet, situated in the alluvial plain about 30 m. from the sea in N. lat. 37° 1′, E. long. 35° 18′, on the right bank of the Seihan (Sihun, anc. Sarus), which is navigable by small craft as far as the town. Adana is connected with Tersus and Mersina by a railway built in 1887, and has a magnificent stone bridge, which carries the road to Missis and the east, and dates in parts from the time of Justinian, but was restored first in 743 A.D. and called Jisr al-Walid after the Omayyad caliph of that name, and again in 840 by the Caliph Mutasim. There are, also, a ruined castle founded by Harun al-Rashid in 782, fine fountains, good buildings, river-side quays, cotton mills and an American mission with church and schools. Adana, which retains its ancient name, rose to importance as a station on the Roman military road to the East, and was at one time a rival of Tarsus. The town was largely rebuilt by Mansur in 758, and during subsequent centuries it often changed hands and suffered many vicissitudes. Its position, commanding the passage of the mountains to the north of Syria, rendered it important as a military station in the contest between the Egyptians and the Turks in 1832. After the defeat of the Turkish army at Konia it was granted to Ibrahim Pasha, and though the firman announcing his appointment named him only *muhassil*, or collector of the crown revenue, it continued to be held by the Egyptians till the treaty of July 1840 restored it to the Porte. The chief productions of the province are cotton, corn, sesame and wool, which are largely exported. The population of the town is greatly mixed, and, having a large element of nomads in it, varies much from time to time. At its maximum it reaches nearly 50,000. (D. G. H.)

ADANSON, MICHEL (1727–1806), French naturalist, of Scottish descent, was born on the 7th of April 1727, at Aix, in Provence. After leaving the Collège Sainte Barbe in Paris, he was employed in the cabinets of R. A. F. Réaumur and Bernard de Jussieu, as well as in the Jardin des Plantes. At the end of 1748 he left France on an exploring expedition to Senegal, which from the unhealthiness of its climate was a *terra incognita* to naturalists. His ardour remained unabated during the five years of his residence in Africa. He collected and described, in greater or less detail, an immense number of animals and plants; collected specimens of every object of commerce; delineated maps of the country; made systematic meteorological and astronomical observations; and prepared grammars and dictionaries of the languages spoken on the banks of the Senegal. After his return to Paris in 1754 he made use of a small portion of the materials he had collected in his *Histoire naturelle du Sénégal* (Paris, 1757). This work has a special interest from the essay on shells, printed at the end of it, where Adanson proposed his *universal method*, a system of classification distinct from those of Buffon and Linnaeus. He founded his classification of all organized beings on the consideration of each individual organ. As each organ gave birth to new relations, so he established a corresponding number of arbitrary arrangements. Those beings possessing the greatest number of similar organs were referred to one great division, and the relationship was considered more remote in proportion to the dissimilarity of organs. In 1763 he published his *Familles naturelles des plantes*. In this work he developed the principle of arrangement above mentioned, which, in its adherence to natural botanical relations, was based on the system of J. P. Tournefort, and had been anticipated to some extent nearly a century before by John Ray. The success of this work was hindered by its innovations in the use of terms, which were ridiculed by the defenders of the popular sexual system of Linnaeus; but it did much to open the way for the establishment, by means principally of A. L. de Jussieu's *Genera Plantarum* (1789), of the natural method of the classification of plants. In 1774 Adanson submitted to the consideration of the Academy of Sciences an immense work, extending to all known beings and substances. It consisted of 27 large volumes of manuscript, employed in displaying the general relations of all these matters, and their distribution; 150 volumes more, occupied with the alphabetical arrangement of 40,000 species; a vocabulary, containing 200,000 words, with their explanations; and a number of detached memoirs, 40,000 figures and 30,000 specimens of the three kingdoms of nature. The committee to which the inspection of this enormous mass was entrusted strongly recommended Adanson to separate and publish all that was peculiarly his own, leaving out what was merely compilation. He obstinately rejected this advice; and the huge work, at which he continued to labour, was never published. He had been elected a member of the Academy of Sciences in 1759, and he latterly subsisted on a small pension it had conferred on him. Of this he was deprived in the dissolution of the Academy by the Constituent Assembly, and was consequently reduced to such a depth of poverty as to be unable to appear before the French Institute when it invited him to take his place among its members. Afterwards he was granted a pension sufficient to relieve his simple wants. He died at Paris after months of severe suffering, on the 3rd of August 1806, requesting, as the only decoration of his grave, a garland of flowers gathered from the fifty-eight families he had differentiated—"a touching though transitory image," says Cuvier, "of the more durable monument which he has erected to himself in his works." Besides the books already mentioned he published papers on the ship-worm, the baobab tree, the *Adansonia digitata* of Linnaeus, the origin of the varieties of cultivated plants, and gum-producing trees.

ADAPTATION (from Lat. *adaptare*, to fit to), a process of fitting, or modifying, a thing to other uses, and so altering its form or original purpose. In literature there may be, *e.g.*, an adaptation of a novel for a drama, or in music an arrangement of a piece for two hands into one for four, &c. In biology, according to the doctrine of evolution, adaptation plays a prominent part as the process by which an organism or species of organisms becomes modified to suit the conditions of its life. Every change in a living organism involves adaptation; for in all cases life consists in a continuous adjustment of internal to external relations. Every living organism reacts to its environment; if the reaction is unfavourable, disability leading to ultimate extinction is the result. If the reaction is favourable, its result is called an adaptation. How far such adaptations are produced afresh in each generation, whether or no their effects are transmitted to descendants and so directly modify the stock, to what extent adaptations characteristic of a species or variety have come about by selection of individuals capable, in each generation, of responding favourably, or how far by the selection of individuals fortuitously suitable to the environment, or, how far, possibly by the inheritance of the responses to the environment, are problems of biology not yet definitely solved.

ADDA (anc. *Addua*), a river of North Italy. Its true source is in some small lakes near the head of the Fraële glen, but its volume is increased by the union with several smaller streams, near the town of Bormio, at the Raetian Alps. Thence it flows first S.W., then due W., through the fertile Valtellina (*q.v.*), passing Tirano, where the Poschiavino falls in on the right, and Sondrio, where is the junction with the Malero, right. It falls into the Lake of Como, at its northern end, and mainly forms that lake. On issuing from its south-eastern or Lecco arm, it crosses the plain of Lombardy, and finally, after a course of about 150 m., joins the Po, 8 m. above Cremona. The lower course of the Adda was formerly the boundary between the territories of Venice and of Milan; and on its banks several important battles have been fought, notably that of Lodi, where Napoleon defeated the Austrians in 1796. (W. A. B. C.)

ADDAMS, JANE (1860–), American sociologist, was born at Cedarville, Illinois, on the 6th of September 1860. After graduating at Rockford (Illinois) Female Seminary (now Rockford College) in 1881, she spent several years in the study of economic and sociological questions in both Europe and America, and in 1889 with Miss Ellen Gates Starr established in Chicago, Illinois, the social settlement known as Hull House, of which she became the head-worker. The success of this settlement, which became a great factor for good in the city, was principally due to Miss Addams's rare executive skill and practical commonsense methods. Her personal participation in the life of the community is exemplified in her acceptance of the office of inspector of streets and alleys under the municipal government. She became known as a lecturer and writer and published *Democracy and Social Ethics* (1902), *Newer Ideals of Peace* (1907), and *The Spirit of Youth and the City Streets* (1909).

ADDAX, a genus of antelopes, with one species (*A. nasomaculatus*) from North Africa and Arabia. It is a little over 3 ft. high, yellowish white in colour, with a brown mane and a fringe of the same hue on the throat. Both sexes carry horns, which are ringed and form an open spiral. The addax is a desert antelope, and in habits probably resembles the gemsbuck. It is hunted by the Arabs for its flesh and to test the speed of their horses and greyhounds; it is during these hunting parties that the young are captured for menagerie purposes.

ADDER, a name for the common viper (*Vipera berus*), ranging from Wales to Saghalien island, and from Caithness to the north of Spain. The puff-adder (*Bitis s. Echidna arietans*) of nearly the whole of Africa, and the death-adder (*Acanthophis antarcticus*) from Australia to the Moluccas, are both very poisonous (see Viper). The word was in Old Eng. *naedre*, later *nadder* or *naddre*; in the 14th century "a nadder" was, like "a napron," wrongly divided into "an adder." It appears with the generic meaning of "serpent" in the older forms of many Teutonic languages, cf. Old High Ger. *natra*; Goth. *nadrs*. It is thus used in the Old Eng. version of the Scriptures for the devil, the "serpent" of Genesis.

ADDISON, JOSEPH (1672–1719), English essayist, poet and man of letters, eldest son of Lancelot Addison, later dean of Lichfield, was born at his father's rectory of Milston in Wiltshire, on the 1st of May 1672. After having passed through several schools, the last of which was the Charterhouse, he went to Oxford when he was about fifteen years old. He was first entered a commoner of Queen's College, but after two years was elected to a demyship of Magdalen College, having been recommended by his skill in Latin versification. He took his master's degree in 1693, and subsequently obtained a fellowship which he held until 1711. His first literary efforts were poetical, and, after the fashion of his day, in Latin. Many of these are preserved in the *Musae Anglicanae* (1691–1699), and obtained academic commendation from academic sources. But it was a poem in the third volume of Dryden's *Miscellanies*, followed in the next series by a translation of the fourth *Georgic*, which brought about his introduction to Tonson the bookseller, and (probably through Tonson) to Lord Somers and Charles Montagu. To both of these distinguished persons he contrived to commend himself by *An Account of the Greatest English Poets* (1694), *An Address to King William* (1695), after Namur, and a Latin poem entitled *Pax Gulielmi* (1697), on the peace of Ryswick, with the result that in 1699 he obtained a pension of £300 a year, to enable him (as he afterwards said in a memorial addressed to the crown) "to travel and qualify himself to serve his Majesty." In the summer of 1699 he crossed into France, where, chiefly for the purpose of learning the language, he remained till the end of 1700; and after this he spent a year in Italy. In Switzerland, on his way home, he was stopped by receiving notice that he was to attend the army under Prince Eugene, then engaged in the war in Italy, as secretary from the king. But his Whig friends were already tottering in their places; and in March 1702 the death of King William at once drove them from power and put an end to the pension. Indeed Addison asserted that he never received but one year's payment of it, and that all the other expenses of his travels were defrayed by himself. He was able, however, to visit a great part of Germany, and did not reach Holland till the spring of 1703. His prospects were now sufficiently gloomy: he entered into treaty, oftener than once, for an engagement as a travelling tutor; and the correspondence in one of these negotiations has been preserved. Tonson had recommended him as the best person to attend in this character Lord Hertford, the son of the duke of Somerset, commonly called "The Proud." The duke, a profuse man in matters of pomp, was economical in questions of education. He wished Addison to name the salary he expected; this being declined, he announced, with great dignity, that in addition to travelling expenses he would give a hundred guineas a year; Addison accepted the munificent offer, saying, however, that he could not find his account in it otherwise than by relying on his Grace's future patronage; and his Grace immediately intimated that he would look out for some one else. In the autumn of 1703 Addison returned to England.

The works which belong to his residence on the continent were the earliest that showed him to have attained maturity of skill and genius. There is good reason for believing that his tragedy of *Cato*, whatever changes it may afterwards have suffered, was in great part written while he lived in France, that is, when he was about twenty-eight years of age. In the winter of 1701, amidst the stoppages and discomforts of a journey across Mt. Cenis, he composed, wholly or partly, his rhymed *Letter from Italy* to Charles Montagu. This contains some fine touches of description, and is animated by a noble tone of classical enthusiasm. While in Germany he wrote his *Dialogues on Medals*, which, however, were not published till after his death. These have much liveliness of style and something of the gay humour which the author was afterwards to exhibit more strongly; but they show little either of antiquarian learning or of critical ingenuity. In tracing out parallels between passages of the Roman poets and figures or scenes which appear in ancient sculptures, Addison opened the easy course of inquiry which was afterwards prosecuted by Spence; and this, with the apparatus of spirited metrical translations from the classics, gave the work a likeness to his account of his travels. This account, entitled *Remarks on Several Parts of Italy, &c.* (1705), he sent home for publication before his own return. It wants altogether the interest of personal narrative: the author hardly ever appears. The task in which he chiefly busies himself is that of exhibiting the illustrations which the writings of the Latin poets, and the antiquities and scenery of Italy, mutually give and receive. Christian antiquities and the monuments of later Italian history had no interest for him.

With the year 1704 begins a second era in Addison's life, which extends to the summer of 1710, when his age was thirty-eight. This was the first term of his official career; and though very barren of literary performance, it not only raised him from indigence, but settled definitely his position as a public man. His correspondence shows that, while on the continent, he had been admitted to confidential intimacy by diplomatists and men of rank; immediately on his return he was enrolled in the Kit-Cat Club, and brought thus and otherwise into communication with the gentry of the Whig party. Although all accounts agree in representing him as a shy man, he was at least saved from all risk of making himself disagreeable in society, by his unassuming manners, his extreme caution and that sedulous desire to oblige, which his satirist Pope exaggerated into a positive fault. His knowledge and ability were esteemed so highly as to confirm the expectations formerly entertained of his usefulness in public business; and the literary fame he had already acquired soon furnished an occasion for recommending him to public employment. Though the Whigs were out of office, the administration which succeeded them was, in all its earlier changes, of a complexion so mixed and uncertain that the influence of their leaders was not entirely lost. Not long after Marlborough's great victory at Blenheim, it is said that Godolphin, the lord treasurer, expressed to Lord Halifax a desire to have the great duke's fame extended by a poetical tribute. Halifax seized the opportunity of recommending Addison as the fittest man for the duty; stipulating, we are told, that the service should not be unrewarded, and doubtless satisfying the minister that his protégé possessed other qualifications for office besides dexterity in framing heroic verse. *The Campaign* (December 1704), the poem thus written to order, was received with extraordinary applause; and it is probably as good as any that ever was prompted by no more worthy inspiration. It has, indeed, neither the fiery spirit which Dryden threw into occasional pieces of the sort, nor the exquisite polish that would have been given by Pope, if he had stooped to make such uses of his genius; but many of the details are pleasing; and in the famous passage of the Angel, as well as in several others, there is even something of force and imagination.

The consideration covenanted for by the poet's friends was faithfully paid. A vacancy occurred by the death of another celebrated man, John Locke; and Addison was appointed one of the five commissioners of appeal in Excise. The duties of the place must have been as light for him as they had been for his predecessor, for he continued to hold it with all the appointments he subsequently received from the same ministry. But there is no reason for believing that he was more careless than other public servants in his time; and the charge of incompetency as a man of business, which has been brought so positively against him, cannot easily be true as to this first period of his official career. Indeed, the specific allegations refer exclusively to the last years of his life; and, if he had not really shown practical ability in the period now in question, it is not easy to see how he, a man destitute alike of wealth, of social or fashionable liveliness and of family interest, could have been promoted, for several years, from office to office, as he was, till the fall of the administration to which he was attached. In 1706 he became one of the under-secretaries of state, serving first under Sir Charles Hedges, who belonged to the Tory section of the government, and afterwards under Lord Sunderland, Marlborough's son-in-law, and a zealous follower of Addison's early patron, Somers. The work of this office, however, like that of the commissionership, must often have admitted of performance by deputy; for in 1707, the Whigs having become stronger, Lord Halifax was sent on a mission to the elector of Hanover; and, besides taking Vanbrugh the dramatist with him as king-at-arms, he selected Addison as his secretary. In 1708 Addison entered parliament, sitting at first for Lostwithiel, but afterwards for Malmesbury, which he represented from 1710 till his death. Here unquestionably he did fail. What part he may have taken in the details of business we are not informed; but he was always a silent member, unless it be true that he once attempted to speak and sat down in confusion. In 1708 Lord Wharton, the father of the notorious duke, having been named lord-lieutenant of Ireland, Addison became his secretary, receiving also an appointment as keeper of records. This event happened only about a year and a half before the dismissal of the ministry.

But there are letters showing that Addison made himself acceptable to some of the best and most distinguished persons in Dublin; and he escaped without having any quarrel with Swift, his acquaintance with whom had begun some time before.

In his literary history those years of official service are almost a blank, till we approach their close. Besides furnishing a prologue to Steele's comedy of *The Tender Husband* (1705), he admittedly gave him some assistance in its composition; he defended the government in an anonymous pamphlet on *The Present State of the War* (1707); he united compliments to the all-powerful Marlborough with indifferent attempts at lyrical poetry in his opera of *Rosamond*; and during the last few months of his tenure of office he contributed largely to the *Tatler*. His entrance on this new field nearly coincides with the beginning of a new period in his life. Even the coalition-ministry of Godolphin was too Whiggish for the taste of Queen Anne; and the Tories, the favourites of the court, gained, both in parliamentary power and in popularity out of doors, by a combination of lucky accidents, dexterous management and divisions and double-dealing among their adversaries. The real failure of the prosecution of Addison's old friend Sacheverell completed the ruin of the Whigs; and in August 1710 an entire revolution in the ministry had been completed. The Tory administration which succeeded kept its place till the queen's death in 1714, and Addison was thus left to devote four of the best years of his life, from his thirty-ninth year to his forty-third, to occupations less lucrative than those in which his time had recently been frittered away, but much more conducive to the extension of his own fame and to the benefit of English literature. Although our information as to his pecuniary affairs is very scanty, we are entitled to believe that he was now independent of literary labour. He speaks, in an extant paper, of having had (but lost) property in the West Indies; and he is understood to have inherited something from a younger brother, who had been governor of Madras. In 1711 he purchased, for £10,000, the estate of Bilton, near Rugby—the place which afterwards became the residence of Mr Apperley, better known by his assumed name of "Nimrod."

During those four years he produced a few political writings. Soon after the fall of the ministry, he started the *Whig Examiner* in opposition to the Tory *Examiner*, then conducted by Prior, and afterwards the vehicle of Swift's most vehement invectives against the party he had once belonged to. These are certainly the most ill-natured of Addison's writings, but they are neither lively nor vigorous, and the paper died after five numbers (14th September to 12th October 1710). There is more spirit in his allegorical pamphlet, *The Trial and Conviction of Count Tariff*.

But from the autumn of 1710 till the end of 1714 his principal employment was the composition of his celebrated periodical essays. The honour of inventing the plan of such compositions, as well as that of first carrying the idea into execution, belongs to Richard Steele, who had been a schoolfellow of Addison at the Charterhouse, continued to be on intimate terms with him afterwards and attached himself with his characteristic ardour to the same political party. When, in April 1709, Steele published the first number of the *Tatler*, Addison was in Dublin, and knew nothing of the design. He is said to have detected his friend's authorship only by recognizing, in the sixth number, a critical remark which he remembered having himself communicated to Steele. Shortly afterwards he began to furnish hints and suggestions, assisted occasionally and finally wrote regularly. According to Mr Aitken (*Life of Steele*, i. 248), he contributed 42 out of the total of 271 numbers, and was part-author of 36 more. The *Tatler* exhibited, in more ways than one, symptoms of being an experiment. For some time the projector, imitating the news-sheets in form, thought it prudent to give, in each number, news in addition to the essay; and there was a want, both of unity and of correct finishing, in the putting together of the literary materials. Addison's contributions, in particular, are in many places as lively as anything he ever wrote; and his style, in its more familiar moods at least, had been fully formed before he returned from the continent. But, as compared with his later pieces, these are only what the painter's loose studies and sketches are to the landscapes which he afterwards constructs out of them. In his invention of incidents and characters, one thought after another is hastily used and hastily dismissed, as if he were putting his own powers to the test or trying the effect of various kinds of objects on his readers; his most ambitious flights, in the shape of allegories and the like, are stiff and inanimate; and his favourite field of literary criticism is touched so slightly, as to show that he still wanted confidence in the taste and knowledge of the public.

The *Tatler* was dropped in January 1711, but only to be followed by the *Spectator*, which was begun on the 1st day of March, and appeared every week-day till the 6th day of December 1712. It had then completed the 555 numbers usually collected in its first seven volumes, and of these Addison wrote 274 to Steele's 236. He co-operated with Steele constantly from the very opening of the series; and they devoted their whole space to the essays. They relied, with a confidence which the extraordinary popularity of the work fully justified, on their power of exciting the interest of a wide audience by pictures and reflexions drawn from a field which embraced the whole compass of ordinary life and ordinary knowledge, no kind of practical themes being positively excluded except such as were political, and all literary topics being held admissible, for which it seemed possible to command attention from persons of average taste and information. A seeming unity was given to the undertaking, and curiosity and interest awakened on behalf of the conductors, by the happy invention of the Spectator's Club, for which Steele made the first sketch. The figure of Sir Roger de Coverley, however, the best even in the opening group, is the only one that was afterwards elaborately depicted; and Addison was the author of most of the papers in which his oddities and amiabilities are so admirably delineated. Six essays are by Steele, who gives Sir Roger's love-story, and one paper by Budgell describes a hunting party.

To Addison the *Spectator* owed the most natural and elegant, if not the most original, of its humorous sketches of human character and social eccentricities, its good-humoured satires on ridiculous features in manners and on corrupt symptoms in public taste; these topics, however, making up a department in which Steele was fairly on a level with his more famous coadjutor. But Steele had neither learning, nor taste, nor critical acuteness sufficient to qualify him for enriching the series with such literary disquisitions as those which Addison insinuated so often into the lighter matter of his essays, and of which he gave an elaborate specimen in his criticism on *Paradise Lost*. Still farther beyond the powers of Steele were those speculations on the theory of literature and of the processes of thought analogous to it, which, in the essays "On the Pleasures of the Imagination," Addison prosecuted, not, indeed, with much of philosophical depth, but with a sagacity and comprehensiveness which we shall undervalue much unless we remember how little of philosophy was to be found in any critical views previously propounded in England. To Addison, further, belong those essays which (most frequently introduced in regular alternation in the papers of Saturday) rise into the region of moral and religious meditation, and tread the elevated ground with a step so graceful as to allure the reader irresistibly to follow; sometimes, as in the "Walk through Westminster Abbey," enlivening solemn thought by gentle sportiveness; sometimes flowing on with an uninterrupted sedateness of didactic eloquence, and sometimes shrouding sacred truths in the veil of ingenious allegory, as in the "Vision of Mirza." While, in short, the *Spectator*, if Addison had not taken part in it, would probably have been as lively and humorous as it was, and not less popular in its own day, it would have wanted some of its strongest claims on the respect of posterity, by being at once lower in its moral tone, far less abundant in literary knowledge and much less vigorous and expanded in thinking. In point of style, again, the two friends resemble each other so closely as to be hardly distinguishable, when both are dealing with familiar objects, and writing in a key not rising above that of conversation. But in the higher tones of thought and composition Addison showed a mastery of language raising him very decisively, not above Steele only, but above all his contemporaries. Indeed, it may safely be said, that no one, in any age of English literature, has united, so strikingly as he did, the colloquial grace and ease which mark the style of an accomplished gentleman, with the power of soaring into a strain of expression nobly and eloquently dignified.

On the cessation of the *Spectator*, Steele set on foot the *Guardian*, which, started in March 1713, came to an end in October, with its 175th number. To this series Addison gave 53 papers, being a very frequent writer during the latter half of its progress. None of his essays here aim so high as the best of those in the *Spectator*; but he often exhibits both his cheerful and well-balanced humour and his earnest desire to inculcate sound principles of literary judgment. In the last six months of the year 1714, the *Spectator* received its eighth and last volume; for which Steele appears not to have written at all, and Addison to have contributed 24 of the 80 papers. Most of these form, in the unbroken seriousness both of their topics and of their manner, a contrast to the majority of his essays in the earlier volumes; but several of them, both in this vein and in one less lofty, are among the best known, if not the finest, of all his essays. Such are the "Mountain of Miseries"; the antediluvian novel of "Shalum and Hilpa"; the "Reflections by Moonlight on the Divine Perfections."

In April 1713 Addison brought on the stage, very reluctantly, as we are assured, and can easily believe, his tragedy of *Cato*. Its success was dazzling; but this issue was mainly owing to the concern which the politicians took in the exhibition. The Whigs hailed it as a brilliant manifesto in favour of constitutional freedom. The Tories echoed the applause, to show themselves enemies of despotism, and professed to find in Julius Caesar a parallel to the formidable Marlborough. Even with such extrinsic aids, and the advantage derived from the established fame of the author, *Cato* could never have been esteemed a good dramatic work, unless in an age in which dramatic power and insight were almost extinct. It is poor even in its poetical elements, and is redeemed only by the finely solemn tone of its moral reflexions and the singular refinement and equable smoothness of its diction. That it obtained the applause of Voltaire must be ascribed to the fact that it was written in accordance with the rules of French classical drama.

The literary career of Addison might almost be held as closed soon after the death of Queen Anne, which occurred in August 1714, when he had lately completed his 42nd year. His own life extended only five years longer; and in this closing portion of it we are reminded of his more vigorous days by nothing but a few happy inventions interspersed in political pamphlets, and the gay fancy of a trifling poem on Kneller's portrait of George I.

The lord justices who, previously chosen secretly by the elector of Hanover, assumed the government on the queen's demise, were, as a matter of course, the leading Whigs. They appointed Addison to act as their secretary. He next held, for a very short time, his former office under the Irish lord-lieutenant; and, late in 1716, he was made one of the lords of trade. In the course of the previous year had occurred the first of the only two quarrels with friends, into which the prudent, good-tempered and modest Addison is said to have ever been betrayed. His adversary on this occasion was Pope, who, a few years before, had received, with an appearance of humble thankfulness, Addison's friendly remarks on his *Essay on Criticism* (*Spectator*, No. 253); but who, though still very young, was already very famous, and beginning to show incessantly his literary jealousies and his personal and party hatreds. Several little misunderstandings had paved the way for a breach, when, at the same time with the first volume of Pope's *Iliad*, there appeared a translation of the first book of the poem bearing the name of Thomas Tickell. Tickell, in his preface, disclaimed all rivalry with Pope, and declared that he wished only to bespeak favourable attention for his contemplated version of the *Odyssey*. But the simultaneous publication was awkward; and Tickell, though not so good a versifier as Pope, was a dangerous rival, as being a good Greek scholar. Further, he was Addison's under-secretary and confidential friend; and Addison, cautious though he was, does appear to have said (quite truly) that Tickell's translation was more faithful than the other. Pope's anger could not be restrained. He wrote those famous lines in which he describes Addison under the name of Atticus; and although it seems doubtful whether he really sent a copy to Addison himself, he afterwards went so far as to profess a belief that the rival translation was really Addison's own. Addison, it is pleasant to observe, was at the pains, in his *Freeholder*, to express hearty approbation of the *Iliad* of Pope, who, on the contrary, after Addison's death, deliberately printed his matchlessly malignant verses in the "Epistle to Dr Arbuthnot." In 1716 there was acted, with little success, Addison's comedy of *The Drummer, or the Haunted House*. It contributes very little to his fame. From September 1715 to June 1716 he defended the Hanoverian succession, and the proceedings of the government in regard to the rebellion, in a paper called the *Freeholder*, which he wrote entirely himself, dropping it with the 55th number. It is much better tempered, not less spirited and much more able in thinking than his *Examiner*. The finical man of taste does indeed show himself to be sometimes weary of discussing constitutional questions; but he aims many enlivening thrusts at weak points of social life and manners; and the character of the Fox-hunting Squire, who is introduced as the representative of the Jacobites, is drawn with so much humour and force that we regret not being allowed to see more of him.

In August 1716, when he had completed his 44th year, Addison married Charlotte, countess-dowager of Warwick, a widow of fifteen years' standing. She seems to have forfeited her jointure by the marriage, and to have brought her husband nothing but the occupancy of Holland House at Kensington. The assertion that the courtship was a long one is probably as erroneous as the contemporary rumour that the marriage was unhappy. Such positive evidence as exists tends rather to the contrary. What seems clear is, that, from obscure causes,—among which it is alleged a growing habit of intemperance was one,—Addison's health was shattered before he took the last, and certainly the most unwise, step in his ascent to political power.

For a considerable time dissensions had existed in the ministry; and these came to a crisis in April 1717, when those who had been the real chiefs passed into the ranks of the opposition. Townshend was dismissed, and Walpole anticipated dismissal by resignation. There was now formed, under the leadership of General Stanhope and Lord Sunderland, an administration which, as resting on court-influence, was nicknamed the "German ministry." Sunderland, Addison's former superior, became one of the two principal secretaries of state; and Addison himself was appointed as the other. His elevation to such a post had been contemplated on the accession of George I., and prevented, we are told, by his own refusal; and it is asserted, on the authority of Pope, that his acceptance now was owing only to the influence of his wife. Even if there is no ground, as there probably is not, for the allegation of Addison's inefficiency in the details of business, his unfitness for such an office in such circumstances was undeniable and glaring. It was impossible that a government, whose secretary of state could not open his lips in debate, should long face an opposition headed by Robert Walpole. The decay of Addison's health, too, was going on rapidly, being, we may readily conjecture, precipitated by anxiety, if no worse causes were at work. Ill-health was the reason assigned for retirement, in the letter of resignation which he laid before the king in March 1718, eleven months after his appointment. He received a pension of £1500 a year.

Not long afterwards the divisions in the Whig party alienated him from his oldest friend. The Peerage Bill, introduced in February 1719, was attacked, on behalf of the opposition, in a weekly paper called the *Plebeian*, written by Steele. Addison answered the attack in the *Old Whig*, and this *bellum plusquam civile*—as Johnson calls it—was continued, with increased acrimony, through two or three numbers. How Addison, who was dying, felt after this painful controversy we are not told directly; but the *Old Whig* was excluded from that posthumous collection of his works (1721–1726) for which his executor Tickell had received from him authority and directions. It is said that the quarrel in politics rested on an estrangement which had been growing for some years. According to a rather nebulous story, for which Johnson is the popular authority, Addison, or Addison's lawyer, put an execution for £100 in Steele's house by way of reading his friend a lesson on his extravagance. This well-meant interference seems to have been pardoned by Steele, but his letters show that he resented the favour shown to Tickell by Addison and his own neglect by the Whigs.

The disease under which Addison laboured appears to have been asthma. It became more violent after his retirement from office, and was now accompanied by dropsy. His deathbed was placid and resigned, and comforted by those religious hopes which he had so often suggested to others, and the value of which he is said, in an anecdote of doubtful authority, to have now inculcated in a parting interview with his step-son. He died at Holland House on the 17th of June 1719, six weeks after having completed his 47th year. His body, after lying in state, was interred in the Poets' Corner of Westminster Abbey.

Addison's life was written in 1843 by Lucy Aikin. This was reviewed by Macaulay in July of the same year. A more modern study is that in the "Men of Letters" series by W. J. Courthope (1884). There is a convenient one-volume edition of the *Spectator*, by Henry Morley (Routledge, 1868), and another in 8 vols. (1897–1898) by G. Gregory Smith. Of the *Tatler* there is an edition by G. A. Aitken in 8 vols. (1898). A complete edition of Addison's works (based upon Hurd) is included in Bohn's *British Classics*. (W. S.; A. D.)

ADDISON'S DISEASE, a constitutional affection manifesting itself in an exaggeration of the normal pigment of the skin, asthenia, irritability of the gastro-intestinal tract, and weakness and irregularity of the heart's action: these symptoms being due to loss of function of the suprarenal glands. It is important to note, however, that Addison's Disease may occur without pigmentation, and pigmentation without Addison's Disease. The condition was first recognized by Dr Thomas Addison of Guy's Hospital, who in 1855 published an important work on *The Constitutional and Local Effects of Diseases of the Suprarenal Capsules*. Sir Samuel Wilks worked zealously in obtaining recognition for these observations in England, and Brown-Séquard in France was stimulated by this paper to investigate the physiology of these glands. Dr Trousseau, many years later, first called the condition by Addison's name. Dr Headlam Greenhow worked at the subject for many years and embodied his observations in the Croonian Lectures of 1875. But from this time on no further work was undertaken until the discovery of the treatment of myxoedema by thyroid extract, and the consequent researches into the physiology of the ductless glands. This stimulated renewed interest in the subject, and work was carried on in many countries. But it remained for Schäfer and Oliver of University College, London, to demonstrate the internal secretion of the suprarenals, and its importance in normal metabolism, thereby confirming Addison's original view that the disease was due to loss of function of these glands. They demonstrated that these glands contain a very powerful extract which produces toxic effects when administered to animals, and that an active principle "adrenalin" can be separated, which excites contraction of the small blood vessels and thus raises blood pressure. The latest views of this disease thus stand: (1) that it is entirely dependent on suprarenal disease, being the result of a diminution or absence of their internal secretion, or else of a perversion of their secretion; or (2) that it is of nervous origin, being the result of changes in or irritation of the large sympathetic plexuses in the abdomen; or else (3) that it is a combination of glandular inadequacy and sympathetic irritation.

The morbid anatomy shows (1) that in over 80% of the cases the changes in the suprarenals are those due to tuberculosis, usually beginning in the medulla and resulting in more or less caseation; and that this lesion is bilateral and usually secondary to tuberculous disease elsewhere, especially of the spinal column. In the remaining cases (2) simple atrophy has been noted, or (3) chronic interstitial inflammation which would lead to atrophy; and finally (4) an apparently normal condition of the glands, but the neighbouring sympathetic ganglia diseased or involved in a mass of fibrous tissue. Other morbid conditions of the suprarenals do not give rise to the symptoms of Addison's Disease.

The onset of the disease is extremely insidious, a slow but increasing condition of weakness being complained of by the patient. There is a feeble and irregular action of the heart resulting in attacks of syncope which may prove fatal. Blood pressure is extremely low. From time to time there may be severe attacks of nausea, vomiting or diarrhoea. The best known symptom, but one which only occurs after the disease has made considerable progress, is a gradually increasing pigmentation of the skin, ranging from a bronzy yellow to brown or even occasionally black. This pigmentation shows itself (1) over exposed parts, as face and hands; (2) wherever pigment appears normally, as in the axillae and round the nipples; (3) wherever pressure is applied, as round the waist; and (4) occasionally on mucous membranes, as in the mouth.

The patient's temperature is usually somewhat subnormal. The disease is found in males far more commonly than in females, and among the lower classes more than the upper. But this latter fact is probably due to poor nourishment and bad hygienic conditions rendering the poorer classes more susceptible to tuberculosis.

The diagnosis, certainly in the early stages of the disease, and often in the later, is by no means easy. Pigmentation of the skin occurs in many conditions—as in normal pregnancy, uterine fibroids, abdominal growths, certain cases of heart disease, exophthalmic goitre, &c., and after the prolonged use of certain drugs—as arsenic and silver. But the presence of a low blood pressure with weakness and irritability of the heart and some of the preceding symptoms render the diagnosis fairly certain. The latest researches on the subject tend to indicate a more certain diagnosis in the effect on the blood pressure of administering suprarenal extract, the blood pressure of the normal subject being unaffected thereby, that of the man suffering from suprarenal inadequacy being markedly raised. The disease is treated by promoting the general health in every possible way;

by diet; by tonics, especially arsenic and strychnine; by attention to the hygienic conditions; and always by the administration of one of the many preparations of the suprarenal gland extract.

"ADDRESS, THE," an English parliamentary term for the reply of the Houses of Parliament (and particularly of the House of Commons) to the speech of the sovereign at the opening of a new parliament or session. There are certain formalities which distinguish this stage of parliamentary proceedings. The "king's speech" itself is divided into three sections: the first, addressed to "My Lords and Gentlemen," touches on foreign affairs; the second, to the "Gentlemen of the House of Commons," has reference to the estimates; the third, to "My Lords and Gentlemen," outlines the proposed legislation for the session. Should the sovereign in person open parliament, he does so in the House of Lords in full state, and the speaker and members of the House of Commons are summoned there into the royal presence. The sovereign then reads his speech. If the sovereign is not present in person, the speech is read by commission. The Commons then return to their House, and an address in answer is moved in both Houses. The government of the day selects two of its supporters in each House to move and second the address, and when carrying out this honourable task they appear in levee dress. Previous to the session of 1890–1891, the royal speech was answered paragraph by paragraph, but "the address" is now moved in the form of a single resolution, thanking the sovereign for his most gracious speech. The debate on the address is used as a means of ranging over the whole government policy, amendments being introduced by the opposition. A defeat on an amendment to the address is generally regarded by the government as a vote of no-confidence. After the address is agreed to it is ordered to be presented to the sovereign. The thanks of the sovereign for the address are then conveyed to the Lords by the lord steward of the household and to the Commons by the comptroller of the household.

ADELAER, or ADELER (Norwegian for "eagle"), the surname of honour given on his ennoblement to Kurt Sivertsen (1622–1675), the famous Norwegian-Danish naval commander. He was born at Brevig in Norway, and at the age of fifteen became a cadet in the Dutch fleet under van Tromp, after a few years entering the service of the Venetian Republic, which was engaged at the time in a war with Turkey. In 1645 he had risen to the rank of captain; and after sharing in various victories as commander of a squadron, he achieved his most brilliant success at the Dardanelles, on the 13th of May 1654, when, with his own vessel alone, he broke through the line of Turkish galleys, sank fifteen of them, and burned others, causing a loss to the enemy of 5000 men. The following day he entered Tenedos, and compelled the complete surrender of the Turks. On returning to Venice he was crowned with honours, and became admiral-lieutenant in 1660. Numerous tempting offers were made to him by other naval powers, and in 1661 he left Venice to return to the Netherlands. Next year he was induced, by the offer of a title and an enormous salary, to accept the command of the Danish fleet from Frederick III. Under Christian V. he took the command of the combined Danish fleets against Sweden, but died suddenly on the 5th of November 1675 at Copenhagen, before the expedition set out. When in the Venetian service, Adelaer was known by the name of Curzio Suffrido Adelborst (*i.e.* Dutch for "naval cadet").

ADELAIDE (Ger. *Adelheid*) (931–999), queen of Italy and empress, was the daughter of Rudolph II. of Burgundy and of Bertha, daughter of Duke Burchard of Swabia. On the death of Rudolph in 937, his widow married Hugh, king of Italy, to whose son Lothair Adelaide was at the same time betrothed. She was married to him in 947; but after an unhappy union of three years Lothair died (November 22, 950). The young widow, remarkable for her character and beauty, was seized by Lothair's successor, Berengar II., margrave of Ivrea, who, angered probably at her refusal to marry his son Adalbert and thus secure his title to the Italian kingdom, kept her in close confinement at Como. After four months (August 951), she escaped, and took refuge at Canossa with Atto, count of Modena-Reggio (d. 981). Meanwhile Otto I., the German king, whose English wife Edgitha had died in 946, had formed the design of marrying her and claiming the Italian kingdom in her right, as a step towards the revival of the empire of Charlemagne. In September 951, accordingly, he appeared in Italy, Adelaide willingly accepted his invitation to meet him at Pavia and at the close of the year the fateful union was celebrated. From the first her part in German affairs was important. To her are ascribed the influences which led in 953 to the revolt of Ludolf, Otto's son by his first marriage, the crushing of which in the following year established Adelaide's power. On the 2nd of February 962 she was crowned empress at Rome by Pope John XII. immediately after her husband, and she accompanied Otto in 966 on his third expedition to Italy, where she remained with him for six years. After Otto I.'s death (May 7, 973), Adelaide exercised for some years a controlling influence over her son, the new emperor, Otto II. The causes of their subsequent estrangement are obscure, but it was possibly due to the empress's lavish expenditure in charity and church building, which endeared her to ecclesiastics but was a serious drain on the imperial finances. In 978 she left the court and lived partly in Italy, partly with her brother Conrad, king of Burgundy, by whose mediation she was ultimately reconciled to her son. In 983, shortly before his death, she was appointed his viceroy in Italy; and was successful, in concert with the empress Theophano, widow of Otto II., and Archbishop Willigis of Mainz, in defending the right of her infant grandson, Otto III., to the German crown against the pretensions of Henry the Quarrelsome, duke of Bavaria. In June 984 the infant king was handed over by Henry to the care of the two empresses; but the masterful will of Theophano soon obtained the upper hand, and until the death of the Greek empress, on the 15th of June 991, Adelaide had no voice in German affairs. She now assumed the regency, in concert with Bishop Willigis and a council of princes of the Empire, and held it until in 995 Otto was declared of age. In 996 the young king went to Italy to receive the imperial crown; and from this date Adelaide ceased to concern herself with worldly affairs, but devoted herself to pious exercises, to intimate correspondence with the abbots Majolus and Odilo of Cluny, and the foundation of churches and religious houses. She died on the 17th of December 999, and was buried in the convent of SS. Peter and Paul, her favourite foundation, at Salz in Alsace. She was proclaimed a saint by the grateful German clergy; but her name has never found a place in the Roman calendar. Like her daughter-in-law Theophano and other exalted ladies of this period, Adelaide possessed considerable literary attainments (*literatissima erat*), and her knowledge of Latin was of use to Otto I., who only learned the language late in life and remained to the end a poor scholar.

By the emperor Otto I. she had four children: Otto II. (d. 983), Mathilda, abbess of Quedlinburg (d. 999), Adelheid (Adelaide), abbess of Essen (d. 974), and Liutgard, who married Conrad II., duke of Franconia, and died in 955.

Adelaide's life (*Vita* or *Epitaphium Adalheidae imperatricis*) was written by St Odilo of Cluny. It is valuable only for the latter years of the empress, after she had retired from any active share in the world's affairs. The rest of her life is merely outlined, though her adventures in escaping from Berengar are treated in more detail. The best edition is in Duchesne, *Bibliotheca Cluniacensis*, pp. 353–362. See Giov. Batt. Semeria, *Vita politico-religiosa di s. Adeleida, &c.* (Turin, 1842); Jul. Bentzinger, *Das Leben der Kaiserin Adelheid . . . während der Regierung Ottos III.*, Inaug. Dissertation (Breslau, 1883); J. J. Dey, *Hist. de s. Adelaide, &c.* (Geneva, 1862); F. P. Wimmer, *Kaiserin Adelheid, Gemahlin Ottos I. des Grossen* (Regensb. 1889); Wattenbach, *Deutschlands Geschichtsquellen* (Stuttgart and Berlin, 1904). Further references in Chevalier, *Répertoire des sources historiques* (Paris, 1903).

ADELAIDE, the capital of South Australia. It is situated in the county to which it gives name, on the banks of the river Torrens, 7 m. from its mouth. Its site is a level plain, near the foot of the Mount Lofty range, in which Mount Lofty itself reaches 2334 ft. The broad streets of the city intersect at right angles. It is divided into North Adelaide, the residential, and South Adelaide, the business quarter. A broad strip of park lands lies between them, through which runs the river Torrens, crossed by five bridges and greatly improved by a dam on the west of the city. The banks are beautifully laid out. Broad belts of park lands surround both North and South Adelaide, and as the greater portion of these lands is planted with fine shady trees, this feature renders Adelaide one of the most attractive cities in Australasia. South Adelaide is bounded by four broad terraces facing north, south, east and west. The main thoroughfare, King William Street, runs north and south, passing through Victoria Square, a small park in the centre of the city. Handsome public buildings are numerous. Government House stands in grounds on the north side of North Terrace, with several other official buildings in the vicinity; but the majority are in King William Street. Here are the town hall, with the lofty Albert Tower, and the general post office, with the Victoria Tower—which, with the old and new Government offices, the Roman Catholic cathedral of St Francis Xavier and the court houses, surround Victoria Square. On North Terrace are the houses of parliament, and the institute, containing a public library and museum. Here is also Adelaide University, established by an act of 1874, and opened in 1876. The existing buildings were opened in 1882. Munificent gifts have from time to time assisted in the extension of its scope, as for example that of Sir Thomas Elder (d. 1897), who took a leading part in the foundation of the university. This gift, among other provisions, enabled the Elder Conservatorium of Music to be established, the building for which was opened in 1900. In 1903 a building for the schools of engineering and science was opened. The total number of students in the university approaches 1000. To the east of the university is the building in which the exhibition was held in commemoration of the jubilee of the colony in 1887. This building is occupied by the Royal Agricultural and Horticultural Society, a technical museum, &c. The school of mines and industries (1903) stands east of this again. The buildings of the numerous important commercial, social and charitable institutions add to the dignity of the city. The Anglican cathedral of St Peter (1878) is in North Adelaide. The Botanical Park, which has an area of 84 acres, lies on the south bank of the Torrens, on the east of the city. It includes the Zoological Garden, is beautifully laid out and forms one of the most attractive features of Adelaide. The city has a number of good statues, chief among which are copies of the Farnese Hercules (Victoria Square) and of Canova's Venus (North Terrace), statues of Queen Victoria and Robert Burns, Sir Thomas Elder's statue at the university, and a memorial (1905) over the grave of Colonel Light, founder of the colony, in Light Square. Adelaide is governed by a mayor and six aldermen elected by the whole body of the ratepayers, and is the only Australian city in which the mayor is so elected. The chief industries are the manufacture of woollen, earthenware and iron goods, brewing, starch-making, flour-milling and soap-boiling. Adelaide is also the central share market of Australia, for West Australian gold-mines, for the silver-mines at Broken Hill, and for the copper-mines at Wallaroo, Burra Burra and Moonta; while Port Adelaide, on the neighbouring shore of St Vincent Gulf, ranks as the third in the Commonwealth. Adelaide is the terminus of an extensive railway system, the main line of which runs through Melbourne, Sydney and Brisbane to Rockhampton. In summer the climate is often oppressively hot under the influence of winds blowing from the interior, but the proximity of the sea on the one side and of the mountains on the other allows the inhabitants to avoid the excessive heat; at other seasons, however, the climate is mild and pleasant; with a mean annual rainfall of 20·4 ins. The vice-regal summer residence is at Marble Hill, on the Mount Lofty range. Adelaide was founded in 1836 and incorporated in 1843. It received its name at the desire of King William IV., in honour of Queen Adelaide. Round the city are many pleasant suburbs, connected with it by rail and tramways; the chief of these are Burnside, Beaumont, Unley, Mitcham, Goodwood, Plymton, Hindmarsh, Prospect, St Peters, Norwood and Kensington. Glenelg is a favourite watering-place. The population of the city proper was 39,240 in 1901; of the city and suburbs within a 10-miles radius, 162,261.

ADELARD (or Aethelard) of Bath (12th century), English scholastic philosopher, and one of the greatest savants of medieval England. He studied in France at Laon and Tours, and travelled, it is said, through Spain, Italy, North Africa and Asia Minor, during a period of seven years. At a time when Western Europe was rich in men of wide knowledge and intellectual eminence, he gained so high a reputation that he was described by Vincent de Beauvais as *Philosophus Anglorum*. He lived for a time in the Norman kingdom of Sicily and returned to England in the reign of Henry I. From the Pipe Roll (31 Henry I. 1130) it appears that he was awarded an annual grant of money from the revenues of Wiltshire. The great interest of Adelard in the history of philosophy lies in the fact that he made a special study of Arabian philosophy during his travels, and, on his return to England, brought his knowledge to bear on the current scholasticism of the time. He has been credited with a knowledge of Greek, and it is said that his translation of Euclid's Elements was made from the original Greek. It is probable, however, from the nature of the text, that his authority was an Arabic version. This important work was published first at Venice in 1482 under the name of Campanus of Novara, but the work is always attributed to Adelard. Campanus may be responsible for some of the notes. It became at once the text-book of the chief mathematical schools of Europe, though its critical notes were of little value. His Arabic studies he collected under the title *Perdifficiles Quaestiones Naturales*, printed after 1472. It is in the form of a dialogue between himself and his favourite nephew, and was dedicated to Richard, bishop of Bayeux from 1113 to 1133. He wrote also treatises on the astrolabe (a copy of this is in the British Museum), on the abacus (three copies exist in the Vatican library, the library of Leiden University and the Bibliothèque Nationale in Paris), translations of the Kharismian Tables and an Arabic *Introduction to Astronomy*. His great contribution to philosophy proper was the *De Eodem et Diverso* (*On Identity and Difference*), which is in the form of letters addressed to his nephew. In this work philosophy and the world are personified as Philosophia and Philocosmia in conflict for the soul of man. Philosophia is accompanied by the liberal arts, represented as Seven Wise Virgins; the world by Power, Pleasure, Dignity, Fame and Fortune. The work deals with the current difficulties between nominalism and realism, the relation between the individual and the genus or species. Adelard regarded the individual as the really existent, and yet, from different points of view, as being himself the genus and the species. He was either the founder or the formulator of the doctrine of indifference, according to which genus and species retain their identity in the individual apart altogether from particular idiosyncrasies. For the relative importance of this doctrine see article Scholasticism.

See Jourdain, *Recherches sur les traductions d'Aristote* (2nd ed., 1843); Hauréau, *Philosophie scolastique* (2nd ed., 1872), and works appended to art. Scholasticism.

ADELSBERG (Slovene *Postojina*), a market-town in Carniola, Austria, 30 m. S.S.W. of Laibach by rail. Pop. (1900) 3636, mostly Slovene. About a mile from the town is the entrance to the famous stalactite cavern of Adelsberg, the largest and most magnificent in Europe. The cavern is divided into four grottoes, with two lateral ramifications which reach to the distance of about a mile and a half from the entrance. The river Poik enters the cavern 60 ft. below its mouth, and is heard murmuring in its recesses. In the Kaiser-Ferdinand grotto, the third of the chain, a great ball is annually held on Whit-Monday, when the chamber is brilliantly illuminated. The Franz-Joseph-Elisabeth grotto, the largest of the four, and the farthest from the entrance, is 665 ft. in length, 640 ft. in breadth and more than 100 ft. high. Besides the imposing proportions of its chambers, the cavern is remarkable for the variegated beauty of its stalactite formations, some resembling transparent drapery, others waterfalls, trees, animals or human beings, the more grotesque being called by various fanciful appellations. These subterranean wonders were known as far back as 1213, but the cavern remained undiscovered in modern times until 1816, and it is only in still more recent times that its vast extent has been fully ascertained and explored. The total length of the passages is now estimated at over 5½ m. The connexion with the Ottokar grotto was established in 1890. The Magdalene grotto, about an hour's walk to the north, is celebrated for the extraordinary subterranean amphibian, the *proteus anguinus*, first discovered there. It is about a foot in length, lives on snails and worms and is provided with both lungs and gills.

ADELUNG, JOHANN CHRISTOPH (1732–1806), German grammarian and philologist, was born at Spantekow, in Pomerania, on the 8th of August 1732, and educated at the public schools of Anklam and Klosterbergen, and the university of Halle. In 1759 he was appointed professor at the gymnasium of Erfurt, but relinquished this situation two years later and went to reside in a private capacity at Leipzig, where he devoted himself to philological researches. In 1787 he received the appointment of principal librarian to the elector of Saxony at Dresden, where he continued to reside until his death on the 10th of September 1806.

The writings of Adelung are very voluminous, and there is not one of them, perhaps, which does not exhibit some proofs of the genius, industry and erudition of the author. By means of his excellent grammars, dictionary and various works on German style, he contributed greatly towards rectifying the orthography, refining the idiom and fixing the standard of his native tongue. His German dictionary—*Grammatisch-kritisches Wörterbuch der hochdeutschen Mundart* (1774–1786)—bears witness to the patient spirit of investigation which Adelung possessed in so remarkable a degree, and to his intimate knowledge of the history of the different dialects on which modern German is based. No man before Jakob Grimm (*q.v.*) did so much for the language of Germany. Shortly before his death he issued *Mithridates, oder allgemeine Sprachenkunde* (1806). The hint of this work appears to have been taken from a publication, with a similar title, published by Konrad von Gesner (1516–1565) in 1555; but the plan of Adelung is much more extensive. Unfortunately he did not live to finish what he had undertaken. The first volume, which contains the Asiatic languages, was published immediately after his death; the other two were issued under the superintendence of Johann Severin Vater (1771–1826). Of the very numerous works by Adelung the following may be noted: *Directorium diplomaticum* (Meissen, 1802); *Deutsche Sprachlehre für Schulen* (Berlin, 1781), and the periodical, *Magazin für die deutsche Sprache* (Leipzig, 1782–1784).

ADEMPTION (Lat. *ademptio*, from *adimere*, a taking away), in law, a revocation of a grant or bequest (see LEGACY).

ADEN, a seaport and territory in Arabia, politically part of British India, under the governor of Bombay. The seaport is situated in 12° 45′ N. lat., and 45° 4′ E. long., on a peninsula near the entrance to the Red Sea, 100 m. E. of the strait of Bab-el-Mandeb. The peninsula of Aden consists chiefly of a mass of barren and desolate volcanic rocks, extending five miles from east to west, and three from its northern shore to Ras Sanailah or Cape Aden, its most southerly point; it is connected with the mainland by a neck of flat sandy ground only a few feet high; and its greatest elevation is Jebel Shamshan, 1776 ft. above the level of the sea. The town is built on the eastern coast, in what is probably the crater of an extinct volcano, and is surrounded by precipitous rocks that form an admirable natural defence. There are two harbours, an outer, facing the town, protected by the island of Sirah, but now partially choked with mud; and an inner, called Aden Back-bay, or, by the Arabs, Bandar Tawayih, on the western side of the peninsula, which at all periods of the year admits vessels drawing less than 20 ft. On the whole, Aden is a healthy place, although it suffers considerably from the want of good water, and the heat is often very intense. From time to time additional land on the mainland has been acquired by cession or purchase, and the adjoining island of Perim, lying in the actual mouth of the strait, was permanently occupied in 1857. Farther inland, and along the coast, most of the Arab chiefs are under the political control of the British government, which pays them regular allowances. The area of the peninsula is only 15 sq. m., but the total area of British territory is returned at 80 sq. m., including Perim (5 sq. m.), and that of the Aden Protectorate is about 9000 sq. m. The seaport of Aden is strongly fortified. Modern science has converted "Steamer Point" into a seemingly impregnable position, the peninsula which the "Point" forms to the whole crater being cut off by a fortified line which runs from north to south, just to the east of the coal wharfs. The administration is conducted by a political resident, who is also the military commandant. All food requires to be imported, and the water-supply is largely derived from condensation. A little water is obtained from wells, and some from an aqueduct 7 m. long, constructed in 1867 at a cost of £30,000, besides an irregular supply from the old reservoirs.

From its admirable commercial and military position, Aden early became the chief entrepôt of the trade between Europe and Asia. It is the *Ἀραβία εὐδαίμων* of the Periplus. It was known to the Romans as *Arabia Felix* and *Attanae*, and was captured by them, probably in the year 24 B.C. In 1513 it was unsuccessfully attacked by the Portuguese under Albuquerque, but subsequently it fell into the hands of the Turks in 1538. In the following century the Turks themselves relinquished their conquests in Yemen, and the sultan of Sana established a supremacy over Aden, which was maintained until the year 1735, when the sheikh of Lahej, throwing off his allegiance, founded a line of independent sultans. In 1837 a ship under British colours was wrecked near Aden, and the crew and passengers grievously maltreated by the Arabs. An explanation of the outrage being demanded by the Bombay government, the sultan undertook to make compensation for the plunder of the vessel, and also agreed to sell his town and port to the English. Captain Haines of the Indian navy was sent to complete these arrangements, but the sultan's son refused to fulfil the promises that his father had made. A combined naval and miltary force was thereupon despatched, and the place was captured and annexed to British India on the 16th of January 1839. The withdrawal of the trade between Europe and the East, caused by the discovery of the passage round the Cape of Good Hope, and the misgovernment of the native rulers, had gradually reduced Aden to a state of comparative insignificance; but about the time of its capture by the British the Red Sea route to India was reopened, and commerce soon began to flow in its former channel. Aden was made a free port, and was chosen as one of the coaling stations of the Peninsular and Oriental Steamship Company. Its importance as a port of call for steamers and a coaling station has grown immensely since the opening of the Suez Canal. It also conducts a considerable trade with the interior of Arabia, and with the Somali coast of Africa on the opposite side of the Red Sea. The submarine cables of the Eastern Telegraph Company here diverge—on the one hand to India, the Far East and Australia, and on the other hand to Zanzibar and the Cape.

In 1839 the population was less than 1000, but in 1901 it had grown to 43,974. The gross revenue (1901–1902) was Rs. 37,25,915. There are three printing-presses, of which one is in the gaol and the other two belong to a European and a Parsee firm of merchants. The port is visited yearly by some 1300 steamers with a tonnage of 2½ million tons. The principal articles of import are coffee, cotton-piece goods, &c., grain, hides, coal, opium, cotton-twist and yarn. The exports are, in the main, a repetition of the imports. Of the total imports nearly one-third come from the east coast of Africa, and another third from Arabia. Of the total exports, nearly one-third again go to the east coast of Africa. The Aden brigade belongs to the western army corps of India.

ADENÈS (ADENEZ or ADANS), surnamed **LE ROI**, French trouvère, was born in Brabant about 1240. He owed his education to the kindness of Henry III., duke of Brabant, and he remained in favour at court for some time after the death (1261) of his patron. In 1269 he entered the service of Guy de Dampierre, afterwards count of Flanders, probably as *roi des ménestrels*, and followed him in the next year on the abortive crusade in Tunis in which Louis IX. lost his life. The expedition returned by way of Sicily and Italy, and Adenès has left in his poems some very exact descriptions of the places through which he passed. The purity of his French and the absence of provincialisms point to a long residence in France, and it has been suggested that Adenès may have followed Mary of Brabant thither on her marriage with Philip the Bold. He seems, however, to have remained in the service of Count Guy, although he made frequent visits to Paris to consult the annals preserved in the abbey of St Denis. The poems written by Adenès are four: the *Enfances Ogier*, an enfeebled version of the *Chevalerie Ogier de Danemarche* written by Raimbert de Paris at the beginning of the century; *Berte aus granspiés*, the history of the mother of Charlemagne, founded on well-known traditions which are also preserved in the anonymous *Chronique de France*, and in the *Chronique rimée* of Philippe Mousket; *Bueves de Comarchis*, belonging to the cycle of romance gathered round the history of Aimeri de Narbonne; and a long *roman d'aventures*, *Cléomadès*, borrowed from Spanish and Moorish traditions brought into France by Blanche, daughter of Louis IX., who after the death of her Spanish husband returned to the French court. Adenès probably died before the end of the 13th century.

The romances of Adenès were edited for the Académie Impériale et Royale of Brussels by A. Scheler and A. van Hasselt in 1874; *Berte* was rendered into modern French by G. Hecq (1897) and by R. Périé(1900); *Cléomadès*, by Le Chevalier de Chatelain (1859). See also the edition of *Berte* by Paulin Paris (1832); an article by the same writer in the *Hist. litt. de la France*, vol. xx. pp. 679-718; Léon Gautier, *Les épopées françaises*, vol. iii., &c.

ADENINE, or 6-AMINO-PURIN, $C_5H_5N_5$, in chemistry, a basic substance which has been obtained as a decomposition product of nuclein, and also from the pancreatic glands of oxen. It has been synthesized by E. Fischer (*Berichte*, 1897, 30, p. 2238) by heating 2.6.8-trichlorpurin with 10 times its weight of ammonia for six hours at 100° C.; by this means 6-amino-2.8-dichlorpurin is obtained, which on reduction by means of hydriodic acid and phosphonium iodide is converted into adenine. In 1898 E. Fischer also obtained it from 8-oxy-2.6-dichlorpurin (*Berichte*, 1898, 31, p. 104). It crystallizes in long needles; forms salts $C_5H_5N_5 \cdot 2HI$ and $(C_5H_5N_5)_2 \cdot H_2SO_4 \cdot 2H_2O$, and is converted by nitrous acid into hypoxanthine or 6-oxypurin. On heating with hydrochloric acid at 180–200° C. it is decomposed; the products of the reaction being glycocoll, ammonia, formic acid and carbon dioxide. Various methyl derivatives of adenine have been described by E. Fischer (*Berichte*, 1898, 31, p. 104) and by M. Kruger (*Zeit. für physiol. Chemie*, 1894, 18, p. 434). For the constitution of adenine see PURIN.

ADENOIDS, or ADENOID GROWTHS (from Gr. ἀδενοειδής, glandular), masses of soft, spongy tissue between the back of the nose and throat, occurring mostly in young children; blocking the air-way, they prevent the due inflation of the lungs and the proper development of the chest. The growths are apt to keep up a constant catarrh near the orifice of the ventilating tubes which pass from the throat to the ear, and so render the child dull of hearing or even deaf. They also give rise to asthma, and like enlarged tonsils—with which they are often associated—they impart to the child a vacant, stupid expression, and hinder his physical and intellectual development. They cause his voice to be "stuffy," thick, and unmusical. Though, except in the case of a cleft palate, they cannot be seen with the naked eye, they are often accompanied by a visible and suggestive granular condition of the wall at the back of the throat. Their presence may easily be determined by the medical attendant gently hooking the end of the index-finger round the back of the soft palate. If the tonsils are enlarged it is kinder to postpone this digital examination of the throat until the child is under the influence of an anaesthetic for operation upon the tonsils, and if adenoids are present they can be removed at the same time that the tonsils are dealt with. Though the disease is a comparatively recent discovery, the pioneer in its treatment being Meyer of Copenhagen, it has probably existed as long as tuberculosis itself, with which affection it is somewhat distantly connected. In the unenlightened days many children must have got well of adenoids without operation, and even at the present time it by no means follows that because a child has these postnasal vegetations he must forthwith be operated on. The condition is very similar to that of enlarged tonsils, where with time, patience and attention to general measures, operation is often rendered unnecessary. But if the child continues to breathe with his mouth open and to snore at night, if he remains deaf and dull, and is troubled with a chronic "cold in his head," the question of thorough exploration of the naso-pharynx and of a surgical operation should most certainly be considered. In recent years the comparatively simple operation for their removal has been very frequently performed, and, as a rule, with marked benefit, but this treatment should always be followed by a course of instruction in respiratory exercises; the child must be taught regularly to fill his lungs and make the tidal air pass through the nostrils. These respiratory exercises may be resorted to before operation is proposed, and in some cases they may render operative treatment unnecessary. Operations should not be performed in cold weather or in piercing east winds, and it is advisable to keep the child indoors for a day or two subsequent to its performance. To expose a child just after operating on his throat to the risks of a journey by train or omnibus is highly inadvisable. Although the operation is not a very painful one, it ought not to be performed upon a child except under the influence of chloroform or some other general anaesthetic. (E. O.*)

ADEPT (if used as a substantive pronounced *ad*ept, if as an adjective ad*ept*; from Lat. *adeptus*, one who has attained), completely and fully acquainted with one's subject, an expert. The word implies more than acquired proficiency, a natural inborn aptitude. In olden times an adept was one who was versed in magic, an alchemist, one who had attained the great secrets of the unknown.

ADERNÒ, a town of the province of Catania, Sicily, 22 m. N.W. of the town of that name. Pop. (1901) 25,859. It occupies the site of the ancient Adranon, which took its name from Adranos, a god probably of Phoenician origin, in Roman times identified with Vulcan, whose chief temple was situated here, and was guarded by a thousand huge gods; there are perhaps some substructures of this building still extant outside the town. The latter was founded about 400 B.C. by Dionysius I.; very fine remains of its walls are preserved. For a time it was the headquarters of Timoleon, and it was the first town taken by the Romans in the First Punic War (263 B.C.). In the centre of the modern town rises the castle, built by Roger I.; in the chapel are frescoes representing his granddaughter, Adelasia, who founded the convent of St Lucia in 1157, taking the veil. The columns in the principal church are of black lava.

See P. Russo, *Illustrazione storica di Adernò* (Adernò, 1897).

ADEVISM, a term introduced by Max Müller to imply the denial of gods (Sans. *deva*), on the analogy of Atheism, the denial of God. Max Müller used it particularly in connexion with the Vedanta philosophy for the correlative of ignorance or nescience (Gifford lectures, 1892, c. ix.).

ADHÉMAR DE CHABANNES (*c.* 988–*c.* 1030), medieval historian, was born about 988 at Chabannes, a village in the French department of Haute-Vienne. Educated at the monastery of St Martial at Limoges, he passed his life as a monk, either at this place or at the monastery of St Cybard at Angoulême. He died about 1030, most probably at Jerusalem, whither he had gone on a pilgrimage. Adhémar's life was mainly spent in writing and transcribing chronicles, and his principal work is a history entitled *Chronicon Aquitanicum et Francicum* or *Historia Francorum*. This is in three books and deals with Frankish history from the fabulous reign of Pharamond, king of the Franks, to A.D. 1028. The two earlier books are scarcely more than a copy of the *Gesta regum Francorum*, but the third book, which deals with the period from 814 to 1028, is of considerable historical importance. This is published in the *Monumenta Germaniae historica. Scriptores.* Band iv. (Hanover and Berlin, 1826–1892). He also wrote *Commemoratio abbatum Lemovicensium* *basilicae S. Martialis apostoli* (848–1029) and *Epistola ad Jordanum, Lemovicensem episcopum et alios de apostolatu S. Martialis*, both of which are published by J. P. Migne in the *Patrologia Latina*, tome cxli. (Paris, 1844–1855).

See F. Arbellot, *Étude historique et littéraire sur Adémar de Chabannes* (Limoges, 1873); J. F. E. Castaigne, *Dissertation sur le lieu de naissance et sur la famille du chroniqueur Adémar, moine de l'abbaye de St Cybard d'Angoulême* (Angoulême, 1850).

ADHÉMAR (Adémar, Aimar, Aelarz) **DE MONTEIL** (d. 1098), one of the principal personages of the first crusade, was bishop of Puy en Velay from before 1087. At the council of Clermont in 1095 he showed great zeal for the crusade, and having been named apostolic legate by the pope, he accompanied Raymond IV., count of Toulouse, to the east. He negotiated with Alexis Comnenus at Constantinople, re-established at Nicaea some discipline among the crusaders, caused the siege of Antioch to be raised and died in that city of the plague on the 1st of August 1098.

See the article by C. Kohler in *La Grande Encyclopédie; Bibliographie du Velay* (1902), 640-650.

ADHESION (from Lat. *adhaerere*, to adhere), the process of adhering or clinging to anything. In a figurative sense, adhesion (like "adherent") is used of any attachment to a party or movement; but the word is also employed technically in psychology, pathology and botany. In psychology Bain and others use it of association of ideas and action; in pathology an adhesion is an abnormal union of surfaces; and in botany "adhesion" is used of dissimilar parts, *e.g.* in floral whorls, in opposition to "cohesion," which applies to similar parts, *e.g.* of the same whorl.

ADIAPHORISTS (Gr. ἀδιάφορος, indifferent). The Adiaphorist controversy among Lutherans was an issue of the provisional scheme of compromise between religious parties, pending a general council, drawn up by Charles V., sanctioned at the diet of Augsburg, 15th of May 1548, and known as the Augsburg Interim. It satisfied neither Catholics nor Protestants. As head of the Protestant party the young elector Maurice of Saxony negotiated with Melanchthon and others, and at Leipzig, on the 22nd of December 1548, secured their acceptance of the Interim as regards *adiaphora* (things indifferent), points neither enjoined nor forbidden in Scripture. This sanctioned jurisdiction of Catholic bishops, and observance of certain rites, while all were to accept justification by faith (relegating *sola* to the *adiaphora*). This modification was known as the Leipzig Interim; its advocates were stigmatized as Adiaphorists. Passionate opposition was led by Melanchthon's colleague, Matth. Flacius, on the grounds that the imperial power was not the judge of *adiaphora*, and that the measure was a trick to bring back popery. From Wittenberg he fled, April 1549, to Magdeburg, making it the headquarters of rigid Lutheranism. Practically the controversy was concluded by the religious peace ratified at Augsburg (Sept. 25, 1555), which left princes a free choice between the rival confessions, with the right to impose either on their subjects; but much bitter internal strife was kept up by Protestants on the theoretical question of *adiaphora*; to appease this was one object of the Formula Concordiae, 1577. Another *Adiaphorist* controversy between Pietists and their opponents, respecting the lawfulness of amusements, arose in 1681, when Anton Reiser (1628–1686) denounced the opera as antichristian.

See arts. by J. Gottschick in A. Hauck's *Realencyklopädie* (1896); by Fritz in I. Goschler's *Dict. Encyclop. de la Théol. Cath.* (1858); other authorities in J. C. L. Gieseler, *Ch. Hist.* (N. York ed., 1868, vol. iv.); monograph by Erh. Schmid, *Adiaphora, wissenschaftlich und historisch untersucht* (1809), from the rigorist point of view.

ADIGE (Ger. *Etsch*, anc. *Athesis*), a considerable river in North Italy. The true source of the Adige is in some small lakes on the summit of the Reschen Scheideck Pass (4902 ft.), and it is swollen by several other streams, near Glurns, where the roads over the Ofen and the Stelvio Passes fall in. It thence flows east to Meran, and then south-east to Botzen, where it receives the Eisak (6 ft.), and becomes navigable. It then turns south-west, and, after receiving the Noce (right) and the Avisio (left), leaves Tirol, and enters Lombardy, 13 m. south of Rovereto. After traversing North Italy, in a direction first southerly and then easterly, it falls into the Adriatic at Porto Fossone, a few miles north of the mouth of the Po. The most considerable towns on its banks (south of Botzen) are Trent and Rovereto, in Tirol, and Verona and Legnago, in Italy. It is a very rapid river, and subject to sudden swellings and overflowings, which cause great damage to the surrounding country. It is navigable from the heart of Tirol to the sea. In Lombardy it has a breadth of 200 yds., and a depth of 10 to 16 ft., but the strength of the current renders its navigation very difficult, and lessens its value as a means of transit between Germany and Italy. The Adige has a course of about 220 m., and, after the Po, is the most important river in Italy. In Roman times it flowed, in its lower course, much farther north than at present, along the base of the Euganean hills, and entered the sea at Brondolo. In A.D. 587 the river broke its banks, and the main stream took its present course, but new streams opened repeatedly to the south, until now the Adige and the Po form conjointly one delta. (W. A. B. C.)

ADIPOCERE (from the Lat. *adeps*, fat, and *cera*, wax), a substance into which animal matter is sometimes converted, and so named by A. F. Fourcroy, from its resemblance to both fat and wax. When the Cimetière des Innocens at Paris was removed in 1786–1787, great masses of this substance were found where the coffins containing the dead bodies had been placed very closely together. The whole body had been converted into this fatty matter, except the bones, which remained, but were extremely brittle. Chemically, adipocere consists principally of a mixture of fatty acids, glycerine being absent. Saponification with potash liberates a little ammonia (about 1%), and gives a mixture of the potassium salts of palmitic, margaric and oxymargaric acids. The insoluble residue consists of lime, &c., derived from the tissues. The artificial formation of adipocere has been studied; it appears that it is not formed from albuminous matter, but from the various fats in the body collecting together and undergoing decomposition.

ADIRONDACKS, a group of mountains in north-eastern New York, U.S.A., in Clinton, Essex, Franklin and Hamilton counties, often included by geographers in the Appalachian system, but pertaining geologically to the Laurentian highlands of Canada. They are bordered on the E. by Lake Champlain, which separates them from the Green Mountains. Unlike the Appalachians, the Adirondacks do not form a connected range, but consist of many summits, isolated or in groups, arranged with little appearance of system. There are about one hundred peaks, ranging from 1200 to 5000 ft. in height; the highest peak, Mt. Marcy (called by the Indians Tahawus or "cloud-splitter"), is near the eastern part of the group and attains an elevation of 5344 ft. Other noted peaks are M'Intyre (5210 ft.), Haystack (4918), Dix (4916) and Whiteface (4871). These mountains, consisting of various sorts of gneiss, intrusive granite and gabbro, have been formed partly by faulting but mainly by erosion, the lines of which have been determined by the presence of faults or the presence of relatively soft rocks. Lower Palaeozoic strata lap up on to the crystalline rocks on all sides of the mountain group. The region is rich in magnetic iron ores, which though mined for many years are not yet fully developed. Other mineral products are graphite, garnet used as an abrasive, pyrite and zinc ore. The mountains form the water-parting between the Hudson and the St Lawrence rivers. On the south and south-west the waters flow either directly into the Hudson, which rises in the centre of the group, or else reach it through the Mohawk. On the north and east the waters reach the St Lawrence by way of Lakes George and Champlain, and on the west they flow directly into that stream or reach it through Lake Ontario. The most important streams within the area are the Hudson, Black, Oswegatchie, Grass, Raquette, Saranac and Ausable rivers. The region was once covered, with the exception of the higher summits, by the Laurentian glacier, whose erosion, while perhaps having little effect on the larger features of the country, has greatly modified it in detail, producing lakes and ponds, whose number is said to exceed 1300, and causing many falls and rapids in the streams. Among the larger lakes are the Upper and Lower

Saranac, Big and Little Tupper, Schroon, Placid, Long, Raquette and Blue Mountain. The region known as the Adirondack Wilderness, or the Great North Woods, embraces between 5000 and 6000 sq. m. of mountain, lake, plateau and forest, which for scenic grandeur is almost unequalled in any other part of the United States. The mountain peaks are usually rounded and easily scaled, and as roads have been constructed over their slopes and in every direction through the forests, all points of interest may be easily reached by stage. Railways penetrate the heart of the region, and small steamboats ply upon the larger lakes. The surface of most of the lakes lies at an elevation of over 1500 ft. above the sea; their shores are usually rocky and irregular, and the wild scenery within their vicinity has made them very attractive to the tourist. The mountains are easily reached from Plattsburgh, Port Kent, Herkimer, Malone and Saratoga Springs. Every year thousands spend the summer months in the wilderness, where cabins, hunting lodges, villas and hotels are numerous. The resorts most frequented are in the vicinity of the Saranac and St Regis lakes and Lake Placid. In the Adirondacks are some of the best hunting and fishing grounds in the eastern United States. Owing to the restricted period allowed for hunting, deer and small game are abundant, and the brooks, rivers, ponds and lakes are well stocked with trout and black bass. At the head of Lake Placid stands Whiteface Mountain, from whose summit one of the finest views of the Adirondacks may be obtained. Two miles south-east of this lake, at North Elba, is the old farm of the abolitionist John Brown, which contains his grave and is much frequented by visitors. Lake Placid is the principal source of the Ausable river, which for a part of its course flows through a rocky chasm from 100 to 175 ft. deep and rarely over 30 ft. wide. At the head of the Ausable Chasm are the Rainbow Falls, where the stream makes a vertical leap of 70 ft. Another impressive feature of the Adirondacks is Indian Pass, a gorge about eleven miles long, between Mt. M'Intyre and Wallface Mountain. The latter is a majestic cliff rising vertically from the pass to a height of 1300 ft. Keene Valley, in the centre of Essex county, is another picturesque region, presenting a pleasing combination of peaceful valley and rugged hills. Though the climate during the winter months is very severe—the temperature sometimes falling as low as -42° F.—it is beneficial to persons suffering from pulmonary troubles, and a number of sanitariums have been established. The region is heavily forested with spruce, pine and broad-leaved trees. Lumbering is an important industry, but it has been much restricted by the creation of a state forest preserve, containing in 1907, 1,401,482 acres, and by the purchase of large tracts for game preserves and recreation grounds by private clubs. The so-called Adirondack Park, containing over 3,000,000 acres, includes most of the state preserve and large areas held in private ownership.

For a description of the Adirondacks, see S. R. Stoddard, *The Adirondacks Illustrated* (24th ed., Glen Falls, 1894); and E. R. Wallace, *Descriptive Guide to the Adirondacks* (Syracuse, 1894). For geology and mineral resources consult the *Reports of the New York State Geologist* and the *Bulletins of the New York State Museum.*

ADIS ABABA ("the new flower"), the capital of Abyssinia and of the kingdom of Shoa, in 9° 1′ N., 38° 56′ E., 220 m. W. by S. of Harrar, and about 450 m. S.W. of Jibuti on the Gulf of Aden. Adis Ababa stands on the southern slopes of the Entotto range, at an altitude of over 8000 ft., on bare, grassy undulations, watered by small streams flowing S.S.E. to the Hawash. It is a large straggling encampment rather than a town, with few buildings of any architectural merit. The Gebi or royal enclosure completely covers a small hill overlooking the whole neighbourhood, while around it are the enclosures of the abuna and principal nobles, and the residences of the foreign ministers. The principal traders are Armenians and Hindus. About a mile north-east of the palace is the military camp. On the hills some five miles to the north, 1500 ft. above the camp, are the ruins of an old fortress, and the churches of St Raguel and St Mariam. The town is in telegraphic communication with Massawa, Harrar and Jibuti. It was founded by Menelek II. in 1892 as the capital of his kingdom in succession to Entotto, a deserted settlement some ten or twelve miles north of Adis Ababa.

ADJECTIVE (from the Lat. *adjectivus*, added), a word used chiefly in its grammatical sense of limiting or defining the noun to which it refers. Formerly grammarians used not to separate a noun from its adjective, or attribute, but spoke of them together as a noun-adjective. In the art of dyeing, certain colours are known as adjective colours, as they require mixing with some basis to render them permanent. "Adjective law" is that which relates to the forms of procedure, as opposed to "substantive law," the rules of right administered by a court.

ADJOURNMENT (through the French from the Late Lat. *adjurnare*, to put off until or summon for another day), the act of postponing a meeting of any private or public body, particularly of parliament, or any business, until another time, or indefinitely (in which case it is an adjournment *sine die*). The word applies also to the period during which the meeting or business stands adjourned.

ADJUDICATION (Lat. *adjudicatio; adjudicare*, to award), generally, a trying or determining of a case by the exercise of judicial power; a judgment. In a more technical sense, in English and American law, an adjudication is an order of the bankruptcy courts by which a debtor is adjudged bankrupt and his property vested in a trustee. It usually proceeds from a resolution of the creditors or where no composition or scheme of arrangement has been proposed by the debtor. It may be said to consummate bankruptcy, for not till then does a debtor's property actually vest in a trustee for division among the creditors, though from the first act of bankruptcy till adjudication it is protected by a *receiving order*. As to the effect which adjudication has on the bankrupt, see under BANKRUPTCY. The same process in Scots law is called sequestration. In Scots law the term "adjudication" has quite a different meaning, being the name of that action by which a creditor attaches the heritable, *i.e.* the real, estate of his debtor, or his debtor's heir, in order to appropriate it to himself either in payment or security of his debt. The term is also applied to a proceeding of the same nature by which the holder of a heritable right, labouring under any defect in point of form, gets that defect supplied by decree of a court.

ADJUNCT (from Lat. *ad*, to, and *jungere*, to join), that which is joined on to another, not an essential part, and inferior to it in mind or function, but which nevertheless amplifies or modifies it. Adverbs and adjectives are adjuncts to the words they qualify. Learning, says Shakespeare, is an "adjunct to ourself" (*Love's Labour's Lost*, IV. iii. 314). Twelve members of the Royal Academy of Sciences in Paris are called "adjuncts."

ADJUSTMENT (from late Lat. *ad-juxtare*, derived from *juxta*, near, but early confounded with a supposed derivation from *justus*, right), regulating, adapting or settling; in commercial law, the settlement of a loss incurred at sea on insured goods. The calculation of the amounts to be made good to and paid by the several interests is a complicated matter. It involves much detail and arithmetic, and requires a full and accurate knowledge of the principles of the subject. Such adjustments are made by men called adjusters, who make the subject their profession. In Great Britain they are for the most part members of the Average Adjusters' Association (1870), a body which has done much careful work with a view to making and keeping the practice uniform and in accord with right principles. This association has gradually formulated, at their annual meetings, a body of practical rules which the individual members undertake to observe. (See AVERAGE and INSURANCE, *Marine.*)

ADJUTAGE (from Fr. *ajutage*, from *ajouter*, to join on; an older English form was "adjustage"), a mouthpiece or nozzle, so formed as to facilitate the outflow of liquids from a vessel or pipe. (See HYDRAULICS.)

ADJUTANT (from Lat. *adjutare*, to aid), a helper or junior in command, one who assists his superior, especially an officer who acts as an assistant to the officer commanding a corps of troops. In the British army the appointment of adjutant is held by a captain or lieutenant. The adjutant acts as staff officer to the commanding officer, issues his orders, superintends the work of the orderly room and the general administration of the corps, and is responsible for musketry duties and the training of recruits. Regular officers are appointed as adjutants to all units of the auxiliary forces. On the European continent the word is not restricted to the lower units of organization; for example, in Germany the *Adjutantur* includes all "routine" as distinct from "general" staff officers in the higher units, and the aides-de-camp of royal persons and of the higher commanders are also styled adjutant-generals, flügel-adjutanten, &c. For the so-called adjutant bird see Jabiru.

ADJUTANT-GENERAL, an army official, originally (as indicated by the word) the chief assistant (Lat. *adjuvare*) staff-officer to a general in command, but now a distinct high functionary at the head of a special office in the British and American war departments. In England the second military member of the Army Council is styled adjutant-general to the forces. He is a general officer and at the head of his department of the War Office, which is charged with all duties relative to personnel. The adjutant-general of the United States army is one of the principal officers in the war department, the head of the bureau for army correspondence, with the charge of the records, recruiting, issue of commissions, &c. Individual American states also have their own adjutant-general, with cognate duties regarding the state militia. In many countries, such as Germany and Russia, the term has retained its original meaning of an officer on the personal staff, and is the designation of personal *aides-de-camp* to the sovereign.

By a looseness of translation, the superintendents of provinces, in the order of Jesuits, who act as officials under the superintendence of and auxiliary to the general, are sometimes called *adjutants-general*.

ADLER, FELIX (1851–), American educationalist, was born at Alzey, Germany, on the 13th of August 1851. His father, a Jewish rabbi, emigrated to the United States in 1857, and the son graduated at Columbia College in 1870. After completing his studies at Berlin and Heidelberg, he became, in 1874, professor of Hebrew and Oriental Literature at Cornell University. In 1876 he established in New York City the Society for Ethical Culture, to the development and extension of which he devoted a great deal of time and energy, and before which he delivered a regular Sunday lecture. In 1902 he became professor of political and social ethics at Columbia University. He also acted as one of the editors of the *International Journal of Ethics*. Under his direction the Society for Ethical Culture became an important factor in educational reform in New York City, exercising through its technical training school and kindergarten (established in January 1878) a wide influence. Dr Adler also took a prominent part in philanthropic and social reform movements, such as the establishment of a system of district nursing, the erection of model tenement houses, and tenement house reform. He published *Creed and Deed* (1877), *The Moral Instruction of Children* (1892), *Life and Destiny* (1903), *Marriage and Divorce* (1905), and *The Religion of Duty* (1905).

ADMETUS, in Greek legend, son of Pheres, king of Pherae in Thessaly. By the aid of Apollo, who served him as a slave—either as a punishment for having slain the Cyclopes, or out of affection for his mortal master—he won the hand of Alcestis, the most beautiful of the daughters of Pelias, king of Iolcus. When Admetus was attacked by an illness that threatened to lead to his premature death, Apollo persuaded the Moerae (Fates) to prolong his life, provided any one could be found to die in his place. His parents refused, but Alcestis consented. She is said to have been rescued from the hands of Death by Heracles, who arrived upon the scene at an opportune moment; a later story represents her as cured of a dangerous illness by his skill.

Homer, *Iliad*, ii. 715; Apollodorus, i. 9; Euripides, *Alcestis*; Plutarch, *Amatorius*, 17; Dissel, *Der Mythus von Admetos und Alkestis*, progr. Brandenburg, 1882.

ADMINISTRATION (Lat. *administrare*, to serve), the performance or management of affairs, a term specifically used in law for the administration or disposal of the estate of a deceased person (see Will or Testament). It is also used generally for "government," and specifically for "the government" or the executive ministry, and in such connexions as the administration (administering or tendering) of the sacraments, justice, oaths, medicines, &c.

Letters of Administration.—Upon the death of a person intestate or leaving a will to which no executors are appointed, or when the executors appointed by the will cannot or will not act, the Probate Division of the High Court is obliged to appoint an administrator who performs the duties of an executor. This is done by the court granting letters of administration to the person entitled. Grants of administration may be either general or limited. A general grant is made where the deceased has died intestate. The order in which general grants of letters will be made by the court is as follows: (1) The husband, or widow, as the case may be; (2) the next of kin; (3) the crown; (4) a creditor; (5) a stranger. Since the Land Transfer Act 1897, the administrator is the real as well as the personal representative of the deceased, and consequently when the estate to be administered consists wholly or mainly of reality the court will grant administration to the heir to the exclusion of the next of kin. In the absence of any heir or next of kin the crown is entitled to the personality as *bona vacantia*, and to the reality by escheat. If a creditor claims and obtains a grant he is compelled by the court to enter into a bond with two sureties that he will not prefer his own debt to those of other creditors. The more important cases of grants of special letters of administration are the following:—

Administration *cum testamento annexo*, where the deceased has left a will but has appointed no executor to it, or the executor appointed has died or refuses to act. In this case the court will make the grant to the person (usually the residuary legatee) with the largest beneficial interest in the estate.

Administration *de bonis non administratis*: this occurs in two cases—(*a*) where the executor dies intestate after probate without having completely administered the estate; (*b*) where an administrator dies. In the first case the principle of administration *cum testamento* is followed, in the second that of general grants in the selection of the person to whom letters are granted.

Administration *durante minore aetate*, when the executor or the person entitled to the general grant is under age.

Administration *durante absentia*, when the executor or administrator is out of the jurisdiction for more than a year.

Administration *pendente lite*, where there is a dispute as to the person entitled to probate or a general grant of letters the court appoints an administrator till the question has been decided.

ADMINISTRATOR, in English law, the person to whom the Probate Division of the High Court of Justice (formerly the ordinary or judge of the ecclesiastical court) acting in the sovereign's name, commits the administration (*q.v.*) of the goods of a person deceased, in default of an executor. The origin of administrators is derived from the civil law. Their establishment in England is owing to a statute made in the 31st year of Edward I. (1303). Till then no office of this kind was known besides that of executor; in default of whom, the ordinary had the disposal of goods of persons intestate, &c. (See also Executors, and, for intestate estates, Intestacy.)

Administrator, in *Scots law*, is a person legally empowered to act for another whom the law presumes incapable of acting for himself, as a father for a pupil child.

ADMIRAL, the title of the general officer who commands a fleet, or subdivision of a fleet. The origin of the word is undoubtedly Arabic. In the 12th century the Mediterranean states which had close relations with the Moslem powers on the shores or in the islands of that sea, found the title amir or emir in combination with other words used to describe men in authority; the amir-al-mumenin—prince of the faithful—or amir-al-bahr—commander of the sea. They took the substantive "amir" and the article "al" to form one word, "amiral" or "ammiral" or "almirante." The Spaniards made miramamolin, out of amiral-mumenin, in the same way. "Amiral," as the name of an eastern ruler, became familiar to the northern nations during the crusades. Layamon, writing in the early years of the 13th century, speaks of the "ammiral of Babilon," and the word was for long employed in this sense. As a naval title it was first taken by the French from the Genoese during the crusade of 1249. By the end of the 13th century it had come to be used in England as the name of the officer who commanded the Cinque Port ships. The English form "admiral" arose from popular confusion with the Latin *admirabilis*. Such errors were naturally produced by the fantastic etymology of the middle ages. In Spain, Alphonso the Wise of Castile, in his code of laws, the *Siete Partidas* (Seven Divisions), accounts for the Spanish form "almirante" by its supposed derivation from the Latin *admirari*, since the admiral is "to be admired" for the difficulties and dangers he overcomes, and because he is the chief of those who see the wonders of the Lord in the deep—*mirabilia ejus* (*sc. Domini*) *in profundo*. Both in Spanish and in Elizabethan English the word has been applied to the flagship of an officer commanding a fleet or part of one. The Spanish *almiranta* is the ship of the second in command, and the *capitana* of the first. In this sense it is not uncommonly found in the narratives of Elizabethan voyages or campaigns, and it is so used by Milton in *Paradise Lost*—"the mast of some tall ammiral."

As the title of an office it was borne by the great military, judicial and administrative officer known in France as *grand amiral*; in England as lord high admiral; in Spain as *almirante mayor*. His functions, which were wide, have been generally absorbed by the crown, or the state, and have been divided among judicial and administrative officials (see NAVY, *History*; ADMIRALTY ADMINISTRATION; and ADMIRALTY JURISDICTION). The title of admiral is still borne as an hereditary honour by the descendants of Columbus, the dukes of Veraqua, in Spain. It is a purely honorific distinction representing the admiralship of the islands and Ocean Sea, conferred on the discoverer by the Catholic sovereigns, Ferdinand and Isabella.

In the staff of a modern navy the admirals correspond to the general officers in the army. Where, as in Russia, the grand admiralship is annexed to the crown, the highest rank is that of lieutenant admiral general. In Great Britain there is the rank of admiral of the fleet, corresponding to field-marshal. It is, however, little more than an honorary distinction. The three active ranks are those of admiral, vice-admiral and rear-admiral, corresponding to general, lieutenant-general and major-general in the army. They are found in all navies under very slightly varied forms. The only difference which is not one of mere spelling is in the equivalent for rear-admiral, which is *contre amiral* in French, and in other navies of the continent of Europe involves some slight variation of the word "contre" (first used at the time of the French Revolution). The vice- and rear-admiral of Great Britain are again honorary titles, without the active functions, conferred in compliment on senior naval officers. "Admiral" is also the name given to the chief of fishery fleets. On the banks of Newfoundland it was given to officials who had powers conferred by the state. In the case of an ordinary fishing-fleet in European waters, it is of private origin, and is of merely customary use.

AUTHORITIES.—Sir N. Harris Nicolas, *History of the Royal Navy*; La Roncière, *Histoire de la marine française*; Yonge, *Geschiedenis van het Nederlandsche Zeewezen*; C. Fernandez Duro, *Historia de la Armada de Castilea*. (D. H.)

ADMIRALTY ADMINISTRATION. 1. *The Administrative System.*—That the navy (*q.v.*) is the only real defence of the British islands has been recognized by English people ever since the days of King Offa, who died in 796, leaving to his successors the admirable lesson that "he who would be secure on land must be supreme at sea." The truth of the lesson thus learnt is sanctioned by all the experience of English history, and parliament has repeatedly enforced the fact. The navy is the only force that can safeguard the British islands from hostile descents; it is the only force that can protect their vast sea-borne commerce and food supplies; by giving safety to the home country it sets British troops free for operations abroad, and makes their passage secure; and thus, as also by giving command of the sea, the fleet is the means by which the empire is guarded and has become a true imperial bond. It is natural for British admiralty administration to be taken here as the type of an efficient system.

British Empire.

The Board of Admiralty.

British naval administration is conducted by the Board of Admiralty, and the function of that board is the maintenance and expansion of the fleet in accordance with the policy of the government, and the supplying of it with trained officers and men; its distribution throughout the world; and its preservation in readiness and efficiency in all material and personal respects. The character of the Admiralty Board is peculiar to the British constitution, and it possesses certain features which distinguish it from other departments of the state. The business it conducts is very great and complex, and the machinery by which its work is done has grown with the expansion of that business. The whole system of naval administration has been developed historically, and is not the product of the organizing skill of one or a few individuals, but an organic growth possessing marked and special characteristics. The Admiralty Board derives its character from the fact that it represents the lord high admiral, and that its powers and operation depend much more upon usage than upon those instruments which actually give it authority, and which, it may be remarked, are not in harmony among themselves. The executive operations are conducted by a series of civil departments which have undergone many changes before reaching their present constitution and relation to the Board. The salient characteristic of the admiralty is a certain flexibility and elasticity with which it works. Its members are not, in a rigid sense, heads of departments. Subject to the necessary and constitutional supremacy of the cabinet minister at their head, they are jointly and co-equally "commissioners for executing the office of high admiral of the United Kingdom, and of the territories thereunto belonging, and of high admiral of the colonies and other dominions." The members of the Board are in direct and constant communication with the first lord and with one another, as also with the civil departments which work under their control. It was enjoined by James I. that the principal officers and commissioners of the navy should be in constant communication among themselves, consulting and advising "by common council and argument of most voices," and should live as near together as could conveniently be, and should meet at the navy office at least twice a week. This system of intercommunication still exists in a manner which no system of minutes could give; and it may be remarked, as illustrative of the flexibility of the system, that a Board may be formed on any emergency by two lords and a secretary, and a decision arrived at then and there. Such an emergency board was actually constituted some years ago on board the admiralty yacht in order to deal on the instant with an event which had just occurred in the fleet. At the same time it must be remarked that, in practice, the first lord being personally responsible under the orders in council, the operations of the Board are dependent upon his direction.

History.

The present system of administering the navy dates from the time of Henry VIII. The naval business of the country had so greatly expanded in his reign that we find the Admiralty and Navy Board reorganized or established; and it is worthy of remark that there existed at the time an ordnance branch, the navy not yet being dependent in that matter upon the War Department.[1] The Navy Board administered the civil departments under the admiralty, the directive and executive duties of the lord high admiral remaining with the admiralty office. A little later the civil administration was vested in a board of principal officers subordinate to the lord high admiral, and we can henceforth trace the work of civil administration being conducted under the navy and victualling boards apart from, but yet subject to, the admiralty itself. This was a system which continued during the time of all the great wars, and was not abolished until 1832, when Sir James Graham, by his reforms, put an end to what appeared a divided control. Whatever may have been the demerits of that system, it sufficed to maintain the navy in the time of its greatest achievements, and through all the wars which were waged with the Spaniards, the Dutch and the French. The original authority for the present constitution of the Admiralty Board is found in a declaratory act (Admiralty Act 1690), in which it is enacted that "all and singular authorities, jurisdictions and powers which, by act of parliament or otherwise, had been lawfully vested" in the lord high admiral of England had always appertained, and did and should appertain, to the commissioners for executing the office for the time being "to all intents and purposes as if the said commissioners were lord high admiral of England." The admiralty commission was dissolved in 1701, and reconstituted on the death of Prince George of Denmark, lord high admiral in 1709. From that time forward, save for a short period in 1827–1828, when the duke of Clarence was lord high admiral, the office has remained in commission.

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[1] The Board of Ordnance was originally instituted for the navy, but eventually fell into military hands, to the detriment of the navy—the only navy of any nation that has not full authority over its own ordnance. In 1653, according to Oppenheim, it was, owing to its inefficiency, placed under the admiralty. In 1632 it appears to have been independent, but "still retained that evil pre-eminence in sloth and incapacity it had already earned and has never since lost."

A number of changes have been made since the amalgamation of the admiralty and the Navy Board by Sir James Graham in 1832 (see NAVY, *History*), but the general principle remains the same, and the constitution of the Admiralty Board and civil departments is described below. The Board consists of the first lord and four naval lords with a civil lord, who in theory are jointly responsible, and are accustomed to meet sometimes daily, but at all times frequently; and the system developed provides for the subdivision of labour, and yet for the co-ordinated exertion of effort. The system has worked well in practice, and has certainly won the approval and the admiration of many statesmen. Lord George Hamilton said, before the Royal Commission on Civil Establishments, 1887, that "It has this advantage, that you have all departments represented round a table, and that if it is necessary to take quick action, you can do in a few minutes that which it would take hours under another system to do"; and the report of the Royal Commission of 1889 remarked that "The constitution of the Board of Admiralty appears to us well designed, and to be placed under present regulations on a satisfactory footing."

Powers.

The special characteristics of the Admiralty Board which have been described are accompanied by a very peculiar and noteworthy feature, which is not without relation to the untrammelled and undefined operations of the admiralty. This feature arises from the discrepancy between the admiralty patent and the orders in council, for the admiralty is not administered according to the terms of the patent which invests it with authority, and its operations raise a singular point in constitutional law.

The legal origin of the powers exercised by the first lord and the Board itself is indeed curiously obscure. Under the patent the full power and authority are conferred upon "any two or more" of the commissioners, though, in the patent of Queen Anne, the grant was to "any three or more of you." It was under the Admiralty Act 1832 that two lords received the necessary authority to legalize any action of the Board; but already, under an act of 1822, two lords had been empowered to sign so long as the Board consisted of six members. We therefore find that the legal authority of the Board under the patent is vested in the Board; but in the order in council of the 14th of January 1869 the sole responsibility of the first lord was officially laid down, and in the order in council of the 19th of March 1872 the first lord was made "responsible to your Majesty and to parliament for all the business of the admiralty." As a matter of fact, the authority of the first lord, independent of his colleagues, had existed in an undefined manner from ancient times. Before a select committee of the House of Commons in 1861 the duke of Somerset stated that he considered the first lord responsible, that he had always "acted under that impression," and that he believed "all former first lords were of this opinion"; while Sir James Graham said that "the Board of Admiralty could never work, whatever the patent might be, unless the first lord were supreme, and did exercise constantly supreme and controlling authority." It is not, therefore, surprising to find that there has been undoubtedly direct government without a Board. Thus, in the operations conducted against the French channel ports in 1803–1804, Lord Melville, then first lord, took steps of great importance without the knowledge of his colleagues, though he afterwards bowed to their views, which did not coincide with his own. Again, when Lord Gambier was sent to Copenhagen in 1807, he was instructed to obey all orders from the king, through the principal secretary of state for war, and in this way received orders to attack Copenhagen, which were unknown to all but the first lord. In a similar way the secretary of the admiralty was despatched to Paris in 1815 with instructions to issue orders as if from the Board of Admiralty when directed to do so by the foreign secretary who accompanied him, and these orders resulted in Napoleon's capture. These instances were cited, except the first of them, by Sir James Graham before the select committee of the House of Commons in 1861, in order to illustrate the elastic powers under the patent which enabled the first lord to take immediate action in matters that concerned the public safety. It is not surprising that this peculiar feature of admiralty administration should have attracted adverse criticism, and have led some minds to regard the Board as "a fiction not worth keeping up."

Between 1860 and 1870 the sittings of the Board ceased to have the effective character they had once possessed. During the administration of Mr Childers,[1] first lord from 1868 to 1871 in Mr Gladstone's cabinet, a new system was introduced by which the free intercommunication of the members of the Board was hampered, and its sittings were quite discontinued. The case of the "Captain" led, however, to a return to the older practice. The "Captain" was a low freeboard masted turret ship, designed by Captain Cowper Phipps Coles, R.N. Competent critics believed that she would be unsafe, and said so before she was built; but the admiralty of Lord Derby's cabinet of 1866 gave their consent to her construction. She was commissioned early in 1870, and capsized in the Bay of Biscay on the 7th of September of that year. Mr Childers, who was nominally responsible for allowing her to be commissioned, distributed blame right and left, largely upon men who had not approved of the ship at all, and had been exonerated from all share of responsibility for allowing her to be built. The disaster was justly held to show that a civilian first lord cannot dispense with the advantage of constant communication with his professional advisers. When Mr Childers retired from the admiralty in March 1871, his successor, Mr Goschen (Viscount Goschen), reverted to the original system. It cannot be said, however, that the question of ultimate responsibility is well defined. The duke of Somerset, Sir James Graham and Sir Charles Wood, afterwards Lord Halifax, held the view that the first lord was singly and personally responsible for the sufficiency of the fleet. Sir Arthur Hood expressed before the House of Commons committee in 1888 the view that the Board collectively were responsible; whilst Sir Anthony Hoskins assigned the responsibility to the first lord alone with certain qualifications, which is a just and reasonable view.

2. *Admiralty Organization.*—Under the organization which now exists, the Board of Admiralty consists of the first lord, the first and second naval lords, the additional naval lord and controller, the junior naval lord and the civil lord, who are commissioners for executing the office of lord high admiral, and with them are the parliamentary and financial secretary and the permanent secretary. As has been explained, the first lord is responsible under the orders in council to the crown and to parliament for all admiralty business. In the hands of the

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[1] Admiral Sir Cooper Key, when director of naval ordnance during Mr Childers' administration, observed to the writer that no first lord of the admiralty knew so little of the working of the admiralty as Mr Childers, because, owing to the discontinuance of board meetings, he lost the great advantage of hearing the discussion. (R. V. H.)

other lords and secretaries rest duties very carefully defined, and they direct the civil departments which are the machinery of naval administration. The first naval lord, the second naval lord and the junior naval lord are responsible to the first lord in relation to so much of the business concerning the personnel of the navy and the movements and condition of the fleet as is confided to them, and the additional naval lord or controller is responsible in the same way for the material of the navy; while the parliamentary secretary has charge of finance and some other business, and the civil lord of all shore works—*i.e.* docks, buildings, &c.—and the permanent secretary of special duties. The first lord of the admiralty is the cabinet minister through whom the navy receives its political direction in accordance with imperial policy. He is the representative of the navy in parliament, which looks to him for everything concerned with naval affairs. The members of the Board are his advisers; but if their advice is not accepted, they have no remedy except protest or resignation. It cannot be denied that the responsibility of the members of the Board, if their advice should be disregarded, must cease, and it is sufficiently obvious that the remedy of resignation will not always commend itself to those whose position and advancement depend upon the favour of the government. Something will be said a little later concerning the working of the system and the relation of the first lord to the Board in regard to the navy estimates. In addition to general direction and supervision, the first lord has special charge of promotions and removals from the service, and of matters relating to honours and rewards, as well as the appointments of flag officers, captains and other officers of the higher ranks. With him rests also the nomination for the major part to naval cadetships and assistant clerkships.

Apart from the first lord, the first naval lord is the most important officer of the Board of Admiralty. It seems to be unquestionable that Sir James Graham was right in describing the senior naval lord as his "first naval adviser." Theoretically, the first naval lord is responsible for the personnel of the fleet; but in practice he is necessarily concerned with the material also as soon as it is put into commission, and with the actual commissioning of it. It is correct to say that he is chiefly concerned with the employment of the fleet, though his advice has weight in regard to its character and sufficiency, and is always sought in relation to the shipbuilding programme. Broadly speaking, the first naval lord's duties and authority cover the fighting efficiency and employment of the fleet, and upon him and upon the controller the naval business of the country largely falls. He directs the operations of the admiral superintendent of naval reserves in regard to ships, the hydrographer, the director of naval ordnance, so far as the gunnery and torpedo training establishments are concerned, and the naval intelligence department, and he has charge of all matters relating to discipline. The mobilization of the fleet, both in regard to personnel and material, also falls to him, and among a mass of other business in his department are necessary preparations for the protection of trade and the fisheries. It will thus be seen that the first naval lord is the chief officer of the Board of Admiralty, and that the operations of the other members of the Board all have relation to his work, which is no other than preparation for war. It may here be remarked that it appears most necessary to change the naval lords frequently, so that there may always be in the Board some one who possesses recent touch with the service afloat.

The second naval lord may be regarded as the coadjutor of the first naval lord, with whose operations his duties are very closely related, though, like every other member of the Board, he is subordinate only to the first lord. The duties of the second naval lord are wholly concerned with the personnel of the fleet, the manning of the navy and mobilization. In his hands rests the direction of naval education, training and the affairs of the royal marine forces. The training establishments and colleges are in his hands. He appoints navigating officers and lieutenants to ships (unless they be to command), sub-lieutenants, midshipmen and cadets, engineer officers, gunners and boatswains, and supervises the management of the reserve. In his province is the mobilization of the personnel, including the coastguard and the royal naval reserve. Necessarily, the first and second naval lords work together, and upon occasion can replace each other.[1]

Most important are the duties that fall to the additional naval lord and controller. He has charge of everything that concerns the material of the fleet, and his operations are the complement of the work of the first naval lord. A great number of civil departments are directed by the controller, and his survey and supervision extend to the dockyards and building establishments of the fleet. He submits plans to the Board for new ships, and is responsible for carrying into effect its decisions in regard to all matters of construction and equipment. The building operations both in the dockyards and in private yards are therefore under his supervision. In regard to all these matters the director of naval construction and the engineer-in-chief are the heads of the civil departments that carry on the work. Again, the controller is responsible in regard to armament—both gunnery and torpedo—and it is the work of his department to see to all gunnery and torpedo fittings, and to magazines, shell-rooms and electric apparatus. The officer in immediate charge of this branch of the controller's work, under his direction, is the director of naval ordnance. In regard to work at the dockyards (*q.v.*) the controller is aided by the director of dockyards. He supervises this officer in preparing the programme of work done in the dockyards, the provision of the material required and its appropriation to particular work in accordance with the programme. Other officers who conduct great operations under the authority and responsibility of the controller are the director of stores, who maintains all necessary supplies of coal and stores at home and abroad, and examines the store accounts of ships, and the inspector of dockyard expense accounts, who has charge of the accounts of dockyard expenditure and seeing that outlay is charged as directed. In regard to the navy estimates, the controller, through his subordinates, is responsible for the preparation and administration of the votes for shipbuilding and naval armaments, except in regard to some sub-headings of the former, and thus in recent years for the expenditure of something like £15,000,000 or over.

The junior naval lord has in his hands the very important duties that are concerned with the transport, medical and victualling services, as well as the regulation of hospitals, the charge of coaling arrangements for the fleet and other duties that conduce to the practical efficiency of the navy. He also appoints chaplains, naval instructors, medical officers (except in special cases) and officers of the accountant branch. A vast business in regard to the internal economy of ships greatly occupies the junior lord. He has charge, for example, of uniforms, prize-money, bounties, naval savings banks, and pensions to seamen and marines and the widows of naval and marine officers. The work of the junior naval lord places under his direction the director of transports, the director-general of the medical department, the director of victualling, and, in regard to particular matters, the director of stores, the accountant-general, the chaplain of the fleet, and the Intelligence Department, so far as the junior lord's department is concerned.

The civil lord supervises, through the director of works, the Department of Works, dealing with admiralty buildings and works, construction and labour, contracts and purchases of building stores and land. He is also responsible for the civil staff of the naval establishments, except in regard to certain officials, and for duties connected with Greenwich Hospital, compassionate allowances, charitable funds, and business of like character. The accountant-general, in regard to these matters, is directed by him, and the director of Greenwich Hospital is under his authority.

The parliamentary and financial secretary is responsible for the finance of the department, the navy estimates and matters of expenditure generally, and is consulted in regard to all matters involving reference to the treasury. His position in regard to estimates and expenditure is very important, and the accountant-general is his officer, while he has financial control over the director of contracts. The financial secretary also examines proposals for new expenditure.

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[1] The drawback is, that a naval lord can only go on leave by throwing all his work on a colleague already overweighted with work.

A most important official of the Board is the permanent secretary, whose office has been described as the "nerve-centre" of the admiralty, since it is the channel through which papers for the lords of the admiralty pass for the intercommunication of departments and for the correspondence of the Board. The tradition of admiralty procedure largely rests with the permanent secretary, and it is most important that he should be chosen from one of the branches, and should have served in as many of them as possible, in order that he may possess a thorough knowledge of the theory and practice of the admiralty system. In addition to the secretarial duties of the permanent secretary's department, the permanent secretary has charge of the military, naval and legal branches, each under a principal clerk, the civil branch and the record office. The various branches deal with matters concerning the commissioning of ships and the distribution of the fleet, and the manning and discipline of the navy, with other associated matters, being the channels for the operations of the naval lords. It is a highly important function of the department of the permanent secretary to preserve the inter-related working of the various departments, and to keep unbroken the thread of administration when a new Board is constituted.

3. *Business and Responsibility.*—The manner in which the Admiralty Board conducts the great operations under its charge has been indicated. It would be impossible here to describe it in detail, though something concerning the civil departments, which are the machinery of naval administration, will be found below. It will, however, indicate the character of admiralty administration if we explain to some extent the conditions which surround the preparation of the estimates and the shipbuilding programme, the more so because this matter has been the battle-ground of critics and supporters of the admiralty. It has already been pointed out that the naval lords, if they dissent from the estimates that are presented, have no remedy but that of protest or resignation. Into the controversies that have arisen as to the responsibility of the several lords it is unnecessary to enter here. The Admiralty Board possesses, in fact, the character of a council, and its members can only be held responsible for their advice. It has even been contended that, in the circumstances, it should not be incumbent upon them to sign the navy estimates, and there have been instances in which the estimates have been presented to parliament without the signature of certain naval lords. It is in any case obvious, as has been explained above, that the ultimate responsibility must always rest with the first lord and the cabinet, by whom the policy of the country is shaped and directed. In the report of the Hartington Commission in 1890 (the chairman of which became 8th duke of Devonshire) to inquire into the civil and professional administration of the Naval and Military Departments, and the relation of these departments to each other and to the treasury, the following recommendation occurs: "On the first lord alone should rest the responsibility of deciding on the provision to be made for the naval requirements of the empire, and the existence of a council should be held in no degree to diminish that responsibility."

Two conditions primarily rule the determination as to the strength of the navy. They are, the foreign policy of the cabinet, and, on the ground of practical expediency, the amount of money available. "The estimates and strength of the navy," said Rear-Admiral Hotham before the select committee on the navy estimates, 1888, "are matters for the cabinet to determine." "Expense," said Sir Anthony Hoskins, "governs everything." The needs of the empire and financial considerations, as it is scarcely necessary to remark, may prove to be antithetical conditions governing the same problem, and in practice it follows that the Admiralty Board directs its operations in accordance with the views of the government, but limited by the public funds which are known to be available. Such considerations suggest a practical limitation of responsibility, so far as the several lords of the admiralty are concerned, but it may be presumed to be their duty individually or collectively to place their views before the first lord; and Lord George Hamilton told the select committee of 1888 that, if his colleagues should represent to him that a certain expenditure was indispensable for the efficiency of the service, he would recognize that all financial considerations should be put on one side. The commissioners reported that this was the only common-sense view of the matter, and that it was difficult to see on what other footing the control of navy expenditure, consistently with responsibility to parliament, could be placed.

Two practical considerations are bound up with the shipbuilding programme—the carrying forward of the work in hand and the new construction to be begun, since it is absolutely necessary that proper provision should be made for the employment and distribution of labour in the dockyards, and for the purchase of necessary materials. Through the director of naval construction and the director of dockyards, the controller is kept informed as to the progress of work and the amount of labour required, as also in regard to the building facilities of the yards. These matters, in a general way, must form a subject of discussion between the first naval lord and the controller, who will report on the subject to the first lord. The accountant-general, as the financial officer of the Board, will be called upon to place the proposed estimates upon a financial basis, and when the views of the cabinet are known as to the amount of money available, the several departments charged with the duty of preparing the various votes will proceed with that work. The financial basis alluded to is, of course, found in the estimates of the previous year, modified by the new conditions that arise. There has been in past times a haphazard character in our shipbuilding programmes, but with the introduction of the Naval Defence Act of 1889, which looked ahead and was not content with hand-to-mouth provision, a better state of things has grown up, and, with a larger sense of responsibility, a policy characterized by something of continuity has been developed. Certainly the largest factor in the better state of things has been the growth of a strong body of public opinion as to the supreme value of the navy for national and imperial welfare.

Another important and related matter that comes before the Board of Admiralty is the character and design of ships. The naval members of the Board indicate the classes and qualities desired, and it is the practice that the sketch-design, presented in accordance with the instructions, is fully discussed by the first naval lord and the controller, and afterwards by the Board. The design then takes further shape, and when it has received the final sanction of the Board it cannot be altered without the sanction of the same authority. A similar procedure is found in the other business of the Admiralty Board, such as shore-works, docks and the preparation of offensive and defensive plans of warfare—the last being a very important matter that falls into the operations of the Naval Intelligence Department, which has been described, though not with perfect accuracy, and certainly in no large sense, as "the brain of the navy." That department is under the direction of the first naval lord.

The shipbuilding programme may be described as the cornerstone of the executive business of the admiralty, because upon it depends very largely the preparation of all the other votes relating to numbers, stores, victualling, clothing, &c. But if the Admiralty Board is responsible through the first lord for the preparation of the estimates, it is also charged with the business of supervising expenditure. In this matter the financial secretary plays a large part, and is directed to assist the spending department of the admiralty in their duty of watching the progress of their liabilities and disbursements. Some notes on admiralty finance will be found below (section 4). The shipbuilding votes set the larger machinery of the admiralty in motion. The executive departments, except in regard to the hulls and machinery of ships and the special requirements of the director of works, do not make purchases of stores, that work resting with the director of navy contracts. Most of the important executive and spending branches are in the department of the controller, and it will be well, while we are dealing with the material side of the navy, to describe briefly their character and duties. The civil branches of the navy tributary to the controller are those of the director of naval construction, the engineer-in-chief, the directors of naval ordnance, of dockyards and of stores, and the inspector of dockyard expense accounts. The first duty of the controller is, as has been explained, in relation to the design and construction of ships and their machinery, and the executive officials who have charge of that work are the director of naval construction and the engineer-in-chief, whose operations are closely interrelated. A vast administrative stride has been made in this particular branch of the admiralty. The work of design and construction now go forward together, and the admiralty designers are in close touch with the work in hand at the dockyards. This has been largely brought about by the institution, in 1883, of the royal corps of naval constructors, whose members interchange their duties between the designing of ships at the admiralty and practical work at the dockyards. It is through the director of naval construction that many of the spending departments are set in motion, since he is responsible both for the design of ships and for their construction. It deserves to be noticed, however, that a certain obscurity exists in regard to the relative duties of the director of naval construction and the director of dockyards touching constructive works in the yards. The former officer has also charge of all the work given out to contract, though it is the business of the dockyard officials to certify that the conditions of the contract have been fulfilled. In all this work the director of naval construction collaborates with the engineer-in-chief, who is an independent officer and not a subordinate, and whose procedure in regard to machinery closely resembles that adopted in the matter of contract-built ships.

The director of naval ordnance is another officer of the Controller's Department whose operations are very closely related to the duties of the director of naval construction, and the relation is both intimate and sustained, for in the Ordnance Department everything that relates to guns, gun-mountings, magazines, torpedo apparatus, electrical fittings for guns, and other electrical fittings is centred. A singular feature of this branch of administration is that the navy long since lost direct control of ordnance matters, through the duties connected with naval gunnery, formerly in the hands of the master-general of the ordnance, and those of the Board of Ordnance—a department common to the sea and land services—being vested in 1855 in the secretary of state for war. A more satisfactory state of things has grown up through the appointment of the director of naval ordnance, taking the place of the naval officer who formerly advised the director of artillery at the War Office. Expenditure on ordnance has also been transferred from the army to the navy estimates, and a Naval Ordnance Store Department has been created. It cannot be said that the condition is yet satisfactory, nor can it be until the navy has control of and responsibility for its own ordnance. The assistant-director of torpedoes is an officer instituted at the admiralty within recent years, and his duty is to assist the director of naval ordnance in all torpedo matters.

The director of dockyards replaced the surveyor of dockyards in 1885, at about which time the inspector of dockyard expense accounts was instituted. It is upon the director of dockyards (*q.v.*) that the responsibility of the controller devolves in regard to the management of dockyards and naval establishments at home and abroad, and to the performance of work in these establishments, ship and boat building, maintenance, repairs and refits. In this department the programme for work in the dockyards is prepared, as well as certain sections of the navy estimates.

We now come to the Stores Department, with the director of stores as its chief. This officer, about the year 1869, took over the storekeeping duties previously vested in the storekeeper-general. The Naval Store Department is charged with the custody and issue of naval, as distinguished from victualling and ordnance stores, to be used in naval dockyards and establishments for the building, fitting and repairing of warships. It has, however, no concern with stores that belong to the Department of Works. The business of the director of stores is also to receive and issue the stores for ships of all classes in commission and reserve, and he deals with a vast array of objects and materials necessary for the fleet, and with coals and coaling. He frames the estimates for his department, but his purchases are made through the director of navy contracts. In practice the main business of the Stores Department is to see to the provision of stores for the navy, and to the proper supply of these at all the establishments, and for this purpose its officials direct the movements of storeships, and arrange for the despatch of colliers, the director being charged to be "careful to provide for His Majesty's ships on foreign stations, and for the necessary supplies to foreign yards." Another important business of the director of stores is the examination of the store accounts of ships as well as some other accounts. Although the director of stores is really in the department of the controller, he is supervised in regard to the coaling of the fleet by the junior naval lord. The inspector of dockyard expense accounts has been alluded to. He is the officer charged with keeping a record of expenditure at the dockyards and of supervising expense accounts.

Expenditure.

It may be useful to add a note concerning the spending of the money. Within the controller's department, as has been explained, are centred the more important spending branches of the admiralty. While the work of designing ships and preparing plans is in progress, the director of stores, the director of dockyards and other officials of that department concerned are making preparation for the work. The necessary stores, comprising almost every imaginable class of materials, are brought together, and the director of stores is specially charged to obtain accurate information in regard to requirements. He is not, however, a purchasing officer, that work being undertaken by the director of navy contracts, who is concerned with the whole business of supply, except in regard to hulls and machinery of ships built by contract, and the special requirements of the director of works. At the same time, the civil departments of the admiralty being held responsible for the administration of the votes they compile, it is their duty to watch the outlay of money, and to see that it is well expended, the accountant-general being directed to assist them in this work. The system is closely jointed and well administered, but it possesses a very centralized character, which interferes to some extent with flexible working, and with the progress of necessary repairs, especially in foreign yards. In so far as ships given out to contract are concerned (and the same is the case in regard to propelling machinery built by contract), the director of navy contracts plays no part, the professional business being conducted through the controller of the navy, who is advised thereon by the director of naval construction and the engineer-in-chief. The work conducted in private establishments is closely watched by the admiralty officials, and is thoroughly tested, but, *mutatis mutandis*, the system in regard to contract-built ships is practically the same as that which prevails in the dockyards.

4. *Naval Finance: The Accountant-General's Department.*—The subject of naval finance is one of great complexity and of vast importance. The large sums of money with which the admiralty deals in the way of both estimates and expenditure, amounting recently to about £30,000,000 annually, implies the existence of the great organization which is found in the department of the accountant-general of the navy. Under the authority of the first lord, the parliamentary and financial secretary is responsible for the finance of the admiralty in general, and for the estimates and the expenditure, the accounts and the purchases, and for all matters which concern the relations of the admiralty to the treasury and to other departments of the government; and in all the practical and advisory work the accountant-general is his officer, acting as his assistant, with the director of naval contracts who, under the several lords, is concerned with the business of purchase.

The organization of the accountant-general's department has undergone many changes, and the resulting condition is the outcome of various modifications which have had for their purpose to give to this officer a measure of financial control. There have been various views as to what the duties of the accountant-general should be. After the reorganization of the admiralty by Sir James Graham in 1832, the accountant-general was regarded as a recording and accounting officer, wholly concerned with receipt and expenditure. His duties were limited to the auditing of accounts, payments and expenditure generally. Owing to changes effected in 1869, which made the parliamentary secretary, assisted by the civil lord, responsible for finance at the admiralty, bringing the naval and victualling store departments into his charge, the accountant-general was invested with the power of criticizing these accounts financially, though he did not as yet possess any financial control, and the position was little changed by fresh rules made in 1876. It was not until 1880 that the powers of the accountant-general were enlarged in this direction. It was then ordered that he should be consulted before any expenditure which the estimates had not provided for was incurred, and before any money voted was applied to other purposes than those for which it was provided. The effect of this order was not happy, for the accountant-general could not undertake these duties without setting up friction with the departments whose accounts he criticized. It was contemplated by the admiralty in 1885 to make the accountant-general the assistant of the financial secretary, and to raise him to the position of a permanent officer of finance instead of being an officer of account invested with imperfect authority in the direction of control. A select committee of the House of Commons reported that the accountant-general possessed no financial control over the departments, and that there was an urgent need for establishing such a control. At the time the position of that officer did not enable him to exercise any sufficient general supervision over expenditure, and there was no permanent high official expressly charged with finance. Accordingly, after being submitted to a departmental committee, a fresh arrangement was made in November 1885, whereby the accountant-general, under the authority of the financial secretary, was given a direct share in the preparation of the estimates. His written concurrence was required before the final approval of the votes, and each vote was referred to him for his approval or observations, and he was to exercise a financial review of expenditure and to see that it was properly accounted for. He became, in fact, "the officer to be consulted on all matters involving an expenditure of naval funds." It was believed that economical administration would result; but much opposition was raised to the principle that was involved of submitting the proposals of responsible departments to the inexpert criticism of a financial authority. Mr Main, assistant accountant-general, stated before the Royal Commission on Civil Establishments, 1887, that the effect had been to develop a tendency to withhold information or to afford only partial information, as well as to cause friction when questions were raised affecting expenditure, accompanied by protests, even in those cases in which these questions were manifestly of a legitimate character. The result was discouraging, and in the opinion of Mr Main had done much to weaken financial control and to defeat the purpose of the order. It is unnecessary to detail the various changes that have been made by the institution of dockyard expense accounts in the department of the controller, and by various other alterations introduced. The treasury instituted an independent audit of store accounts which greatly affected the position of the accountant-general, and the Royal Commission on Civil Establishments reported that the Board of Admiralty were of opinion that they could dispense with the accountant-general's review altogether. The commission was, however, of opinion that the accountant-general should be the permanent assistant and adviser, on all matters involving the outlay of public money, of the financial secretary.

The operations of the accountant-general are now conducted in accordance with the order in council of the 18th of November 1885, and of an office memorandum issued shortly afterwards. He thus acts as deputy and assistant of the parliamentary and financial secretary, and works with a finance committee within the admiralty, of which the financial secretary is president and the accountant-general himself vice-president. The duties of the department are precisely defined as consisting in the criticism of the annual estimates as to their sufficiency before they are passed, and in advising the financial and parliamentary secretary as to their satisfying the ordinary conditions of economy. The accountant-general also reviews the progress of liabilities and expenditure, and in relation to dockyard expenditure he considers the proposed programme of construction as it affects labour, material and machinery. He further reviews current expenditure, or the employment of labour and material, as distinguished from cash payments of the yard, as well as proposals for the spending of money on new work or repairs of any kind for which estimates are currently proposed. The accountant-general's department has three principal divisions: the estimates division, the navy pay division, and the invoices and claims division. In the first of these is the ledger branch, occupied with the work of accounts under the several votes and sub-heads of votes, and with preparing the navy appropriation account, as well as the estimates and liabilities branch, in which the navy estimates are largely prepared after having been proposed and worked out in the executive departments of the admiralty. There are also ships' establishments and salaries branches. The navy pay division includes the full and half-pay branch and a registry section. There is also the seamen's pay branch, which audits ships' ledgers and wages, and has charge of all matters concerning the wages of seamen. The victualling audit is also in this branch, and is concerned with payments for savings in lieu of victualling and some other matters. Further, the navy pay division examines ships' ledgers, and is concerned with the service, characters, ages, &c., of men as well as with allotments and pensions. The third division of the accountant-general's department, known as that of invoices and claims, conducts a vast amount of clerical work through many branches, and is concerned with the management of naval savings banks and matters touching prize-money and bounties.

The importance of this great department of the admiralty cannot be overrated. It is, in the first place, of supreme importance that the navy estimates should be placed upon a sound financial basis; and in practice the Board requires the concurrence of the accountant-general to the votes before they are approved, and thus in greater or less degree this officer is concerned in the preparation of every one of the votes. He does not concern himself with matters of larger policy outside the domain of finance, and it must be confessed that there appears to be something anomalous in his "review" of naval expenditure. It is, however, a mark of the flexibility or elasticity of the admiralty system that in practice the operations of the accountant-general's department work easily, and that admiralty finance is recognized as having been placed upon a sound and efficient basis. There are important financial officers outside the accountant-general's department concerned with assisting the controller. The inspector of dockyard expense accounts, who is entirely in the controller's department, enables him to exercise careful supervision over expenditure and the distribution of funds to special purposes. This work, however, though highly important, is merely one part of the system of financial control. Within recent years the bonds have been considerably tightened, and the work is untainted by corruption. It is true that in exercising rigid supervision over expenditure the work has become more centralized than is desirable, and it is a mark of change within recent years that local officers have been in larger measure deprived of independent powers. This, indeed, is a necessary condition of financial control, or at least a condition which it is not easy to change where rigid control is necessary.

5. *Mobilization of the Fleet.*—By the mobilization of the fleet is meant the placing of naval resources upon a war footing, in readiness in all material and personal respects for hostile operations. A complete mobilization for purposes of practice in peace time would dislocate seafaring life in a manner which would be justifiable only by actual war. Thus no country in peace manœuvres calls out all its naval reserves, or makes use of the auxiliary cruisers—merchant ships for which a subvention is

paid, and which are constructed with a view to use in warfare. Experience has shown that when vessels are commissioned they are liable to numerous small breakdowns of their machinery if they are manned by crews who have no familiarity with them. Many accidents of this kind had occurred in the British navy at manœuvres, though it could not be shown that the vessel was defective, or that the crew was either untrained or negligent. These experiments led the admiralty to adopt a new system in 1904, designed to obviate the risk that vessels would be crippled at a critical moment by want of acquaintance on the part of the crew with their machinery. Under this system all vessels which are considered to be available for war are divided into two classes:—first, those in full commission which constitute the different squadrons maintained at all times; and secondly, those which form the reserve and are kept in partial commission—or rather partially manned though in commission. These are kept at the home ports—Chatham, Portsmouth, Plymouth—in reserve squadrons under a flag-officer who will command them in war. Each vessel has a captain, a second in command, and a proportion of other officers including engineer, navigating and torpedo officers. Two-fifths of her full complement of crew are always on board, and they include the most skilled men needed for the proper management of the machinery of all kinds—more especially that of the torpedoes and guns. These vessels go to sea for periodical practice. When therefore the fleet must be mobilized for war it will only be necessary to fill up the number of trained men by the less skilled hands from the naval barracks occupied by the sailors not belonging to any particular ship, or from the naval reserve. All ranks of the navy are placed on a roster by which they successively serve in ships in full commission, are quartered in the naval barracks and drafted from them to the ships of the reserve, from which they return to the sea-going ships. It is calculated that there are always men enough in the barracks to complete the crews of a small squadron for emergency service without disturbing the regular routine of the peace establishment. The British admiralty may claim that though the machinery at its command in the past was not perfect it has commonly been able to send a squadron to sea more rapidly than any other power in Europe. Much depends on the arrangement of the stores as well as the disposition of the men. The introduction at the end of the 18th century of the businesslike practice of keeping the fittings of each ship together by themselves, did much to facilitate the rapid mobilization of a portion of the British fleet in 1790 which impressed all Europe. The prompt manning of a special service squadron in 1895 in consequence of the troubles then arising in connexion with the former South African Republic, showed that even before its plans for mobilization were completed the admiralty had its resources well in hand. (R .V. H.)

Other countries.

As regards the navies of countries other than Great Britain, their government is in the hands of ministers or departments variously constituted. The Russian admiralty is a highly organized bureau, divided into departments, and under the supreme control of a high admiral, usually a grand duke of the Imperial House. The German admiralty was, till 1872, a branch of the War Office, though governed by a vice-admiral under a naval prince of the reigning family. In 1872 it was severed from the War Office, though remaining an appanage thereof, and a general of the army was placed at its head. The French minister of marine, assisted by a permanent staff, controls the navy of France on a highly centralized system of administration; but the departments are well organized, and work well. The Italian fleet is governed on principles analogous to the French, but with a large admixture of the English representative element. The American system is worth describing in more detail.

United States Navy Department.

The president of the United States is commander-in-chief of the navy—a constitutional prerogative which he seldom asserts. The Navy Department is administered by a civilian secretary of the navy—a cabinet officer appointed by the president—who exercises general supervision. Next in authority is the assistant-secretary, also a civilian nominee, who acts as an assistant, and has, besides, certain specific duties, including general supervision of the marine corps, naval militia and naval stations beyond the continental limits of the United States. The details of administration are supervised by the chiefs of bureaus, of which there are eight. They are appointed by the president from the navy list for a period of four years, and have the rank of rear-admiral while serving in this capacity. They have direct control of the business and correspondence pertaining to their respective bureaus; and orders emanating from them have the same force as though issued by the secretary.

The bureau of navigation is the executive, or military, bureau, and as such promulgates and enforces the orders and regulations prescribed by the secretary; it has general direction of the procurement, education, assignment and discipline of the personnel. It also controls the movements of ships, including the authorization of manœuvres and drills, such as target practice. The bureau of equipment has charge of all electrical appliances, compasses, charts and fuel, and generally all that relates to the equipment of vessels, exclusive of those articles that come naturally under the cognizance of other bureaus. It has charge of the naval observatory, where the *Ephemeris* is prepared annually, and of the hydrographic office, where charts, sailing directions, notices to mariners, &c., are issued. The bureau of ordnance has charge of the gun factory, proving ground, and torpedo station, and all naval magazines; all the details that pertain to the manufacture, tests, installation or storage of all offensive and defensive apparatus, including armour, ammunition hoists, ammunition rooms, &c., though much of the actual installation is performed by the bureau of construction after consultation with the bureau of ordnance. The bureau of construction and repair has charge of the designing, building and repairing of hulls of ships, including turrets, spars and many other accessories. It builds all boats, has charge of the docking of vessels and the care of ships in reserve. The chief of this bureau is usually a naval constructor. The bureau of steam engineering has charge of all that relates to the designing, building and repairing of steam machinery, and of all the steam connexions on board ship. The bureau of supplies and accounts procures and distributes provisions, clothing and supplies of the pay department afloat, and acts as the purchasing agent for all materials used at naval stations, except for the medical department and marine corps. It also has charge of the disbursement of money and keeping of accounts. The chief of this bureau is a pay officer. The bureau of medicine and surgery has charge of all naval hospitals, dispensaries and laboratories, and of all that pertains to the care of sick afloat and ashore. The chief of this bureau is a medical officer. The bureau of yards and docks has charge of construction and maintenance of wet and dry docks, buildings, railways, cranes, and generally all permanent constructions at naval stations. The chief of this bureau is often a civil engineer.

Under the cognizance of the secretary's office is the office of the judge-advocate-general, an officer selected by the president from the navy list for a term of four years, with the rank of captain while so serving. He is legal adviser to the department, and reviews the records of all courts and statutory boards. Under the cognizance of the assistant-secretary's office is the office of naval intelligence, which collates information on naval matters obtainable at home and abroad. The staff is composed of naval officers on shore duty, the senior in charge being usually a captain, and known as chief intelligence officer. Several boards are employed under the various bureaus, or directly as advisers to the secretary. Some are permanent in character, while others are composed of officers employed on other duty, and are convoked periodically or when required. The naval policy board is composed of officers of high rank, and meets once a month; its duties conform to those of the general staff in armies. The board of construction consists of the chiefs of bureaus of ordnance, equipment, construction and repair, steam engineering, and the chief intelligence officer. Its duty is to advise the secretary in all matters relating to the construction policy in detail. The general construction policy is suggested by the naval policy board. The board of inspection and survey is composed of representatives of all bureaus, who inspect vessels soon after commission and on return from a cruise, and report on the condition of the ship and efficiency of its personnel; it also conducts the official trials of new vessels. The boards for the examination of officers for promotion are composed of officers of the corps to which the candidate belongs and of medical officers. Every officer is examined professionally, morally and physically at each promotion. The Navy Department is located at Washington, D.C., and occupies a building together with the State and War Departments (the latter being charged solely with army affairs).

The personnel (see also under NAVY) is limited in number by law. The engineer corps was abolished in 1899, the then engineer-officers becoming line officers in their respective relative grades. Line officers are the military and executive branch, and are required besides to perform engineer duties. They are graduates of the Naval Academy. Vacancies occurring in the construction corps are filled from the graduates of the Naval Academy having the highest standing in scholarship, who are given a two years' graduate course, generally abroad, on being graduated from the Academy, and are then appointed assistant naval constructors. All other staff officers are appointed directly from civil life by the president, from candidates passing prescribed examinations. Each representative and delegate in Congress has authority to nominate a candidate for naval cadet whenever his congressional district has no representative in the Naval Academy. The candidate must be a resident of the district which the congressman represents, between fifteen and twenty years old, and must pass prescribed mental and physical examinations. The president is allowed ten representatives at the Academy at all times, appointed "at large," and one appointed from the District of Columbia.

The course of instruction at the Academy is four years, each comprising eight months' study, three months' practice cruise, and one month's furlough. At the expiration of four years, cadets are sent to cruising ships for two years' further instruction, and are then commissioned ensigns. After three years' further sea service, ensigns are promoted to lieutenants (junior grade). After this, promotion is dependent upon seniority alone, the senior officer in any grade being promoted to the lowest number in the next higher grade when a vacancy occurs in the higher grade, and not before. All officers are retired on three-fourths sea pay at the age of sixty-two, or whenever a board of medical officers certifies that an officer is not physically qualified to perform all duties of his grade. A few officers are allowed to retire voluntarily in certain circumstances, to stimulate promotion. Any officer on the retired list may be ordered by the secretary to such duty as he may be able to perform: this is a legal provision to provide for emergencies. Promotion in the staff corps is dependent upon seniority, though relative rank in the lower grades in some corps somewhat depends upon promotion of line officers of the same length of service, and accounts for the existence of staff officers in the same grade having different ranks. All sea-going officers, after commission, are required to spend three years at sea, and are then usually employed on shore-duty for a time, according to the needs of the service—short terms of shore-duty thereafter alternating with three-year cruises. This rule is adhered to as strictly as circumstances will permit. Shore-duty includes executive or distinctly professional duties in the Navy Department, under its bureaus, and at navy yards and stations; inspection of ordnance, machinery, dynamos, &c., under construction by private firms; duty on numerous temporary or permanent boards; instructors at the Naval Academy; recruiting duty; charge of branch hydrographic offices; inspection duty in the lighthouse establishment; at state nautical schools; as attachés with United States legations; and many others. Naval constructors (usually), civil engineers and professors of mathematics are continuously employed on shore-duty connected with their professions, the Naval Observatory, Nautical Almanac and the Naval Academy employing most of the last.

Warrant officers (boatswains, gunners, carpenters, sailmakers, warrant machinists and pharmacists) are appointed by the secretary, preference being given to enlisted men in the navy who have shown marked ability for the positions. They must be between twenty-one and thirty-five years of age, and pass an examination. After serving satisfactorily for one year under an acting appointment, they receive warrants that secure the permanency of their office. Ten years after appointment, boatswains, gunners, carpenters and sailmakers are eligible for examination for a commission as chief-boatswain, &c., and as such they rank with, but next after, ensigns. Mates are rated by the secretary from seamen or ordinary seamen. They have no relative rank, but take precedence of all petty officers. Their duties approximate to those of boatswains, though they seldom serve on large cruising vessels. Clerks to pay officers are appointed by the secretary on the nominations of the pay officers. They have no rank and are not promoted or retired. Their appointments are revoked when their services are no longer needed.

Boys between fifteen and seventeen years old of good character, who can read and write and pass the physical examination, may enlist for the term of their minority. They enlist as third-class apprentices, and are given six months' instruction at a training station, and thence go to sea in apprentice training vessels. When proficient they are transferred to regular cruising vessels as second class, and when further qualified are rated first class. All other enlistments are for four years. Recruits must speak English. Landsmen are usually sent to sea on special training-ships until proficient, and are then sent into general service. Raw recruits may enlist as landsmen, or coal-passers or mess attendants. Ordinary seamen must have served two years, and seamen four years before the mast, prior to first enlistment as such; and before enlistment in any other rating allowed on first enlistment, applicants must prove their ability to hold such rating. Landsmen, coal-passers, &c., as soon as they become proficient, are advanced to higher grades, and, if American citizens, may eventually become petty officers (ranking with army non-commissioned officers), with acting appointments. In twelve months, or as soon thereafter as proficiency is established, the acting appointment is made permanent, and an acting appointment for the next higher grade is issued, &c. Permanent appointments are not revokable except by sentence of court-martial, and a man re-enlists in that rating for which he held a permanent appointment in his previous enlistment. All persons re-enlisting within four months after expiration of previous enlistment are entitled to a bounty equal to four months' pay, and in addition receive a "continuous service certificate," which entitles them to higher pay and to other special considerations. The same is true for each re-enlistment. When an enlisted man completes thirty years' service and is over fifty years of age he may retire on three-fourths pay.

The Marine corps (see MARINES) is a wholly separate military body, but it is under the control of the Navy Department.

United States naval vessels are, as a rule, built at private yards under contracts awarded after competition. The government is not committed to any fixed policy or building programme. Each year the secretary recommends certain new construction. The final action rests with Congress, which must appropriate money for the new ships before the construction can be commenced. Repairing and reconstruction are usually done at government navy yards.

Ships in commission are distributed among five stations: (1) the North Atlantic, *i.e.* the Atlantic coast of the United States, Central America, and South America as far as the Amazon, also the West Indies; (2) the South Atlantic, *i.e.* the remainder of the Atlantic coast of South America and both coasts of South Africa; (3) the European, comprising the coast of Europe, including the inland seas, and the North Atlantic coast of Africa; (4) the Asiatic station, comprising the coast of Asia, including the islands north of the equator, also the east coast of North Africa; (5) the Pacific station, comprising the Pacific coast of North and South America, and Australia and the adjacent islands lying south of the equator. Each station is commanded by a flag officer, and the number of ships under the command varies according to circumstances. Ships in commission on special service, such as training, gunnery, surveying ships, &c., are not attached to stations. The shore stations of the navy are enumerated in the article on Dockyards. (W. T. S.)

ADMIRALTY, HIGH COURT OF. The High Court of Admiralty of England was the court of the deputy or lieutenant of the admiral. It is supposed in the *Black Book of the Admiralty* to have been founded in the reign of Edward I.; but it would appear, from the learned discussion of R. G. Marsden, that it was established as a civil court by Edward III. in the year 1360; the power of the admiral to determine matters of discipline in the fleet, and possibly questions of piracy and prize, being somewhat earlier. Even then the court as such took no formal shape; but the various admirals began to receive in their patents express grants of jurisdiction with powers to appoint lieutenants or deputies. At first there were separate admirals or rear-admirals of the north, south and west, each with deputies and courts. A list of them was collected by Sir H. Spelman. These were merged in or absorbed by one high court early in the 15th century. Sir Thomas Beaufort, afterwards earl of Dorset and duke of Exeter (appointed admiral of the fleet 1407, and admiral of England, Ireland and Aquitaine 1412, which latter office he held till his death in 1426), certainly had a court, with a marshal and other officers, and forms of legal process—mandates, warrants, citations, compulsories, proxies, &c. Complaints of encroachment of jurisdiction by the Admiralty Courts led to the restraining acts, 13 Ric. II. c. 5 (1389), 15 Ric. II. c. 3 (1391) and 2 Hen. IV. c. 11 (1400).

Jurisdiction.

The original object of the institution of the courts or court seems to have been to prevent or punish piracy and other crimes upon the narrow seas and to deal with questions of prize; but civil jurisdiction soon followed. The jurisdiction in criminal matters was transferred by the Offences at Sea Act 1536 to the admiral or his deputy and three or four other substantial persons appointed by the lord chancellor, who were to proceed according to the course of the common law. By the Central Criminal Court Act 1834, cognizance of crimes committed within the jurisdiction of the admiralty was given to the central criminal court. By an act of 1844 it has been also given to the justices of assize; and crimes done within the jurisdiction of the admiralty are now tried as crimes committed within the body of a county. See also the Criminal Law Consolidation Acts of 1861.

From the time of Henry IV. the only legislation affecting the civil jurisdiction of the High Court of Admiralty till the time of Queen Victoria is to be found in an act of 1540, enabling the admiral or his lieutenant to decide on certain complaints of freighters against shipmasters for delay in sailing, and one of 1562, giving the lord high admiral of England, the lord warden of the Cinque Ports, their lieutenants and judges, co-ordinate power with other judges to enforce forfeitures under that act—a very curious and miscellaneous statute called "An Act for the Maintenance of the Navy."

In an act of 1534, with regard to ecclesiastical appeals from the courts of the archbishops to the crown, it is provided that the appeal shall be to the king in Chancery, "and that upon every such appeal a commission shall be directed under the great seal to such persons as shall be named by the king's highness, his heirs or successors, like as in cases of appeal from the Admiralty Court." The appeal to these "persons," called delegates, continued until it was transferred first to the privy council and then to the judicial committee of the privy council by acts of 1832 and 1833.

The early jurisdiction of the court appears to have been exercised very much under the same procedure as that used by the courts of common law. Juries are mentioned, sometimes of the county and sometimes of the county and merchants. But the connexion with foreign parts led to the gradual introduction of a procedure resembling that coming into use on the continent and based on the Roman civil law. The Offences at Sea Act 1536 states the objection to this application of the civil law to the trial of criminal cases with much force: "After the course of the civil laws, the nature whereof is that before any judgment of death can be given against the offenders, either they must plainly confess their offences (which they will never do without torture or pain), or else their offences be so plainly and directly proved by witness indifferent such as saw their offences committed, which cannot be gotten but by chance at few times."

Restraining Acts.

The material enactments of the restraining statutes were as follows:—An act of 1389 (13 Ric. II. c. 5) provided that "the admirals and their deputies shall not meddle from henceforth of anything done within the realm, but only of a thing done upon the sea, as it hath been used in the time of the noble prince king Edward, grandfather of our lord the king that now is." The act of 1391 (15 Ric. II. c. 3) provided that "of all manner of contracts, pleas and quarrels, and other things rising within the bodies of the counties as well by land as by water, and also of wreck of the sea, the admiral's court shall have no manner of cognizance, power, nor jurisdiction; but all such manner of contracts, pleas and quarrels, and all other things rising within the bodies of counties, as well by land as by water, as afore, and also wreck of the sea, shall be tried, determined, discussed and remedied by the laws of the land, and not before nor by the admiral, nor his lieutenant in any wise. Nevertheless, of the death of a man, and of a maihem done in great ships, being and hovering in the main stream of great rivers, only beneath the [bridges] of the same rivers [nigh] to the sea, and in none other places of the same rivers, the admiral shall have cognizance, and also to arrest ships in the great flotes for the great voyages of the king and of the realm; saving always to the king all manner of forfeitures and profits thereof coming; and he shall have also jurisdiction upon the said flotes, during the said voyages only; saving always to the lords, cities, and boroughs, their liberties and franchises." The act of 1400 (2 Hen. IV. c. 11) adds nothing by way of definition or restriction, but merely gives additional remedies against encroachments, providing heavy fines for those who improperly sue in the court, and those officials of the court who improperly assert jurisdiction. It was repealed by the Admiralty Court Act 1861. The statutes of Richard, except the enabling part of the second, were repealed by the Civil Procedure Acts Repeal Act 1879. The formation of a High Court of Justice rendered them obsolete.

In the reign of James I. the chronic controversies between the courts of common law and the Admiralty Court as to the limits of their respective jurisdictions reached an acute stage. We find the records of it in the second volume of Marsden's *Select Pleas in the Court of Admiralty*, and in Lord Coke's writings: *Reports*, part xiii. 51; *Institutes*, part iv. chap. 22. In this latter passage Lord Coke records how, notwithstanding an agreement asserted to have been made in 1575 between the justices of the King's Bench and the judge of the admiralty, the judges of the common law courts successfully maintained their right to prohibit suits in admiralty upon contracts made on shore, or within havens, or creeks, or tidal rivers, if the waters were within the body of any county, wheresoever such contracts were broken, for torts committed within the body of a county, whether on land or water, and for contracts made in parts beyond the seas. It is due to the memory of the judges of Lord Coke's time to say that, at any rate as regards contracts made *in partibus transmarinis*, the same rule appears to have been applied at least as early as 1544, the judges then holding that "for actions transitory abroad action may lie at common law."

Judge's patent.

All the while, however, the patents of the admiralty judge purported to confer on him a far ampler jurisdiction than the jealousy of the other courts would concede to him. The patent of the last judge of the court, Sir Robert Joseph Phillimore, dated the 23rd of August 1867, styles him "Lieut. Off^{l}. Princ^{l}. and Commissary Genl. and Special in our High Court of Admiralty of Eng. and President and Judge of the same," and gives to him power to take cognizance of "all causes, civil and maritime, also all contracts, complaints, offences or suspected offences, crimes, pleas, debts, exchanges, accounts, policies of assurance, loading of ships, and all other matters and contracts which relate to freight due for the use of ships, transportation, money or bottomry; also all suits civil and maritime between merchants or between proprietors of ships and other vessels for matters in, upon, or by the sea, or public streams, or fresh-water ports, rivers, nooks and places overflown whatsoever within the ebbing and flowing of the sea and high-water mark, or upon any of the shores or banks adjacent from any of the first bridges towards the sea through England and Ireland and the dominions thereof, or elsewhere beyond the seas." Power is also given to hear appeals from vice-admirals; also "to arrest . . . according to the civil laws and ancient customs of our high court . . . all ships, persons, things, goods, wares and merchandise"; also "to enquire by the oaths of honest and lawful men . . . of all . . . things which . . . ought to be enquired after, and to mulct, arrest, punish, chastise and reform"; also "to preserve the public streams of our admiralty as well for the preservation of our royal navy, and of the fleets and vessels of our kingdom . . . as of whatsoever fishes increasing in the rivers"; also "to reform nets too straight and other unlawful engines and instruments whatsoever for the catching of fishes"; also to take cognizance "of the wreck of the sea . . . and of the death, drowning and view of dead bodies," and the conservation of the statutes concerning wreck of the sea and the office of coroner [1276], and concerning pillages [1353], and "the cognizance of mayhem" within the ebb and flow of the tide; all in as ample manner and form as they were enjoyed by Dr David Lewis [judge from 1558 to 1584], Sir Julius Caesar, and the other judges in order (22 in all) before Sir Robert Phillimore. This form of patent differs in but few respects from the earlier Latin patents—*tempore* Henry VIII.—except that they have a clause *non obstantibus statutis*.

Modern progress.

As has been said, however, the contention of the common law judges prevailed, and the Admiralty Court (except for a temporary revival under Cromwell) sank into comparative insignificance during the 17th century. The great maritime wars of the 18th century gave scope to the exercise of its prize jurisdiction; and its international importance as a prize court in the latter half of the 18th and the first part of the 19th centuries is a matter of common historical knowledge. There were upwards of 1000 prize causes each year between 1803 and 1811, in some years upwards of 2000.

There were other great judges; but Sir William Scott, afterwards Lord Stowell, is the most famous. Before his time there were no reports of admiralty cases, except Hay and Marriott's prize decisions. But from his time onwards there has been a continuous stream of admiralty reports, and we begin to find important cases decided on the instance as well as on the prize side.

In the reign of Queen Victoria, two enabling statutes, 1840 and 1861, were passed and greatly enlarged the jurisdiction of the court. The manner in which these statutes were administered by Dr Stephen Lushington and Sir R. J. Phillimore, whose tenure of office covered the whole period of the queen's reign till the creation of the High Court of Justice, the valuable assistance rendered by the nautical assessors from the Trinity House, the great increase of shipping, especially of steam shipping, and the number and gravity of cases of collision, salvage and damage to cargo, restored the activity of the court and made it one of the most important tribunals of the country. In 1875, by the operation of the Judicature Acts of 1873 and 1875, the High Court of Admiralty was with the other great courts of England formed into the High Court of Justice. The principal officers of the court in subordination to the judge were the registrar (an office which always points to a connexion with canon or civil law), and the marshal, who acted as the maritime sheriff, having for his baton of office a silver oar. The assistance of the Trinity Masters, which has been already mentioned, was provided for in the charter of incorporation of the Trinity House. These officers and their assistance have been preserved in the High Court of Justice.

Practitioners in the court.

Till the year 1859 the practitioners in the High Court of Admiralty were the same as those in the ecclesiastical courts and distinct from those who practised in the ordinary courts. Advocates took the place of barristers, and proctors of solicitors. The place of the attorney-general was taken by the king's or queen's advocate-general, and that of the treasury solicitor by the king's or queen's procurator or proctor. There were also an admiralty advocate and an admiralty proctor. The king's advocate also represented the crown in the ecclesiastical courts, and was its standing adviser in matters of international and foreign law. The king's advocate led the bar of his courts, and before the privy council took precedence of the attorney-general. The admiralty advocate or advocate to his majesty in his office of admiralty represented specially the lords of the admiralty. In the Admiralty Court he ranked next after the king's advocate.

In an act of 1859 the practice was thrown open to barristers and to attorneys and solicitors.

Upon the next vacancy after the courts were thrown open, the crown altered the precedence and placed the queen's advocate after the attorney- and solicitor-general. There were two holders of the office under these conditions, Sir R. J. Phillimore and Sir Travers Twiss. The office was not filled up after the resignation of the latter. The admiralty had, when the courts were thrown open, a standing counsel for the ordinary courts and a solicitor. Questions soon arose as to the respective claims of the admiralty advocate and the counsel to the admiralty, and their acuteness was increased when the courts were fused into one High Court of Justice. Upon the resignation of Sir James Parker Deane the office of admiralty advocate was not filled up. In like manner the proctor to the admiralty has disappeared. The office of king's or queen's proctor has been kept alive but amalgamated with that of the solicitor for the treasury. That officer uses the title of king's proctor when he appears in certain matrimonial causes.

The last holder of the office of standing counsel to the admiralty was Alexander Staveley Hill, K.C., M.P. Since his death the office, like those of the king's or queen's advocate and the admiralty advocate, has not been filled up; and the ordinary law officers of the crown with the assistance of a junior counsel to the admiralty (a barrister appointed by the attorney-general) perform the duties of all these offices.

Judge Advocate of the Fleet.

The judge advocate of the fleet is a practising barrister whose function it is to advise the admiralty on all matters connected with courts-martial. Though section 61 of the Naval Discipline Act 1866 recognizes the possibility of his presence at a court-martial, he does not nowadays attend, but is represented by his deputy or by an officiating deputy judge advocate appointed *ad hoc* by the admiralty, the commander-in-chief of the fleet or squadron who convenes the court-martial, or, if no such appointment is made, by the president of the court-martial. But though the judge advocate of the fleet does not actually attend the courts-martial very responsible duties are imposed upon him. By a minute of the Board passed in 1884 (which is still in force) all proceedings of courts-martial on officers and men of the royal navy, excepting those where the prisoner pleads guilty and no evidence is taken, are to be referred to him, with a view to the consideration of (*a*) the charge, (*b*) the evidence on which the finding is based, and (*c*) the legality of the sentence, and he writes a minute on each case for the information of the lords commissioners of the admiralty with regard to these points. He has no power to modify a sentence, a power which is reserved to the admiralty by § 53 (1) of the Naval Discipline Act 1866, except in the case of a death sentence, which can only be remitted by the crown. All cases where the prisoner has pleaded guilty are examined in the admiralty, and if in any case there is any reason to think that there has been any informality or that the prisoner has not understood the effect of his plea, such case is submitted to the judge advocate of the fleet for his opinion. The judge advocate of the fleet receives no fees but is remunerated by a salary of £500 per annum.

The existence of a deputy judge of the fleet appointed by the admiralty has been recognized by the king's regulations, but no such officer had been appointed up to 1908.

In accordance with the provisions of § 61 of the Naval Discipline Act 1866, in the absence of the judge advocate of the fleet and his deputy, an officiating judge advocate is appointed for each court-martial. His duties are described in detail by the king's regulations, but may be summed up as consisting of seeing that the charges are in order, pointing out any informalities or defects in the charges or in the constitution of the court, seeing that any witness required by prosecutor or prisoner is summoned, keeping the minutes of the proceedings, advising on matters of law which arise at any time after the warrant for the court-martial is issued, drawing up the findings and sentence, and forwarding the minutes when completed to the admiralty. The officiating judge advocate is usually the secretary of the flag-officer convening the court-martial or some other officer of the accountancy branch. He is remunerated for his services by a fixed fee for each day the court sits.

Ireland.—The High Court of Admiralty of Ireland, being formed on the same pattern as the High Court in England, sat in the Four Courts, Dublin, having a judge, a registrar, a marshal and a king's or queen's advocate. In peace time and war time alike it exercised only an instance jurisdiction, though in 1793 it claimed to exercise prize jurisdiction (see ADMIRALTY JURISDICTION). No prize commission ever issued to it. By the Irish Judicature Act of 1877 it was directed that it should be amalgamated with the Irish High Court of Justice upon the next vacancy in the office of judge, and this subsequently took place. There was no separate lord high admiral for Ireland.

Scotland.—At the Union, while the national functions of the lord high admiral were merged in the English office it was provided by the Act of Union that the Court of Admiralty in Scotland should be continued "for determination of all maritime cases relating to private rights in Scotland competent to the jurisdiction of the Admiralty Court." This court continued till 1831, when its civil jurisdiction was given to the Court of Session and the Sheriffs' Courts (see ADMIRALTY JURISDICTION).

See Sir Travers Twiss, *Black Book of the Admiralty*, Rolls series; R. G. Marsden, *Select Pleas in the Court of Admiralty*, published by the Selden Society; Godolphin, *View of the Admiral Jurisdiction*. (W. G. F. P.)

ADMIRALTY ISLANDS, a group of about forty islands lying north of New Guinea, between 1° and 3° S., and 146° and 148° E., within the Bismarck Archipelago, belonging to Germany. The largest, Manus, is about 60 m. in length, and its highest point is about 3000 ft. above the sea; the others are very small, and rise little above sea-level. Most are of coral formation, but the hills of Manus are believed to be extinct volcanoes. The islands were discovered by the Dutch in 1616, and visited in 1767 by Philip Carteret; but no landing seems to have been effected, owing to the surrounding reefs, until the arrival of the "Challenger" in 1875. The natives are of the Papuan type, but show signs of mixed origin. They are cannibals, and many murders of whites have taken place.

ADMIRALTY JURISDICTION. The courts by which, as far as we know, admiralty jurisdiction in civil matters was first exercised were the following. In and throughout England the courts of the several admirals soon combined into one High Court of Admiralty (see ADMIRALTY, HIGH COURT OF). Within the territories of the Cinque Ports the Court of Admiralty of the Cinque Ports exercised a co-ordinate jurisdiction. In certain towns and places there were local courts of vice-admiralty. In Scotland there existed the Scottish High Court of Admiralty, in Ireland the Irish High Court of Admiralty. Of these courts that of the Cinque Ports alone remains untouched. The Scottish court was abolished, and its civil jurisdiction given to the Court of Session and to the courts of the sheriffs by the Court of Session Act 1830—not, however, till a decision given by it and the appeal therefrom to the House of Lords had established a remarkable rule of admiralty law in cases of collision (*Hay* v. *le Neve*, 1824, 2 Shaw, Sc. App. Cas. 305). The act states that the Court of Justiciary held cumulative jurisdiction with the Court of Admiralty in criminal matters. The local vice-admiralty courts in England had ceased to do much work when they were abolished by the Municipal Corporations Act 1835; the High Court became, with the other superior courts, a component part of the High Court of Justice by virtue of the Judicature Acts 1873 and 1875. And the Irish court has in like manner become a part of the High Court of Justice in Ireland by virtue of the Judicature Act passed in 1877.

Vice-Admiralty Courts.

As England first, and Great Britain afterwards, acquired colonies and possessions beyond seas, vice-admiralty courts were established. The earliest known was that in Jamaica, established in the year 1662. Some vice-admiralty courts which were created for prize purposes in the last century were suffered to expire after 1815. In the year 1863, when the act regulating the vice-admiralty courts was passed, there were vice-admiralty courts at Antigua, Bahamas, Barbadoes, Bermuda, British Columbia, British Guiana, British Honduras, Cape of Good Hope, Ceylon, Dominica, Falkland Islands, Gambia River, Gibraltar, Gold Coast, Grenada, Hong Kong, Jamaica, Labuan, Lagos, Lower Canada (otherwise Quebec), Malta, Mauritius, Montserrat, Natal, Nevis, New Brunswick, Newfoundland, New South Wales, New Zealand, Nova Scotia (otherwise Halifax), Prince Edward Island, Queensland, St Christopher, St Helena, St Lucia, St Vincent, Sierra Leone, South Australia, Tasmania, Tobago, Trinidad, Vancouver's Island, Victoria, Virgin Islands (otherwise Tortola), and Western Australia, and (for matters of the slave trade only) Aden. By the act of 1867 one for the Straits Settlements was added. These courts have been regulated from time to time by the following statutes: 2 and 3 Will. IV. c. 51, 26 and 27 Vict. c. 24 (Vice-Admiralty Courts Act 1863), already cited, and 30 and 31 Vict. c. 45 (Vice-Admiralty Courts Act Amendment Act 1867); and by the slave trade acts, of which the last and consolidating act was that of 1873.

In 1890 the Colonial Courts of Admiralty Act provided that, except in the colonies of New South Wales, Victoria, St Helena and British Honduras, vice-admiralty courts should be abolished, and a substitution made of colonial courts of admiralty. There is power, however, reserved to the crown to erect through the admiralty in any British possession any vice-admiralty court, except in India or any British possession having a representative legislature. No vice-admiralty court so established can exercise any jurisdiction except for some purpose relating to prize, the royal navy, the slave trade, foreign enlistment, Pacific Islanders' protection, and questions relating to treaties or conventions on international law. Vice-admiralty courts exercised all usual admiralty jurisdiction, and in addition a certain revenue jurisdiction, and jurisdiction over matters of slave trade and prize and under the Pacific Islanders' Protection Act. The appeal from vice-admiralty courts used to lie to the High Court of Admiralty of England, but has been transferred to the king in council.

Colonial Courts of Admiralty.

By the Colonial Courts of Admiralty Act 1890, already referred to, every court of law in a British possession which is declared by its legislature to be such, or if there be no such declaration, which has original unlimited civil jurisdiction, shall be a court of admiralty.

India.

There used at one time to be vice-admiralty courts for Calcutta, Madras and Bombay; but by the India High Courts Act 1861, § 9, the admiralty jurisdiction is given to the High Courts of these places.

Consular Courts.

Consular courts established in Turkey, China and Japan have had admiralty jurisdiction given to them, and by § 12 of the Colonial Admiralty Courts Act any court established by H.M. for the exercise of jurisdiction in any place outside H.M.'s dominion may have admiralty jurisdiction granted to it.

Australia.

By the Commonwealth of Australia Constitution Act 1900 a federal supreme court, to be called the High Court of Australia, is created, and the parliament of the Commonwealth may make laws conferring original jurisdiction on the High Court in matters of admiralty and maritime jurisdiction.

Isle of Man.

There is a court of admiralty in the Isle of Man of which the water-bailiff is judge. He is also styled admiral. It is said to have jurisdiction in salvage and over other maritime matters occurring within 3 leagues from the shore.

County Local Courts.

Modern statutes have given admiralty jurisdiction to the City of London Court, the Court of Passage and to the county courts in the following matters: Salvage, where the value of the salved property does not exceed £1000, or the claim for reward £300; towage, necessaries and wages, where the claim does not exceed £150; claims for damage to cargo, or by collision, up to £300 (and for sums above these prescribed limits by agreement between the parties); and claims arising out of breaches of charter parties and other contracts for carriage of goods in foreign ships, or torts in respect thereof, up to £300. This jurisdiction is restricted to subjects over which jurisdiction was possessed by the High Court of Admiralty at the time when the first of these acts was passed, except as regards the last branch of it (the "*Aline*," 1880, 5 Ex. Div. 227; *R.* v. *Judge of City of London Court*, 1892, 1 Q.B. 272). In analogy with the county court admiralty jurisdiction created in England, a limited admiralty jurisdiction has been given in Ireland to the recorders of certain boroughs and the chairmen of certain quarter sessions; and in salvage cases, where a county court in England would have jurisdiction, magistrates, recorders and chairmen of quarter sessions may have jurisdiction as official arbitrators (Merchant Shipping Act 1894, § 547). In Scotland, admiralty suits in cases not exceeding the value of £25 are exclusively tried in the sheriff's court; while over that limit the sheriff's court and the Court of Session have concurrent jurisdiction. The sheriff has also criminal admiralty jurisdiction, but only as to crimes which he would be competent to try if committed on land (The Court of Session Act 1830, §§ 21 and 22).

By an act of 1821 an arbitral jurisdiction in cases of salvage was given to certain commissioners of the Cinque Ports.

Appeals.

The appeal from county courts and commissioners is to the High Court of Justice, and is exercised by a divisional court of the Probate, Divorce and Admiralty Division. In cases arising within the Cinque Ports there is an optional appeal to the Admiralty Court of the Cinque Ports. The appeal from the High Court of Justice is in ordinary admiralty matters, as in others, to the Court of Appeal, and from thence to the House of Lords. But it is specially provided by the Judicature Act 1891, as it was by the Prize Act 1864, that the appeal in prize cases shall be to the sovereign in council.

Civil jurisdiction.

The unfortunate provisions of the legislature, giving to the jurisdiction of county courts different money limits in admiralty equity and common law cases, make the distinction between cases coming under the admiralty jurisdiction and other civil cases of practical moment in those courts. Arguments full of learning and research have been addressed to the courts, and weighty decisions have been given, upon questions which would never have arisen if the county courts had not a larger money area of jurisdiction in admiralty cases than they have in other matters (*R.* v. *Judge of City of London Court*, 1892, 1 Q.B. 273; the "*Zeta*," 1893, App. Cas. 468). But as regards the high courts, whether in England, Scotland or Ireland, it is not now necessary to distinguish their civil admiralty jurisdiction from their ordinary civil jurisdiction, except for the purpose of seeing whether there can or cannot be process *in rem*. Not that every admiralty action can of right be brought *in rem*, but that no process *in rem* lies at the suit of a subject unless it be for a matter of admiralty jurisdiction—one, for instance, that could in England have been tried in the High Court of Admiralty. Now these matters of admiralty jurisdiction with process *in rem* range themselves under four primary and four supplementary heads. The four primary are damage, salvage, bottomry, wages; and the four supplementary are extensions due to one or other of the statutes of 1840 (Admiralty Court) and 1861 (Admiralty Court Act). They are damage to cargo carried in a ship, necessaries supplied to a ship, mortgage of ship, and master's claim for wages and disbursements on account of a ship. In all these cases, primary and secondary, the process of which a plaintiff can avail himself for redress, may be either *in personam* as in other civil suits, or by arrest of the ship, and, in cases of salvage and bottomry, the cargo. Whenever, also, the ship can be arrested, any freight due can also be attached, by arrest of the cargo to the extent only of the freight which it has to pay. For the purpose of ascertaining whether or not process *in rem* would lie, there have been distinctions as nice, and the line of admiralty jurisdiction has been drawn as carefully, as in the cases of the admiralty jurisdiction of the county courts (the "*Theta*," 1894, Prob. 280; the "*Gas Float Whitton*," 1897, App. Cas. 337). There have been similar questions raised in the United States, from *De Lovio* v. *Boit* (1815, 2 Gallison, 398), and *Ramsay* v. *Allegre* (1827, 12 Wheaton, 611), down to the quite modern cases which will be found quoted in the arguments and judgments in the "*Gas Float Whitton*."

Disciplinary.

The disciplinary jurisdiction at one time exercised by the Admiralty Court, over both the royal navy and merchant vessels, may be said to be obsolete in time of peace, the last remnant of it being suits against merchantmen for flying flags appropriate to men-of-war (the "*Minerva*," 1800, 3 C. Rob. 34), a matter now more effectively provided against by the Merchant Shipping Act 1894. In time of war, however, it was exercised in some instances as long as the Admiralty Court lasted, and is now in consequence exercisable by the High Court of Justice (see *Prize* below). It was, perhaps, in consequence of its ancient disciplinary jurisdiction that the Admiralty Court was made the court to enforce certain portions of the Foreign Enlistment Act 1870.

Finally, appeals from decisions of courts of inquiry, under the Merchant Shipping Act, cancelling or suspending the certificates of officers in the merchant service, may be made to the Probate, Divorce and Admiralty Division of the High Court of Justice.

Criminal cases.

The admiralty jurisdiction in criminal matters extends over all crimes committed on board British ships at sea or in tidal waters, even though such tidal waters be well within foreign territory (*R.* v. *Anderson*, 1868, L.R. 1 C.C.R. 161), but not over crimes committed on board foreign vessels upon the high seas (*R.* v. *Serva*, 1845, 1 Denison C.C. 104). Whether it extended over crimes committed on foreign ships within territorial waters of the United Kingdom, and whether a zone of three miles round the shores of the United Kingdom was for such purpose territorial water, were the great questions raised in *R.* v. *Keyn* (the "*Franconia*," L.R. 2 Ex. Div. 126), and decided in the negative by the majority of the judges, rightly, as the writer of this article respectfully thinks. Since then, however, the legislature has brought these waters within the jurisdiction of the admiralty by the Territorial Waters Jurisdiction Act 1878. Section 2 runs as follows: "An offence committed by a person, whether he is or is not a British subject, on the open sea within the territorial waters of British dominions, is an offence within the jurisdiction of the admiral, although it may have been committed on board or by means of a foreign ship, and the person who committed such offence may be arrested, tried and punished accordingly." By § 7 the "jurisdiction of the admiral" is defined as "including the jurisdiction of the admiralty of England or Ireland, or either of such jurisdictions as used in any act of parliament; and for the purpose of arresting any person charged with an offence declared by this act to be within the jurisdiction of the admiral, the territorial waters adjacent to the United Kingdom, or any other part of her majesty's dominions, shall be deemed to be within the jurisdiction of any judge, magistrate or officer." And "territorial waters of her majesty's dominions" are defined as "in reference to the sea, meaning such part of the sea adjacent to the coast of the United Kingdom, or the coast of some other part of her majesty's dominions, as is deemed by international law to be within the territorial sovereignty of her majesty; and for the purpose of any offence declared by this act to be within the jurisdiction of the admiral, any part of the open sea within one marine league of the coast, measured from low-water mark, shall be deemed to be open sea within the territorial waters of her majesty's dominions." As to those portions of the sea and tidal waters which, by reason of their partially land-locked positions, are deemed to be in the body of a county, there is not admiralty jurisdiction, but crimes are tried as if they were committed on land within the same county.

Pirates, whatever flag they pretended to fly, were, from 1360 onwards, wherever their crimes were committed, subject to the admiralty jurisdiction. The criminal jurisdiction of the admiralty was first exercised by the High Court of Admiralty; and then, by virtue of the Offences at Sea Act 1536, transferred to commissioners appointed under the great seal, among whom were to be the admiral or admirals, his or their deputies. Admiralty sessions were held for this purpose till 1834. Admiralty criminal jurisdiction is now, by virtue of the series of statutes, the Offences at Sea Act 1799, the Central Criminal Court Act 1834, Offences at Sea Act 1844, and the criminal law consolidation acts passed in 1861, exercised by the Central Criminal Court and by the ordinary courts of assize. Special provision for trial in the colonies of offences committed at sea has been made by an act of William III. (1698–1699), the Offences at Sea Act 1806, and the Admiralty Offences (Colonial) Act 1849.

Prize.

The Admiralty Court had jurisdiction in matters of prize from very early times; and although since the middle of the 17th century the *instance*, or ordinary civil jurisdiction of the court, has been kept distinct from the *prize* jurisdiction, they were originally both administered and regarded as being within the ordinary jurisdiction of the lord high admiral. The early records of the admiralty show that the origin of the prize jurisdiction is to be traced to the power given to the court of the admiral to try cases of piracy and "spoil," *i.e.* captures of foreign ships by English ships. The earliest recorded case of spoil tried before the admiral is in 1357, when the goods of a Portuguese subject, taken at sea by Englishmen from a French ship which had previously spoiled a Portuguese, were awarded by the admiral as good prize to the English captors; and Edward III. in a letter to the king of Portugal answering a complaint on the subject gives the admiral's decision as a reason for refusing their restoration. During the 16th century a very large part of the business of the Admiralty Court related to spoil and piracy, and the privy council often directed the judge of the court how to deal with the spoil cases, with regard to which foreigners who had suffered from attacks by English ships made petition for redress to the admiral or the council. The spoil suit at this time (*causa spolii*) was a civil proceeding resulting in a decree *absolutoria*, dismissing the defendant, or *condemnatoria*, ordering restoration to be made by him. In 1585 the patent of Howard, the lord high admiral, authorized him to issue letters of reprisal against Spain; and an order in council regulating the conduct of those to whom such letters were issued provided by an additional article (1859) that all prizes were to be brought in without breaking of bulk for adjudication by the Admiralty Court. The court was also resorted to at this time by captors, sailing under commissions granted by the allies of England, such as the king of France and the Dutch. About the middle of the 17th century separate sittings of the court for instance and prize business began, perhaps because of the conflicting claims to *droits* of Charles II. and the duke of York as lord high admiral; and privateering under royal commission took the place of the former irregular "spoiling." The account which Lord Mansfield gave of the records of the Admiralty Court, that there were no prize act books earlier than 1641, or prize sentences earlier than 1648, and that before 1690 the records were in confusion, must be qualified by the correction that there are in existence prize sentences (on paper, not parchment) as early as 1589.

Although the courts of common law hardly ever seem to have interfered with or disputed the admiralty prize jurisdiction, its exclusive nature was not finally admitted till 1782; but long previously royal ordinances (1512, 1602) and statutes (1661, giving an alternative of commissioners, 1670, 1706) had given the Admiralty Court the only express jurisdiction over prize. The same statute of Anne and acts of 1739 and 1744 give prize jurisdiction to any court of admiralty, and the courts of admiralty for the colonies and plantations in North America.

It has been a disputed question whether the prize jurisdiction of the court was inherent, *i.e.* coming within the powers given by the general patent of the judge, in which no express mention of it is made, or whether it required a special commission. Upon this subject the judgment of Lord Mansfield in *Lindo* v. *Rodney* (1782, Dougl. 612), the judgment of Mr Justice Story in *De Lovio* v. *Boit* (1815, 2 Gallison, 398), and Marsden's *Select Pleas of the Court of Admiralty* (introduction), may be consulted. But the settled practice now and for a long time past has been for a special commission and warrant to be issued for this purpose. In connexion with this it is observable that in 1793 the Admiralty Court of Ireland claimed to exercise prize jurisdiction under its general patent; and it is said to have been the opinion of Sir W. Wynne that the Admiralty Court of Scotland had a similar right (Brown, *Civil Law of Admiralty*, vol. ii. 211, 212). Any jurisdiction of the Scottish court over prize of war was transferred to the English court by the Court of Session Act 1825, § 57. As to the Irish court, by the Act of Union it was provided that there should remain in Ireland an instance court of admiralty for the determination of causes civil and maritime only.

In 1864 the constitution and procedure of prize courts, which had until then been prescribed by occasional acts passed for each war as it arose, were for the first time made permanent by the Naval Prize Act, by which the High Court of Admiralty and every admiralty or vice-admiralty court, or any other court exercising admiralty jurisdiction in British dominions, if for the time being authorized to exercise prize jurisdiction, were made prize courts. The High Court of Admiralty was given jurisdiction throughout British dominions as a prize court, and, as such, power to enforce any order of a vice-admiralty prize court and the judicial committee of the privy council in prize appeals—this power *mutatis mutandis* being also given to vice-admiralty prize courts. An appeal was given from any prize court to the sovereign in council. Prize courts were given jurisdiction in cases of captures made in a land expedition or an expedition made conjointly with allied forces, and power to give prize salvage on recaptured ships and prize bounty; and a form of procedure was prescribed. The High Court was also given exclusive jurisdiction as a prize court over questions of ransom and petitions of right in prize cases, and power to punish masters of ships under convoy disobeying orders or deserting convoy. By the Naval Discipline Act 1866, power to award damages to convoyed ships exposed to danger by the fault of the officer in charge of the convoy was also given to the High Court. Under other statutes it had power to try questions of booty of war when referred to it by the crown, in the same way as prize causes, and claims of king's ships for salvage on recaptures from pirates, which could be condemned as *droits* of admiralty, subject to the owner's right to receive them on paying one-eighth of the value, and also power to seize and restore prizes captured by belligerents in violation of British neutrality, or by a ship equipped in British ports contrary to British obligations of neutrality.

All jurisdiction of the High Court of Admiralty has since passed to the High Court of Justice, which is made a prize court under the Naval Prize Act, with all the powers of the Admiralty Court in that respect; and all prize causes and matters within the jurisdiction of that court as a prize court are assigned to the Probate, Divorce and Admiralty Division; and an appeal from it as a prize court lies only to the king in council (Judicature Acts 1873 and 1891).

By an act of 1894 further provision is made for the constitution of prize courts in British possessions. A commission, warrant or instruction from the crown or the admiralty may be issued at any time, even in peace; and upon such issue, subject to instructions from the crown, the vice-admiral of the possessions on being satisfied by information from a secretary of state that war has broken out between Great Britain and a foreign state, may make proclamation to that effect, and the commission or warrant comes into effect. The commission or warrant may authorize a vice-admiralty court or colonial court of admiralty to act as a prize court, or establish a vice-admiralty court for that purpose, and may be revoked or altered at any time. The court is authorized to act as a prize court during the war, and shall after its conclusion continue to act as such, and finally dispose of all matters and things arising during the war, including all penalties and forfeitures incurred therein. Rules of court may also be made by order in council for regulating, subject to the Naval Prize Act, the procedure and practice of prize courts under that act, the duties and conduct of their officers and practitioners, and the fees and costs therein (Prize Courts Act 1894, §§2, 3). This latter power has been exercised; and prize rules for the High Court of Justice and the vice-admiralty prize courts were framed in 1898 (Statutory Rules and Orders, 1898).

Authorities.—Marsden, *Select Pleas of the Court of Admiralty*, Selden Society, London, 1892 and 1897; Zouch, *Jurisdiction of the Admiralty of England asserted*; Robinson, *Collectanea Maritima*; Brown, *Admiralty*; Edwardes, *Admiralty*; Phillimore, *International Law*, vol. i., vol. iii. part xi.; Pritchard, *Admiralty Digest*, tit. Jurisdiction. (W. G. F. P.)

United States

The source of admiralty jurisdiction in the United States is Article 3, § 2 of the United States Constitution:—"The judicial power shall extend to all cases of admiralty and maritime jurisdiction." The United States Supreme Court has declared that by virtue of these words the admiralty jurisdiction extends not only to the high seas but to the great lakes and the rivers connecting them, and to all public navigable waters in the United States (the "*Genesee Chief*" v. *Fitz-Hugh*, 12 Howards U.S. Rep. 443), including even interstate canals (*Ex. p. Boyer*, 109 U.S. Rep. 629, the "*Robert W. Parsons*," [1903] 191 U.S. 17), and is not confined to tide waters. The American colonies had vice-admiralty courts with an admiralty jurisdiction equal to the largest claimed by the English admiralty courts even under Edward III. When they became states they delegated to the federal government their several "admiralty and maritime jurisdiction," using these words in the sense understood in every country in Europe, England excepted, and in the sense in which they had then been used in the colonies for a long time, and without reference to the very narrow jurisdiction of the English admiralty courts then existing (*Waring* v. *Clark*, 5 Howards U.S. Rep. 441).

It is settled as to the United States admiralty jurisdiction not that it is "co-equal with that of the original English, or that of continental European admiralty, but is rather that defined by the statutes of Richard II., under the construction given to them by contemporary or immediately subsequent courts of admiralty" (2 Parsons *Adm.* 176), and that it embraced all maritime contracts, torts, injuries or offences (*De Lovio* v. *Boit*, 2 Gallisons Rep. 398; *Waring* v. *Clark*, 5 Howards U.S. Rep. 441), and that it has never been restricted by the action of the common law courts as in England under Lord Coke (2 Parsons *Adm.* 166 n.; *Waring* v. *Clark*; *De Lovio* v. *Boit*).

Original admiralty jurisdiction was by the Judiciary Act of 1789 (U.S. Rev. Stats. § 563) granted to the United States district courts exclusively, except that concurrent original jurisdiction was given to United States circuit courts over seizures for slave trading, and condemnations of property used by persons in insurrection (§ 629; § 5309), and in the coolie trade (§ 2159), and by the act of the 3rd of March 1901; the supreme court of the District of Columbia is given the same jurisdiction as the district and circuit courts. The Supreme Court of the United States has no original jurisdiction in admiralty. All suits are brought in the first instance in the district court. Appeals lie, both on the law and on the facts, from a final decree of that court to the circuit court of appeals only, except in cases involving the jurisdiction of the court, the constitutionality of a law of any state or of the United States, or the validity or construction of any treaty of the United States, and except cases of prize and capital or infamous crime, in which cases of appeal lies directly to the supreme court. In cases of gravity and importance the Supreme Court may by certiorari review the judgment of the circuit court of appeals, but such cases are rare (re *Lau Ow Bew*, 141 U.S. Rep. 587; Benedict's *The American Admiralty*, § 607). Formerly the Judiciary Act authorized an appeal from the district court to the circuit court, and thence to the Supreme Court. But the act of the 3rd of March 1891 (Ch. 517) abolished this and created the circuit court of appeals, making it the final appellate court in admiralty, except as above stated. In any case where the district judge is unable to perform his duties or is disqualified by reason of interest or of relationship, or has acted as counsel for one of the parties to the action, it may be removed to the circuit court in that district (U.S. Rev. Stats. §§ 587, 589 and 601). These are now the only cases in which admiralty suits can come before the circuit court (Benedict's *Adm.* § 321).

The subject matter in cases of contract determines the jurisdiction (the "*General Smith*," 4 Wheaton U.S. Rep. 438), and not the presence or absence of tide, salt water, current, nor that the water be an inland basin or land-locked, or a river, nor by its being a harbour, or a port within the body of the county, nor that a remedy exists at common law. The admiralty courts have jurisdiction over all matters that concern owners and proprietors of ships as such; possessory actions and petitory actions to try title of a ship; cases of mariners' wages, wharfage, dockage, lighterage, stevedores, contracts of affreightment, charter parties, rights of passengers as such (the "*Moses Taylor*," 71 U.S. Rep. 411), pilotage, towage, maritime liens and loans, bottomry, respondentia and hypothecation of ship and cargo, marine insurance, average, jettison, demurrage, collisions, consortship, bounties, survey and sale of vessel, salvage, seizures under the laws of impost navigation or trade, cases of prize, ransom, condemnation, restitution and damages; assaults, batteries, damages and trespasses on the high seas and navigable waters of the United States; but not suits *in rem* for duties (Benedict's *Adm.* § 303a).

The U.S. Supreme Court has held in *Peoples Ferry Co.* v. *Beers*, 20 Howards U.S. Rep. 393, and in a series of subsequent cases that a contract to build a vessel is not a maritime contract (the "*Robert W. Parsons*"). Contracts to furnish cargo for ships and to furnish ships to carry the cargoes are maritime contracts (*Graham* v. *Oregon R. & N. Co.*, [1905] 135 Fed. Rep. 608).

Whenever there is a maritime lien, even though created by state statute as to a ship in her home port, it may be enforced by suit *in rem* in admiralty in the federal courts (the "*General Smith*"; the "*Lottawanna*," 21 Wallace Rep. 558, Benedict's *Adm.* § 270). In all suits by material men for supplies and repairs or other necessaries for a foreign ship, the libellant may proceed against the ship and freight *in rem* or against the master or owner *in personam* (12th Admiralty Rule; Benedict's *Adm.* § 268; the "*General Smith*"). Actions *in rem* and *in personam* may be joined in the same libel (*Newell* v. *Norton*, 3 Wallace 257; the "*Normandie*," 40 Fed. Rep. 590). But a contract to furnish fishermen with clothing, tobacco and other personal effects for use on a voyage is not a maritime contract, and a court of admiralty has no jurisdiction to enforce it *in rem* (the "*May F. Chisholm*," 1904; 129 Fed. Rep. 814). The state courts have no jurisdiction *in rem* over any maritime contract or tort (the "*Lottawanna*," the "*Belfast*," 7 Wallace Rep. 624). Admiralty jurisdiction in tort depends on locality; it must have occurred on the high seas or other navigable waters within admiralty cognizance (2 Parsons *Adm.* 347; the "*Plymouth*," 3 Wallace Rep. 20; the "*Genesee Chief*" v. *Fitz-Hugh*, the "*Blackheath*," [1903] 122 Fed. Rep. 112).

The U.S. Supreme Court in the "*Harrisburg*" (119 U.S. 199) and the "*Alaska*" (130 U.S. 207), after some conflict of opinion, held that the admiralty courts have no jurisdiction under the general admiralty law to try an action for damages for negligence on the high seas, causing death of a human being, while there was no act of Congress and no statute of the state to which the vessel belonged giving such right of action (Benedict's *Adm.* §§ 275-309a), nor where such statute is that of a foreign country (*Rundell* v. *Compagnie Générale*, [1899] 94 Fed. Rep. 366).

Admiralty has jurisdiction in cases of spoliation and piracy, collision and proceedings by owners to limit their liability under U.S. Rev. Stats. §§ 4281-9.

The United States admiralty courts have always had jurisdiction in matters of prize (*The Prize Cases*, 2 Black U.S. Rep. 635). The district courts have exclusive original jurisdiction (except that circuit courts also have jurisdiction when prize is taken from persons in insurrection), and the supreme court of the District of Columbia now has concurrent jurisdiction (*U.S.* v. *Sampson*, 1902, 187 U.S. 436) and appeals are direct to the Supreme Court. Special commissioners are appointed on the breaking out of hostilities to act under the orders of the district courts (U.S. Rev. Stats. § 4621, Prize Rule 9; Benedict's *Adm.* §509; 680 *Pieces Merchandise*, 2 Sprague 233). These commissioners take the depositions of witnesses and report to the court the evidence upon which it adjudicates. Proceedings in prize cases must be in conformity with admiralty proceedings, where the seizure is on land (*Union Insurance Co.* v. *U.S.*, 6 Wallace 759; 2 Parsons *Adm.* 174). The district courts have all the powers of a court of admiralty whether as instance or prize courts (*Glass* v. *sloop* "*Betsy*," 3 Dallas 6). To adjudicate in matters of prize is one of the ordinary functions of that court (Benedict's *Adm.* § 509).

The admiralty courts have jurisdiction over crimes and offences committed upon vessels belonging to citizens of the United States on the high seas or any arm of the sea or any waters within the admiralty and maritime jurisdiction of the United States (U.S. Rev. Stats. § 5339). High seas include the great lakes (*U.S.* v. *Rogers*, 150 U.S. 249). (J. A. Ba.)

Other Countries

France, and countries following France.

In France, and in Belgium, Spain, Portugal, Italy and Greece—countries which have adopted codes based on the Code Napoléon—the civil, or, as it would have been formerly called in England, the "instance," jurisdiction of the admiralty is exercised by the ordinary tribunals, and there are no separate courts of admiralty for this purpose. France and some other countries have special commercial tribunals, which deal with shipping matters, but also with ordinary commercial cases. France has also *tribunaux maritimes commerciaux* (*Code disciplinaire et pénal de la marine marchande du 24 mars 1852, loi du 11 mars 1891*) to deal with maritime offences. Austria adopts the French law in commercial matters. Italy had tribunals of commerce, but has given them up. She has, however, by Art. 14 of her Merchant Shipping Code, given jurisdiction to captains of ports to decide collision cases when the sum in dispute does not exceed 200 lire.

Germany.

In Germany there are no special tribunals for admiralty matters. *Kammern für Handelssachen*, commercial courts, have been established in Berlin and some of the principal seaports. These deal with shipping matters, but also with all other commercial suits.

Scandinavian nations.

In Denmark, Sweden and Norway there is a maritime code which came into force in Sweden in 1891, in Denmark in 1892, and in Norway in 1893. This was intended to be one code for the three countries; but each country as it finally adopted the code made some modifications of its own. Under this code there are in Norway permanent maritime courts for each town presided over by the judge of the inferior local civil court (*civile underdömmer*), or if there be more than one such judge then by the president, with two assessors chosen out of a list. Temporary local courts, consisting of the same judge with two other members of nautical skill and knowledge, can be constituted in districts where there are no permanent courts. Appeals lie to the supreme court (*Höiesteret*). In Denmark maritime cases are brought before the local courts constituted for maritime and commercial causes (*Sö-og-Handelsret*). In Sweden maritime cases are brought before local courts of first instance consisting of a judge and assessors. There is an intermediate appeal to courts of second instance, and then to the supreme court, which finally decides upon all causes civil and commercial.

Maritime cases in Holland are tried by the ordinary civil tribunals, with the same right of appeal.

Prize jurisdiction.

"By the maritime law of nations universally and immemorially received there is an established method of determination whether the capture be or be not lawful prize. Before the ship or goods can be disposed of by the captor there must be a regular judicial proceeding wherein both parties may be heard and condemnation thereupon as prize in a court of admiralty judging by the law of nations and treaties. . . . If the sentence of the court of admiralty is thought to be erroneous, there is in every maritime country a superior court of review. . . ." (duke of Newcastle's letter to M. Michell, secretary to the embassy of the king of Prussia, 1753). "So far as belligerent states do not make a practice of giving up the taking of booty at sea . . . they are required by international law to establish prize tribunals and thus give to their proceedings in the matter of prize a judicial character" (v. Holtzendorff, *Rechtslexikon*, tit. "Prisengerichte").

In France till the death of the duke of Montmorency in 1632 prize matters were adjudicated upon by the admiral. The duke had sold the office of admiral some years before his death to Cardinal Richelieu; but about the period of the duke's death the office of admiral appears to have been abolished, and one of grand master of navigation established in lieu. This new office was first held by Cardinal Richelieu and continued till 1695. The grand master took the admiral's place in matters of prize; but in 1659 a commission of councillors of state and masters of requests was appointed to assist the grand master and form a *Conseil des Prises*. From this conseil there was an appeal to the *Conseil d'État*. When the office of admiral was restored in 1695 he exercised his jurisdiction in prize matters with the assistance of the *Conseil des Prises*. The appeal was then given to the *Conseil Royal des Finances*. The *Ordonnance sur la marine* of August 1681 regulated the procedure. This system continued till the Revolution. The last *Conseil des Prises* was appointed in 1778. A law of the 14th of February 1793 abolished the *Conseil des Prises* and gave cognizance of prize matters "provisionally" to the tribunals of commerce. On the 8th of November 1793 (18 Brumaire, an II.) this jurisdiction was taken from the tribunals of commerce and given to the *Conseil Exécutif*. Later it was given to the *Comité de Salut Public*. On the 25th of October 1795 (3 Brumaire, an IV.) the jurisdiction was restored to the tribunals of commerce. This was again altered on the 27th of March 1800 (6 Germinal, an VIII.), when a *Conseil des Prises* was established, consisting of nine councillors of state, a commissary of the government and a secretary, all nominated by the First Consul.

On the 11th of June 1806 an appeal was given to the *Conseil d'État*. It was disputed among French jurists whether the *Conseil des Prises* was to be considered as a body actuated only by political considerations or one exercising what the French term an "administrative jurisdiction"; which is, as nearly as a parallel to it can be found in England, administration of justice between individuals and the state.

As most of the cases arising out of the great wars had been dealt with, an ordinance of the 9th of January 1815 suppressed the *Conseil des Prises* and directed the *Comité du contentieux* of the *Conseil d'État* to prepare the remaining prize matters for decision by the *Conseil d'État*. Such prize matters (probably including captures for trading in slaves) as required to be dealt with till 1854, appear to have been dealt with by this body; an ordinance of the 9th of September 1831 directing that the proceedings before the *Conseil d'État* should be private, was held to show that the jurisdiction was not political but administrative.

An Imperial decree, however, of the 18th of July 1854 restored the *Conseil des Prises*, with appeal to the *Conseil d'État*. This was for the war with Russia. A similar decree was published on the 9th of May 1859 for the war with Austria in Italy.

On the 28th of November 1861 a further decree ordered that the *Conseil* instituted in 1859 should so long as it was kept in being decide all prize matters; and this *Conseil* has decided on prizes taken in the wars with Mexico and Germany and in Cochin

China. It consists of seven judges and a commissary of the government. An appeal to the government in the *Conseil d'État* can be brought within three months. It is then decided by *l'Assemblée du Conseil d'État*.

Under the First Empire there were *commissions des ports, commissions colonials* and *commissions consulaires*, established mainly to collect materials for the *Conseil des Prises*, but sometimes, when the ship and cargo were clearly those of the enemy, proceeding to actual condemnation.

In Prussia Regulations of the 20th of June 1864 established a prize council consisting of a president and six associates with a law officer. An appeal was given to an upper prize council (v. Holtzendorff, *Rechtslexikon*, tit. "Prisengerichte").

By a law of the German empire of the 3rd of May 1884 the legality of prizes made during war has to be decided by prize courts, and the imperial government is authorized to determine the particulars as to the seat of such courts, their members and their proceedings (*Reichsgesetzblatt* of 1884, p. 49). Prize courts were established under this law on the occasion of the East African blockade in 1889 (*Reichsgesetzblatt* of 1889, pp. 5 sqq.).

In Italy Art. 14 of the Merchant Shipping Code provides that prize matters shall be tried by a special commission established by royal decree. On the occasion of the war with Austria such a special commission was established by royal decree of the 20th of June 1866. For the war with Abyssinia a fresh commission was established by royal decree of the 16th of August 1896. The composition of this commission, which was slightly different in character from that established in 1866, was as follows: (*a*) a first president of a court of appeal or a retired one, or a president of a section of the council of state or of cassation; (*b*) two general officers of the navy; (*c*) a member of the "contentious part" of the diplomatic service; (*d*) two councillors of a court of appeal; (*e*) a captain of a port, with a commissary of the government and a secretary; five to be a quorum. There was no appeal; but the ordinary right to have recourse to the Court of Cassation at Rome, if the prize commission proceeded without jurisdiction or in excess of jurisdiction, was preserved.

By an ordinance of the 27th of March 1895 regulating the whole matter of prize in Russia, two sorts of prize tribunals of first instance were contemplated—port tribunals and fleet tribunals. The latter are for captures made by ships of the fleet, and are to be composed of some of the principal officers of the fleet. The former are to have presidents named by the emperor from among those "*qui font partie de l'administration maritime judiciaire*"; the other members are to be appointed by the ministers of the navy, justice and foreign affairs. The court of appeal is formed by the council of the admiralty with the addition of two members of the senate and a nominee of the minister of foreign affairs (Clunet, 1904, p. 271).

On the occasion of the Russo-Japanese war, port tribunals were established under the authority of this ordinance by the lord high admiral, the Grand Duke Alexis, on the 13th of March 1904, at Sebastopol—Port Alexander III., Port Arthur and Vladivostock (Clunet, 1904, p. 479; *London Gazette*, 22nd March 1904). Many cases were heard before these tribunals and on appeal.

The procedure in prize cases under the old law of Spain is described in Abreu (Felix Joseph de Abreu y Bertodano), *Tratado juridico Politico sobre Presas de Mar* (Cadiz, 1746). On the occasion of the war with the United States the Spanish government published a proclamation stating the circumstances in which captures were to be made and prizes taken; but information is lacking as to the particular constitution of the prize court or courts.

In Greece prize questions are apparently left to be tried by the ordinary tribunals. See decision of Civil Tribunal of Athens, 1898, No. 3385 (reported Clunet, 1900, p. 826).

Turkey during her war of 1877 with Russia established a prize court and a court of appeal. The ordinance establishing these courts is set out in the *London Gazette* of the 6th of July 1877.

Japan established, in the war (1904–5) with Russia, prize courts at Sasébo and Yokosco with a court of appeal at Tokyo. Advocates were heard before these courts, and the procedure seems generally to have been modelled upon European patterns.

AUTHORITIES.—Clunet, *Journal du droit international privé*, cited shortly as Clunet; v. Holzendorff, *Rechtslexikon*, Leipzig, 1881; De Pistoye et Duverdy, *Traité des prises maritimes*, Paris, 1855, vol. ii., tit. viii.; Phillimore, *International Law*, vol. i., vol. iii. part xi.; Autran, *Code international de l'abordage, de l'assistance, et du sauvetage maritimes*, Paris, 1902; Raikes, *The Maritime Codes of Spain and Portugal* (1896), *of Holland and Belgium* (1898), *of Italy* (1900), London. (W. G. F. P.)

ADMISSION, in law, a statement made out of the witness-box by a party to legal proceedings, whether civil or criminal, or by some person whose statements are binding on that party against the interest of that party. (See EVIDENCE.)

ADO (d. 874), archbishop of Vienne in Lotharingia, belonged to a famous Frankish house, and spent much of his middle life in Italy. He held his archiepiscopal see from 859 till his death on the 16th of December 874. Several of his letters are extant and reveal their writer as an energetic man of wide sympathies and considerable influence. Ado's principal works are a *Martyrologium* (printed *inter al.* in Migne, *Patrolog. lat.* cxxiii. pp. 181–420; append. pp. 419–436), and chronicle, *Chronicon sive Breviarium chronicorum de sex mundi aetatibus de Adamo usque ad ann.* 869 (in Migne, cxxiii. pp. 20–138, and Pertz, *Monumenta Germ.* ii. pp. 315–323, &c.). Ado's chronicle is based on that of Bede, with which he combines extracts from the ordinary sources, forming the whole into a consecutive narrative founded on the conception of the unity of the Roman empire, which he traces in the succession of the emperors, Charlemagne and his heirs following immediately after Constantine and Irene. "It is," says Wattenbach, "history from the point of view of authority and preconceived opinion, which exclude any independent judgment of events." Ado wrote also a book on the miracles (*Miracula*) of St Bernard, archbishop of Vienne (9th century), published in the Bollandist *Acta Sanctorum*; a life or *Martyrium* of St Desiderius, bishop of Vienne (d. 608), written about 870 and published in Migne, cxxiii. pp. 435–442; and a life of St Theudericus, abbot of Vienne (563), published in Mabillon, *Acta Sanct.* i. pp. 678–681, Migne, cxxiii. pp. 443–450, and revised in Bollandist *Acta Sanct.* 29th Oct. xii. pp. 840–843.

See W. Wattenbach, *Deutschlands Geschichtsquellen*, vol. i. (Stuttgart and Berlin, 1904).

ADOBE (pronounced *a-dō-be*; also corrupted to *dobie*; from the Span. *adobar*, to plaster, traceable through Arabic to an Egyptian hieroglyph meaning "brick"), a Spanish-American word for the sun-dried clay used by the Indians for building in some of the south-western states of the American Union, this method having been imported in the 16th century by Spaniards from Mexico, Peru, &c. A distinction is made between the smaller "adobes," which are about the size of ordinary baked bricks, and the larger "adobines," some of which are as much as from one to two yards long.

ADOLESCENCE (Lat. *adolescentia*, from *adolescere*, to grow up, past part. *adultus*, grown up, Eng. "adult"), the term now commonly adopted for the period between childhood and maturity, during which the characteristics—mental, physical and moral—that are to make or mar the individual disclose themselves, and then mature, in some cases by leaps and bounds, in others by more gradual evolution. The annual rate of growth, in height, weight and strength, increases to a marked extent and may even be doubled. The development in the man takes place in the direction of a greater strength, in the woman towards a fitter form for maternity. The sex sense develops, the love of nature and religion, and an overmastering curiosity both individual and general. This period of life, so fraught with its power for good and ill, is accordingly the most important and by far the most difficult for parents and educationists to deal with efficiently. The chief points for attention may be briefly indicated. Health depends mainly on two factors, heredity, or the sum total of physical and mental leanings of the individual, and environment. In an ideal system of training these two factors will be so fitted in and adapted to one another, that what is weak or unprovided for in the first will be amply compensated for in the second.

In an ideal condition children should be brought up in the country as much as possible rather than in the town. Though adults may live where they like within very wide limits and take no harm, children, even of healthy stock, living in towns, are continually subject to many minor ills, such as chronic catarrh, tonsilitis, bronchitis, and even the far graver pneumonia. Removed to healthier conditions in the country their ailments tend to disappear, and normal physical development supervenes. The residence should be on a well-drained soil, preferably near the sea in the case of a delicate child, on higher ground for those of more robust constitution. The child should be lightly clad in woollen garments all the year round, their thickness being slightly greater in winter than in summer. An abundance of simple well-cooked food in sufficient variety, ample time at table, where an atmosphere of light gaiety should be cultivated, and a period free from restraint both before and after meals, should be considered fundamental essentials. As regards the most suitable kinds of food—milk and fruit should be given in abundance, fresh meat once a day, and fish or eggs once a day. Bread had better be three days old, and baked in the form of small rolls to increase the ratio of crust to crumb. Both butter and sugar are good foods, and should be freely allowed in many forms.

The exercise of the body must be duly attended to. Nowadays this is provided for in the shape of games, some being optional, others prescribed, and such sports as boating, swimming, fencing, &c. But severe exercise should only be allowed under adequate medical control, and should be increased very gradually. In the case of girls, let them run, leap and climb with their brothers for the first twelve years or so of life. But as puberty approaches, with all the change, stress and strain dependent thereon, their lives should be appropriately modified. Rest should be enforced during the menstrual periods of these earlier years, and milder, more graduated exercise taken at other times. In the same way all mental strain should be diminished. Instead of pressure being put on a girl's intellectual education at about this time, as is too often the case, the time devoted to school and books should be diminished. Education should be on broader, more fundamental lines, and much time should be passed in the open air. With regard to the mental training of both sexes two points must be borne in mind. First, that an ample number of hours should be set on one side for sleep, up to ten years of age not less than eleven, and up to twenty years not less than nine. Secondly, that the time devoted to "bookwork" should be broken up into a number of short periods, very carefully graduated to the individual child.

In every case where there is a family tendency towards any certain disease or weakness, that tendency must determine the whole circumstances of the child's life. That diathesis which is most serious and usually least regarded, the nervous excitable one, is by far the most important and the most difficult to deal with. Every effort should be made to avoid the conditions in which the hereditary predisposition would be aroused into mischievous action, and to encourage development on simple unexciting lines. The child should be confined to the schoolroom but little and receive most of his training in wood and field. Other diatheses—the tuberculous, rheumatic, &c.—must be dealt with in appropriate ways.

The adolescent is prone to special weaknesses and moral perversions. The emotions are extremely unstable, and any stress put on them may lead to undesirable results. Warm climates, tight-fitting clothes, corsets, rich foods, soft mattresses, or indulgences of any kind, and also mental over-stimulation, are especially to be guarded against. The day should be filled with interests of an objective—in contradistinction to subjective—kind, and the child should retire to bed at night healthily fatigued in mind and body. Let there be confidence between mother and daughter, father and son, and, as the years bring the bodily changes, those in whom the children trust can choose the fitting moments for explaining their meaning and effect, and warning against abuses of the natural functions.

For bibliography see CHILD.

ADOLPH OF NASSAU (*c.* 1255–1298), German king, son of Walram, count of Nassau. He appears to have received a good education, and inherited his father's lands around Wiesbaden in 1276. He won considerable fame as a mercenary in many of the feuds of the time, and on the 5th of May 1292 was chosen German king, in succession to Rudolph I., an election due rather to the political conditions of the time than to his personal qualities. He made large promises to his supporters, and was crowned on the 1st of July at Aix-la-Chapelle. Princes and towns did homage to him, but his position was unstable, and the allegiance of many of the princes, among them Albert I., duke of Austria, son of the late king Rudolph, was merely nominal. Seeking at once to strengthen the royal position, he claimed Meissen as a vacant fief of the Empire, and in 1294 allied himself with Edward I., king of England, against France. Edward granted him a subsidy, but owing to a variety of reasons Adolph did not take the field against France, but turned his arms against Thuringia, which he had purchased from the landgrave Albert II. This bargain was resisted by the sons of Albert, and from 1294 to 1296 Adolph was campaigning in Meissen and Thuringia. Meissen was conquered, but he was not equally successful in Thuringia, and his relations with Albert of Austria were becoming more strained. He had been unable to fulfil the promises made at his election, and the princes began to look with suspicion upon his designs. Wenceslaus II., king of Bohemia, fell away from his allegiance, and his deposition was decided on, and was carried out at Mainz, on the 23rd of May 1298, when Albert of Austria was elected his successor. The forces of the rival kings met at Göllheim on the 2nd of July 1298, where Adolph was killed, it is said by the hand of Albert. He was buried at Rosenthal, and in 1309 his remains were removed to Spires.

See F. W. E. Roth, *Geschichte des Römischen Königs Adolf I. von Nassau* (Wiesbaden, 1879); V. Domeier, *Die Absetzung Adolfs von Nassau* (Berlin, 1889); L. Ennen, *Die Wahl des Königs Adolf von Nassau* (Cologne, 1866); L. Schmid, *Die Wahl des Grafen Adolf von Nassau zum Römischen König*; B. Gebhardt, *Handbuch der deutschen Geschichte*, Band i. (Berlin, 1901).

ADOLPHUS, JOHN LEYCESTER (1795–1862), English lawyer and author, was the son of John Adolphus (1768–1845), a well-known London barrister who wrote a *History of England to 1783* (1802), a *History of France from 1790* (1803) and other works. He was educated at Merchant Taylors' School and at St. John's College, Oxford. In 1821 he published *Letters to Richard Heber, Esq.*, in which he discussed the authorship of the then anonymous Waverley novels, and fixed it upon Sir Walter Scott. This conclusion was based on the resemblance of the novels in general style and method to the poems acknowledged by Scott. Scott thought at first that the letters were written by Reginald Heber, afterwards bishop of Calcutta, and the discovery of J. L. Adolphus's identity led to a warm friendship. Adolphus was called to the bar in 1822, and his *Circuiteers, an Eclogue*, is a parody of the style of two of his colleagues on the northern circuit. He became judge of the Marylebone County Court in 1852, and was a bencher of the Inner Temple. He was the author of *Letters from Spain in 1856 and 1857* (1858), and was completing his father's *History of England* at the time of his death on the 24th of December 1862.

ADOLPHUS FREDERICK (1710–1771), king of Sweden, was born at Gottorp on the 14th of May 1710. His father was Christian Augustus (1673–1726), duke of Schleswig-Holstein-Gottorp, bishop of Lübeck, and administrator, during the war of 1700–1721, of the duchies of Holstein-Gottorp for his nephew Charles Frederick; his mother was Albertina Frederica of Baden-Durlach. From 1727 to 1750 he was bishop of Lübeck, and administrator of Holstein-Kiel during the minority of Duke Charles Peter Ulrich, afterwards Peter III. of Russia. In 1743 he was elected heir to the throne of Sweden by the "Hat" faction in order that they might obtain better conditions of peace from the empress Elizabeth, whose fondness for the house of Holstein was notorious (see SWEDEN, *History*). During his whole reign (1751–1771) Adolphus Frederick was little more than a state decoration, the real power being lodged in the hands of an omnipotent *riksdag*, distracted by fierce party strife. Twice he endeavoured to free himself from the intolerable tutelage of the estates. The first occasion was in 1755 when, stimulated by his imperious consort Louisa Ulrica, sister of Frederick the Great, he tried to regain a portion of the attenuated prerogative, and nearly lost his throne in consequence. On the second occasion, under the guidance of his eldest son, the crown prince Gustavus, afterwards Gustavus III., he succeeded in overthrowing the tyrannous "Cap" senate, but was unable to make any use of his victory. He died of surfeit at Stockholm on the 12th of February 1771.

See R. Nisbet Bain, *Gustavus III. and his Contemporaries*, vol. i. (London, 1895). (R. N. B.)

ADONI, a town of British India, in the Bellary district of Madras, 307 m. from Madras by rail. It has manufactures of carpets, silk and cotton goods, and several factories for ginning and pressing cotton. The hill-fort above, now in ruins, was an important seat of government in Mahommedan times and is frequently mentioned in the wars of the 18th century. Pop. (1901) 30,416.

ADONIJAH (Heb. *Adoniyyah* or *Adoniyyahu*, "Yah is Lord"), a name borne by several persons in the Old Testament, the most noteworthy of whom was the fourth son of David. He was born to Haggith at Hebron (2 Sam. iii. 4; 1 Ch. iii. 2). The natural heir to the throne, on the death of Absalom, he sought with the help of Joab and Abiathar to seize his birthright, and made arrangements for his coronation (1 Kings i. 5 ff.). Hearing, however, that Solomon, with the help of Nathan the prophet and Bathsheba, and apparently with the consent of David, had ascended the throne, he fled for safety to the horns of the altar. Solomon spared him on this occasion (1 Kings i. 50 ff.), but later commanded Benaiah to slay him (ii. 13 ff.), because with the approval of Bathsheba he wished to marry Abishag, formerly David's concubine, and thus seemed to have designs on the throne.

ADONIS, in classical mythology, a youth of remarkable beauty, the favourite of Aphrodite. According to the story in Apollodorus (iii. 14. 4), he was the son of the Syrian king Theias by his daughter Smyrna (Myrrha), who had been inspired by Aphrodite with unnatural love. When Theias discovered the truth he would have slain his daughter, but the gods in pity changed her into a tree of the same name. After ten months the tree burst asunder and from it came forth Adonis. Aphrodite, charmed by his beauty, hid the infant in a box and handed him over to the care of Persephone, who afterwards refused to give him up. On an appeal being made to Zeus, he decided that Adonis should spend a third of the year with Persephone and a third with Aphrodite, the remaining third being at his own disposal. Adonis was afterwards killed by a boar sent by Artemis. There are many variations in the later forms of the story (notably in Ovid, *Metam.* x. 298). The name is generally supposed to be of Phoenician origin (from *adon*—"lord"), Adonis himself being identified with Tammuz (but see F. Dümmler in Pauly-Wissowa's *Real-encyklopädie*, who does not admit a Semitic origin for either name or cult). The name Abobas, by which he was known at Perga in Pamphylia, certainly seems connected with *abub* (a Semitic word for "flute"; cf. "ambubaiarum collegia" in Horace, *Satires*, i. 2. 1). (See also Attis.)

Annual festivals, called Adonia, were held in his honour at Byblus, Alexandria, Athens and other places. Although there were variations in the ceremony itself and in its date, the central idea was the death and resurrection of Adonis. A vivid description of the festival at Alexandria (for which Bion probably wrote his *Dirge of Adonis*) is given by Theocritus in his fifteenth idyll, the *Adoniasusae*. On the first day, which celebrated the union of Adonis and Aphrodite, their images were placed side by side on a silver couch, around them all the fruits of the season, "Adonis gardens" in silver baskets, golden boxes of myrrh, cakes of meal, honey and oil, made in the likeness of things that creep and things that fly. On the day following the image of Adonis was carried down to the shore and cast into the sea by women with dishevelled hair and bared breasts. At the same time a song was sung, in which the god was entreated to be propitious in the coming year. This festival, like that at Athens, was held late in summer; at Byblus, where the mourning ceremony preceded, it took place in spring.

It is now generally agreed that Adonis is a vegetation spirit, whose death and return to life represent the decay of nature in winter and its revival in spring. He is born from the myrrh-tree, the oil of which is used at his festival; he is connected with Aphrodite in her character of vegetation-goddess. A special feature of the Athenian festival was the "Adonis gardens," small pots of flowers forced to grow artificially, which rapidly faded (hence the expression was used to denote any transitory pleasure). The dispute between Aphrodite and Persephone for the possession of Adonis, settled by the agreement that he is to spend a third (or half) of the year in the lower world (the seed at first underground and then reappearing above it), finds a parallel in the story of Tammuz and Ishtar (see Aphrodite). The ceremony of the Adonia was intended as a charm to promote the growth of vegetation, the throwing of the gardens and images into the water being supposed to procure a supply of rain (for European parallels see Mannhardt). It is suggested (Frazer) that Adonis is not a god of vegetation generally, but specially a corn-spirit, and that the lamentation is not for the decay of vegetation in winter, but for the cruel treatment of the corn by the reaper and miller (cf. Robert Burns's *John Barleycorn*).

An important element in the story is the connexion of Adonis with the boar, which (according to one version) brings him into the world by splitting with his tusk the bark of the tree into which Smyrna was changed, and finally kills him. It is probable that Adonis himself was looked upon as incarnate in the swine, so that the sacrifice to him by way of expiation on special occasions of an animal which otherwise was specially sacred, and its consumption by its worshippers, was a sacramental act. Other instances of a god being sacrificed to himself as his own enemy are the sacrifice of the goat and bull to Dionysus and of the bear to Artemis. The swine would be sacrificed as having caused the death of Adonis, which explains the dislike of Aphrodite for that animal. It has been observed that whenever swine-sacrifices occur in the ritual of Aphrodite there is reference to Adonis. In any case, the conception of Adonis as a swine-god does not contradict the idea of him as a vegetation or corn spirit, which in many parts of Europe appears in the form of a boar or sow.

Authorities.—H. Brugsch, *Die Adonisklage und das Linoslied* (Berlin, 1852); Greve, *De Adonide* (Leipzig, 1877); W. H. Engel, *Kypros*, ii. (1841), still valuable; W. Mannhardt, *Wald- und Feldkulte*, ii. (1905); M. P. Nilsson, *Griechische Feste* (Leipzig, 1906); articles in Roscher's *Lexikon* and Pauly-Wissowa's *Encyklopädie;* J. G. Frazer, *The Golden Bough*, ii. (2nd ed.), p. 115, and *Adonis, Attis and Osiris* (1906); L. R. Farnell, *Cults of the Greek States*, ii. p. 646; W. Robertson Smith (*Religion of the Semites*, new ed., 1894, pp. 191, 290, 411), who, regarding Adonis as the swine-god, characterizes the Adonia as an annual piacular sacrifice (of swine), "in which the sacrifice has come to be overshadowed by its popular and dramatic accompaniments, to which the Greek celebration, not forming part of the state religion, was limited."

ADONIS, a genus of plants belonging to the natural order *Ranunculaceae*, known commonly by the names of pheasant's eye and *Flos Adonis*. They are annual or perennial herbs with much divided leaves and yellow or red flowers. *Adonis autumnalis* has become naturalized in some parts of England; the petals are scarlet with a dark spot at the base. An early flowering species, *Adonis vernalis*, with large bright yellow flowers, is well worthy of cultivation. It prefers a deep light soil. The name is also given to the butterfly, Mazarine or Clifton Blue (*Polyommatus Adonis*).

ADOPTIANISM. As the theological doctrine of the Logos which bulks so largely in the writings of the apologists of the 2nd century came to the front, the trinitarian problem became acute. The necessity of a constant protest against polytheism led to a tenacious insistence on the divine unity, and the task was to reconcile this unity with the deity of Jesus Christ. Some thinkers fell back on the "modalistic" solution which regards "Father" and "Son" as two aspects of the same subject but a simpler and more popular method was the "adoptianist" or humanitarian. Basing their views on the synoptic Gospels, and tracing descent from the obscure sect of the Alogi, the Adoptianists under Theodotus of Byzantium tried to found a school at Rome *c.* 185, asserting that Jesus was a man, filled with the Holy Spirit's inspiration from his baptism, and so attaining such a perfection of holiness that he was adopted by God and exalted to divine dignity. Theodotus was excommunicated by the bishop of Rome, Victor, *c.* 195, but his followers lived on under a younger teacher of the same name and under Artemon, while in the East similar views were expounded by Beryllus of Bostra and Paul of Samosata, who undoubtedly influenced Lucian of Antioch and his school, including Arius and, later, Nestorius.

There is thus a traceable historical connexion between the early adoptian controversy and the struggle in Spain at the end of the 8th century, to which that name is usually given. It was indeed only a renewal, under new conditions, of the conflict between two types of thought, the rational and the mystical, the school of Antioch and that of Alexandria. The writings of Theodore of Mopsuestia had become well known in the West, especially since the strife over the "three chapters" (544–553), and the opposition of Islam also partly determined the form of men's views on the doctrine of Christ's person. We must further remember the dyophysitism which had been sanctioned at the council of Chalcedon. About 780 Elipandus (b. 718), archbishop of Toledo, revived and vehemently defended the expression *Christus Filius Dei adoptivus*, and was aided by his much more gifted friend Felix, bishop of Urgella. They held that the duality of natures implied a distinction between two modes of sonship in Christ—the natural or proper, and the adoptive. In support of their views they appealed to scripture and to the Western Fathers, who had used the term "adoption" as synonymous with "assumption" in the orthodox sense; and especially to Christ's fraternal relation to Christians—the brother of God's adopted sons. Christ, the firstborn among many brethren, had a natural birth at Bethlehem and also a spiritual birth begun at his baptism and consummated at his resurrection. Thus they did not teach a dual *personality*, nor the old Antiochene view that Christ's divine exaltation was due to his sinless virtue; they were less concerned with old disputes than with the problem as the Chalcedon decision had left it—the relation of Christ's one personality to his two natures.

Felix introduced adoptian views into that part of Spain which belonged to the Franks, and Charlemagne thought it necessary to assemble a synod at Regensburg (Ratisbon), in 792, before which the bishop was summoned to explain and justify the new doctrine. Instead of this he renounced it, and confirmed his renunciation by a solemn oath to Pope Adrian, to whom the synod sent him. The recantation was probably insincere, for on returning to his diocese he taught adoptianism as before. Another synod was held at Frankfort in 794, by which the new doctrine was again formally condemned, though neither Felix nor any of his followers appeared.

In this synod Alcuin of York took part. A friendly letter from Alcuin, and a controversial pamphlet, to which Felix replied, were followed by the sending of several commissions of clergy to Spain to endeavour to put down the heresy. Archbishop Leidrad (d. 816) of Lyons, being on one of these commissions, persuaded Felix to appear before a synod at Aix-la-Chapelle in 799. There, after six days' disputing with Alcuin, he again recanted his heresy. The rest of his life was spent under the supervision of the archbishop at Lyons, where he died in 816. Elipandus, secure in his see at Toledo, never swerved from the adoptian views, which, however, were almost universally abandoned after the two leaders died.

In the scholastic discussions of the 12th century the question came to the front again, for the doctrine as framed by Alcuin was not universally accepted. Thus both Abelard and Peter Lombard, in the interest of the immutability of the divine substance (holding that God could not "become" anything), gravitated towards a Nestorian position. The great opponent of their Christology, which was known as Nihilianism, was the German scholar Gerhoch, who, for his bold assertion of the perfect interpenetration of deity and humanity in Christ, was accused of Eutychianism. The proposition *Deus non factus est aliquid secundum quod est homo* was condemned by a synod of Tours in 1163 and again by the Lateran synod of 1179, but Adoptianism continued all through the middle ages to be a source of theological dispute.

See A. Harnack, *Hist. of Dogma*, esp. vol. v. pp. 279-292; R. Ottley, *The Doctrine of the Incarnation*, vol. i. p. 228 ff., vol. ii. pp. 151-161; Herzog-Hauck, *Realencyk.*, art. "Adoptianismus." (A. J. G.)

ADOPTION (Lat. *adoptio*, for *adoptatio*, from *adoptare*, to choose for oneself), the act by which the relations of paternity and filiation are recognized as legally existing between persons not so related by nature. Cases of adoption were very frequent among the Greeks and Romans, and the custom was accordingly very strictly regulated in their laws. In Athens the power of adoption was allowed to all citizens who were of sound mind, and who possessed no male offspring of their own, and it could be exercised either during lifetime or by testament. The person adopted, who required to be himself a citizen, was enrolled in the family and *demus* of the adoptive father, whose name, however, he did not necessarily assume. In the interest of the next of kin, whose rights were affected by a case of adoption, it was provided that the registration should be attended with certain formalities, and that it should take place at a fixed time—the festival of the *Thargelia*. The rights and duties of adopted children were almost identical with those of natural offspring, and could not be renounced except in the case of one who had begotten children to take his place in the family of his adoptive father. Adopted into another family, children ceased to have any claim of kindred or inheritance through their natural father, though any rights they might have through their mother were not similarly affected. Among the Romans the existence of the *patria potestas* gave a peculiar significance to the custom of adoption. The motive to the act was not so generally childlessness, or the gratification of affection, as the desire to acquire those civil and agnate rights which were founded on the *patria potestas*. It was necessary, however, that the adopter should have no children of his own, and that he should be of such an age as to preclude reasonable expectation of any being born to him. Another limitation as to age was imposed by the maxim *adoptio imitatur naturam*, which required the adoptive father to be at least eighteen years older than the adopted children. According to the same maxim eunuchs were not permitted to adopt, as being impotent to beget children for themselves. Adoption was of two kinds according to the state of the person adopted, who might be either still under the *patria potestas* (*alieni juris*), or his own master (*sui juris*). In the former case the act was one of *adoption proper*, in the latter case it was styled *adrogation*, though the term adoption was also used in a general sense to describe both species. In adoption proper the natural father publicly sold his child to the adoptive father, and the sale being thrice repeated, the maxim of the Twelve Tables took effect, *Si pater filium ter venunduit, filius a patre liber esto*. The process was ratified and completed by a fictitious action of recovery brought by the adoptive father against the natural parent, which the latter did not defend, and which was therefore known as the *cessio in jure*. *Adrogation* could be accomplished originally only by the authority of the people assembled in the *Comitia*, but from the time of Diocletian it was effected by an imperial rescript. Females could not be adrogated, and, as they did not possess the *patria potestas*, they could not exercise the right of adoption in either kind. The whole Roman law on the subject of adoption will be found in Justinian's *Institutes*, lib. i. tit. II.

In Hindu law, as in nearly every ancient system, wills were formerly unknown, and adoptions took their place. (See Indian Law.) Adoption is not recognized in the laws of England, Scotland or the Netherlands, though there are legal means by which one may be enabled to assume the name and arms and to inherit the property of a stranger. (See Name.)

In France and Germany, countries which may be said to have embodied the Roman law in their jurisprudence, adoption is regulated according to the principles of Justinian, though with several more or less important modifications, rendered necessary by the usages of these countries respectively. Under French law the rights of adoption can be exercised only by those who are over fifty years of age, and who, at the time of adoption, have neither children nor legitimate descendants. They must also be fifteen years older than the person adopted. In German law the person adopting must either be fifty years of age, or at least eighteen years older than the adopted, unless a special dispensation is obtained. If the person adopted is a legitimate child the consent of his parents must be obtained; if illegitimate, the consent of the mother. Both in Germany and France the adopted child remains a member of his original family, and acquires no rights in the family of the adopter other than that of succession to the person adopting.

In the United States adoption is regulated by the statutes of the several states. Adoption of minors is permitted by statute in many of the states. These statutes generally require some public notice to be given of the intention to adopt, and an order of approval after a hearing before some public authority. The consequence commonly is that the person adopted becomes, in the eyes of the law, the child of the person adopting, for all purposes. Such an adoption, if consummated according to the law of the domicile, is equally effectual in any other state into which the parties may remove. The relative status thus newly acquired is ubiquitous. (See Whitmore, *Laws of Adoption; Ross* v. *Ross*, 129 Massachusetts Reports, 243.)

The part played by the legal fiction of adoption in the constitution of primitive society and the civilization of the race is so important, that Sir Henry S. Maine, in his *Ancient Law*, expresses the opinion that, had it never existed, the primitive groups of mankind could not have coalesced except on terms of absolute superiority on the one side and absolute subjection on the other. With the institution of adoption, however, one people might *feign itself* as descended from the same stock as the people to whose *sacra gentilicia* it was admitted; and amicable relations were thus established between stocks which, but for this expedient, must have submitted to the arbitrament of the sword with all its consequences.

ADORATION (Lat. *ad*, to, and *os*, mouth; *i.e.* "carrying to one's mouth"), primarily an act of homage or worship, which, among the Romans, was performed by raising the hand to the mouth, kissing it and then waving it in the direction of the adored object. The devotee had his head covered, and after the act turned himself round from left to right. Sometimes he kissed the feet or knees of the images of the gods themselves, and Saturn and Hercules were adored with the head bare. By a natural transition the homage, at first paid to divine beings alone, came to be paid to monarchs. Thus the Greek and Roman emperors were adored by bowing or kneeling, laying hold of the imperial robe, and presently withdrawing the hand and pressing it to the lips, or by putting the royal robe itself to the lips. In Eastern countries adoration has ever been performed in an attitude still more lowly. The Persian method, introduced by Cyrus, was to bend the knee and fall on the face at the prince's feet, striking the earth with the forehead and kissing the ground. This striking of the earth with the forehead, usually a fixed number of times, is the form of adoration usually paid to Eastern potentates to-day. The Jews kissed in homage. Thus in 1 Kings xix. 18, God is made to say, "Yet I have left me seven thousand in Israel, all the knees which have not bowed unto Baal, and every mouth which hath not kissed him." And in Psalms ii. 12, "Kiss the Son, lest he be angry, and ye perish from the way." (See also Hosea xiii. 2.) In England the ceremony of kissing the sovereign's hand, and some other acts which are performed kneeling, may be described as forms of adoration. Adoration is applied in the Roman Church to the ceremony of kissing the pope's foot, a custom which is said to have been introduced by the popes following the example of the emperor Diocletian. The toe of the famous statue of the apostle in St Peter's, Rome, shows marked wear caused by the kisses of pilgrims. In the Roman Church a distinction is made between *Latria*, a worship due to God alone, and *Dulia* or *Hyperdulia*, the adoration paid to the Virgin, saints, martyrs, crucifixes, &c. (See further Homage.)

ADORF, a town of Germany, in the kingdom of Saxony, 3 m. from the Bohemian frontier, at an elevation of 1400 ft. above the sea, on the Plauen–Eger and Aue–Adorf lines of railway. Pop. 5000. It has lace, dyeing and tanning industries, and manufactures of toys and musical instruments; and there is a convalescent home for the poor of the city of Leipzig.

ADOUR (anc. *Aturrus* or *Adurus*, from Celtic *dour*, water), a river of south-west France, rising in the department of Hautes Pyrénées, and flowing in a wide curve to the Bay of Biscay. It is formed of several streams having their origin in the *massifs* of the Pic d'Arbizon and the Pic du Midi de Bigorre, but during the first half of its course remains an inconsiderable river. In traversing the beautiful valley of Campan it is artificially augmented in summer by the waters of the Lac Bleu, which are drawn off by means of a siphon, and flow down the valley of Lesponne. After passing Bagnères de Bigorre the Adour enters the plain of Tarbes, and for the remainder of its course in the department of Hautes Pyrénées is of much less importance as a waterway than as a means of feeding the numerous irrigation canals which cover the plains on each side. Of these the oldest and most important is the Canal d'Alaric, which follows the right bank for 36 m. Entering the department of Gers, the Adour receives the Arros on the right bank and begins to describe the large westward curve which takes it through the department of Landes to the sea. In the last-named department it soon becomes navigable, namely, at St Sever, after passing which it is joined on the left by the Larcis, Gabas, Louts and Luy, and on the right by the Midouze, which is formed by the union of the Douze and the Midour, and is navigable for 27 m.; now taking a south-westerly course it receives on the left the Gave de Pau, which is a more voluminous river than the Adour itself, and flowing past Bayonne enters the sea through a dangerous estuary, in which sandbars are formed, after a total course of 208 m., of which 82 are navigable. The mouth of the Adour has repeatedly shifted, its old bed being represented by the series of *étangs* and lagoons extending northward as far as the village of Vieux Boucau, 22½ m. north of Bayonne, where it found a new entrance into the sea at the end of the 14th century. Its previous mouth had been 10 m. south of Vieux Boucau. The present channel was constructed by the engineer Louis de Foix in 1579. There is a depth over the bar at the entrance of 10½ to 16 ft. at high tide. The area of the basin of the Adour is 6565 sq. m.

ADOWA (properly Adua), the capital of Tigré, northern Abyssinia, 145 m. N.E. of Gondar and 17 m. E. by N. of Axum, the ancient capital of Abyssinia. Adowa is built on the slope of a hill at an elevation of 6500 ft., in the midst of a rich agricultural district. Being on the high road from Massawa to central Abyssinia, it is a meeting-place of merchants from Arabia and the Sudan for the exchange of foreign merchandise with the products of the country. During the wars between the Italians and Abyssinia (1887–96) Adowa was on three or four occasions looted and burnt; but the churches escaped destruction. The church of the Holy Trinity, one of the largest in Abyssinia, contains numerous wall-paintings of native art. On a hill about 2½ m. north-west of Adowa are the ruins of Fremona, the headquarters of the Portuguese Jesuits who lived in Abyssinia during the 16th and 17th centuries. On the 1st of March 1806, in the hills north of the town, was fought the battle of Adowa, in which the Abyssinians inflicted a crushing defeat on the Italian forces (see Italy, *History*, and Abyssinia, *History*).

ADRA (anc. *Abdera*), a seaport of southern Spain, in the province of Almeria; at the mouth of the Rio Grande de Adra, and on the Mediterranean Sea. Pop. (1900) 11,188. Adra is the port of shipment for the lead obtained near Berja, 10 m. north-east; but its commercial development is retarded by the lack of a railway. Besides lead, the exports include grapes, sugar and esparto. Fuel is imported, chiefly from the United Kingdom.

ADRAR (Berber for "uplands"), the name of various districts of the Saharan desert, Northern Africa. Adrar Suttuf is a hilly region forming the southern part of the Spanish protectorate of the Rio de Oro (*q.v.*). Adrar or Adrar el Jebli, otherwise Adghagh, is a plateau north-east of Timbuktu. It is the headquarters of the Awellimiden Tuareg (see Tuareg and Sahara). Adrar n'Ahnet and Adrar Adhafar are smaller regions in the Ahnet country south of Insalah. Adrar Temur, the country usually referred to when Adrar is spoken of, is in the western Sahara, 300 m. north of the Senegal and separated on the north-west from Adrar Suttuf by wide valleys and sand dunes. Adrar is within the French sphere of influence. In general barren, the country contains several oases, with a total population of about 10,000. In 1900 the oasis of Atar, on the western borders of the territory, was reached by Paul Blanchet, previously known for his researches on ancient Berber remains in Algeria. (Blanchet died in Senegal on the 6th of October 1900, a few days after his return from Adrar.) Atar is inhabited by Arab and Berber tribes, and is described as a wretched spot. The other centres of population are Shingeti, Wadan and Ujeft, Shingeti being the chief commercial centre, whence caravans take to St Louis gold-dust, ostrich feathers and dates. A considerable trade is also done in salt from the sebkha of Ijil, in the north-west. Adrar occupies the most elevated part of a plateau which ends westwards in a steep escarpment and falls to the east in a succession of steps.

Adrar or Adgar is also the name sometimes given to the chief settlement in the oasis of Tuat in the Algerian Sahara.

ADRASTUS, in Greek legend, was the son of Talaus, king of Argos, and Lysianassa, daughter of Polybus, king of Sicyon. Having been driven from Argos by Amphiaraus, Adrastus fled to Sicyon, where he became king on the death of Polybus. After a time he became reconciled to Amphiaraus, gave him his sister Eriphyle in marriage, and returned to Argos and occupied the throne. In consequence of an oracle which had commanded him to marry his daughters to a lion and a boar, he wedded them to Polyneices and Tydeus, two fugitives, clad in the skins of these animals or carrying shields with their figures on them, who claimed his hospitality. He was the instigator of the famous war against Thebes for the restoration of his son-in-law Polyneices, who had been deprived of his rights by his brother Eteocles. Adrastus, followed by Polyneices and Tydeus, his two sons-in-law, Amphiaraus, his brother-in-law, Capaneus, Hippomedon and Parthenopaeus, marched against the city of Thebes, and on his way is said to have founded the Nemean games. This is the expedition of the "Seven against Thebes," which the poets have made nearly as famous as the siege of Troy. As Amphiaraus had foretold, they all lost their lives in this war except Adrastus, who was saved by the speed of his horse Arion (*Iliad*, xxiii. 346). Ten years later, at the instigation of Adrastus, the war was renewed by the sons of the chiefs who had fallen. This expedition was called the war of the "Epigoni" or descendants, and ended in the taking and destruction of Thebes. None of the followers of Adrastus perished except his son Aegialeus, and this affected him so greatly that he died of grief at Megara, as he was leading back his victorious army.

Apollodorus iii. 6, 7; Aeschylus, *Septem contra Thebas*; Euripides, *Phoenissae, Supplices*; Statius, *Thebais*; Herodotus v. 67.

ADRIA (anc. *Atria*; the form Adria or Hadria is less correct: Hatria was a town in Picenum, the modern Atri), a town and episcopal see of Venetia, Italy, in the province of Rovigo, 15 m. E. by rail from the town of Rovigo. It is situated between the mouths of the Adige and the Po, about 13½ m. from the sea and but 13 ft. above it. Pop. (1901) 15,678. The town occupies the site of the ancient Atria, which gave its name to the Adriatic. Its origin is variously ascribed by ancient writers, but it was probably a Venetian, *i.e.* Illyrian, not an Etruscan, foundation—still less a foundation of Dionysius I. of Syracuse. Imported vases of the second half of the 5th century B.C. prove the existence of trade with Greece at that period; and the town was famous in Aristotle's day for a special breed of fowls. Even at that period, however, the silt brought down by the rivers rendered access to the harbour difficult, and the historian Philistus excavated a canal to give free access to the sea. This was still open in the imperial period, and the town, which was a *municipium*, possessed its own gild of sailors; but its importance gradually decreased. Its remains lie from 10 to 20 ft. below the modern level. The Museo Civico and the Bocchi collection contain antiquities.

See R. Schöne, *Le antichità del Museo Bocchi di Adria* (Rome, 1878). (T. As.)

ADRIAN, or Hadrian (Lat. *Hadrianus*), the name of six popes.

Adrian I., pope from 772 to 795, was the son of Theodore, a Roman nobleman. Soon after his accession the territory that had been bestowed on the popes by Pippin was invaded by Desiderius, king of the Lombards, and Adrian found it necessary to invoke the aid of Charlemagne, who entered Italy with a large army, besieged Desiderius in his capital of Pavia, took that town, banished the Lombard king to Corbie in France and united the Lombard kingdom with the other Frankish possessions. The pope, whose expectations had been aroused, had to content himself with some additions to the duchy of Rome, and to the Exarchate, and the Pentapolis. In his contest with the Greek empire and the Lombard princes of Benevento, Adrian remained faithful to the Frankish alliance, and the friendly relations between pope and emperor were not disturbed by the difference which arose between them on the question of the worship of images, to which Charlemagne and the Gallican Church were strongly opposed, while Adrian favoured the views of the Eastern Church, and approved the decree of the council of Nicaea (787), confirming the practice and excommunicating the iconoclasts. It was in connexion with this controversy that Charlemagne wrote the so-called *Libri Carolini*, to which Adrian replied by letter, anathematizing all who refused to worship the images of Christ, or the Virgin, or saints. Notwithstanding this, a synod, held at Frankfort in 794, anew condemned the practice, and the dispute remained unsettled at Adrian's death. An epitaph written by Charlemagne in verse, in which he styles Adrian "father," is still to be seen at the door of the Vatican basilica. Adrian restored the ancient aqueducts of Rome, and governed his little state with a firm and skilful hand.

Adrian II., pope from 867 to 872, was a member of a noble Roman family, and became pope in 867, at an advanced age. He maintained, but with less energy, the attitude of his predecessor. Rid of the affair of Lothair, king of Lorraine, by the death of that prince (869), he endeavoured in vain to mediate between the Frankish princes with a view to assuring to the emperor, Louis II., the heritage of the king of Lorraine. Photius, shortly after the council in which he had pronounced sentence of deposition against Pope Nicholas, was driven from the patriarchate by a new emperor, Basil the Macedonian, who favoured his rival Ignatius. An oecumenical council (called by the Latins the 8th) was convoked at Constantinople to decide this matter. At this council Adrian was represented by legates, who presided at the condemnation of Photius, but did not succeed in coming to an understanding with Ignatius on the subject of the jurisdiction over the Bulgarian converts. Like his predecessor Nicholas, Adrian II. was forced to submit, at least in temporal affairs, to the tutelage of the emperor, Louis II., who placed him under the surveillance of Arsenius, bishop of Orta, his confidential adviser, and Arsenius's son Anastasius, the librarian. Adrian had married in his youth, and his wife and daughter were still living. They were carried off and assassinated by Anastasius's brother, Eleutherius, whose reputation, however, suffered but a momentary eclipse. Adrian died in 872.

Adrian III., pope, was born at Rome. He succeeded Martin II. in 884, and died in 885, on a journey to Worms. (L. D.*)

Adrian IV. (Nicholas Breakspear), pope from 1154 to 1159, the only Englishman who has occupied the papal chair, was born before A.D. 1100 at Langley near St Albans in Hertfordshire. His father was Robert, a priest of the diocese of Bath, who entered a monastery and left the boy to his own resources. Nicholas went to Paris and finally became a monk of the cloister of St Rufus near Arles. He rose to be prior and in 1137 was unanimously elected abbot. His reforming zeal led to the lodging of complaints against him at Rome; but these merely attracted to him the favourable attention of Eugenius III., who created him cardinal bishop of Albano. From 1152 to 1154 Nicholas was in Scandinavia as legate, organizing the affairs of the new Norwegian archbishopric of Trondhjem, and making arrangements which resulted in the recognition of Upsala as seat of the Swedish metropolitan in 1164. As a compensation for territory thus withdrawn the Danish archbishop of Lund was made legate and perpetual vicar and given the title of primate of Denmark and Sweden. On his return Nicholas was received with great honour by Anastasius IV., and on the death of the latter was elected pope on the 4th of December 1154. He at once endeavoured to compass the overthrow of Arnold of Brescia, the leader of anti-papal sentiment in Rome. Disorders ending with the murder of a cardinal led Adrian shortly before Palm Sunday 1155 to take the previously-unheard-of step of putting Rome under the interdict. The senate thereupon exiled Arnold, and the pope, with the impolitic co-operation of Frederick I. Barbarossa, was instrumental in procuring his execution. Adrian crowned the emperor at St Peter's on the 18th of June 1155, a ceremony which so incensed the Romans that the pope had to leave the city promptly, not returning till November 1156. With the aid of dissatisfied barons, Adrian brought William I. of Sicily into dire straits; but a change in the fortunes of war led to a settlement (June 1156) not advantageous to the papacy and displeasing to the emperor. At the diet of Besançon in October 1157, the legates presented to Barbarossa a letter from Adrian which alluded to the *beneficia* conferred upon the emperor, and the German chancellor translated this *beneficia* in the feudal sense. In the storm which ensued the legates were glad to escape with their lives, and the incident at length closed with a letter from the pope, declaring that by *beneficium* he meant merely *bonum factum*. The breach subsequently became wider, and Adrian was about to excommunicate the emperor when he died at Anagnia on the 1st of September 1159.

A controversy exists concerning an embassy sent by Henry II. of England to Adrian in 1155. According to the elaborate investigation of Thatcher, the facts seem to be as follows. Henry asked for permission to invade and subjugate Ireland, in order to gain absolute ownership of that isle. Unwilling to grant a request counter to the papal claim (based on the forged Donation of Constantine) to dominion over the islands of the sea, Adrian made Henry a conciliatory proposal, namely, that the king should become hereditary feudal possessor of Ireland while recognizing the pope as overlord. This compromise did not satisfy Henry, so the matter dropped; Henry's subsequent title to Ireland rested on conquest, not on papal concession, and was therefore absolute. The much-discussed bull *Laudabiliter* is, however, not genuine.

See Herzog-Hauck, *Realencyklopädie*, 3rd ed. (excellent bibliography), and Wetzer and Welte, *Kirchenlexikon*, 2nd ed., under "Hadrian IV."; also Oliver J. Thatcher, *Studies concerning Adrian IV.* (The University of Chicago: Decennial Publications, 1st series, vol. iv., Chicago, 1903); R. Raby, *Pope Adrian IV.: An Historical Sketch* (London, 1849); and A. H. Tarleton, *Life of Nicholas, Breakspear* (London, 1896).

Adrian V. (Ottobuono de' Fieschi), pope in 1276, was a Genoese who was created cardinal deacon by his uncle Innocent IV. In 1264 he was sent to England to mediate between Henry III. and his barons. He was elected pope to succeed Innocent V. on the 11th of July 1276, but died at Viterbo on the 18th of August, without having been ordained even to the priesthood.

Adrian VI. (Adrian Dedel, not Boyens, probably not Rodenburgh, 1459–1523), pope from 1522 to 1523, was born at Utrecht in March 1459, and studied under the Brethren of the Common Life either at Zwolle or Deventer. At Louvain he pursued philosophy, theology and canon law, becoming a doctor of theology (1491), dean of St Peter's and vice-chancellor of the university. In 1507 he was appointed tutor to the seven-year-old Charles V. He was sent to Spain in 1515 on a very important diplomatic errand; Charles secured his succession to the see of Tortosa, and on the 14th of November 1516 commissioned him inquisitor-general of Aragon. During the minority of Charles, Adrian was associated with Cardinal Jimenes in governing Spain. After the death of the latter Adrian was appointed, on the 14th of March 1518, general of the reunited inquisitions of Castile and Aragon, in which capacity he acted till his departure from Tarragona for Rome on the 4th of August 1522: he was, however, too weak and confiding to cope with abuses which Jimenes had been able in some degree to check. When Charles left for the Netherlands in 1520 he made Adrian regent of Spain: as such he had to cope with a very serious revolt. In 1517 Leo X. had created him cardinal priest *SS. Ioannis et Pauli*; on the 9th of January 1522 he was almost unanimously elected pope. Crowned in St Peter's on the 31st of August at the age of sixty-three, he entered upon the lonely path of the reformer. His programme was to attack notorious abuses one by one; but in his attempt to improve the system of granting indulgences he was hampered by his cardinals; and reducing the number of matrimonial dispensations was impossible, for the income had been farmed out for years in advance by Leo X. The Italians saw in him a pedantic foreign professor, blind to the beauty of classical antiquity, penuriously docking the stipends of great artists. As a peacemaker among Christian princes, whom he hoped to unite in a protective war against the Turk, he was a failure: in August 1523 he was forced openly to ally himself with the Empire, England, Venice, &c., against France; meanwhile in 1522 the sultan Suleiman I. had conquered Rhodes. In dealing with the early stages of the Protestant revolt in Germany Adrian did not fully recognize the gravity of the situation. At the diet which opened in December 1522 at Nuremberg he was represented by Chieregati, whose instructions contain the frank admission that the whole disorder of the church had perchance proceeded from the Curia itself, and that there the reform should begin. However, the former professor and inquisitor-general was stoutly opposed to doctrinal changes, and demanded that Luther be punished for heresy. The statement in one of his works that the pope could err in matters of faith ("*haeresim per suam determinationem aut Decretalem asserendo*") has attracted attention; but as it is a private opinion, not an *ex cathedra* pronouncement, it is held not to prejudice the dogma of papal infallibility. On the 14th of September 1523 he died, after a pontificate too short to be effective.

Most of Adrian VI.'s official papers disappeared soon after his death. He published *Quaestiones in quartum sententiarum praesertim circa sacramenta* (Paris, 1512, 1516, 1518, 1537; Rome, 1522), and *Quaestiones quodlibeticae XII.* (1st ed., Louvain, 1515). See L. Pastor, in *Geschichte der Päpste*, vol. iv. pt. ii.; *Adrian VI. und Klemens VII.* (Freiburg, 1907); also Wetzer and Welte, *Kirchenlexikon*, 2nd ed., and Herzog-Hauck, *Realencyklopädie*, 3rd ed., under "Hadrian VI."; H. Hurter, *Nomenclator literarius recentioris theologiae catholicae*, tom. iv. (Innsbruck, 1899), 1027; *The Cambridge Modern History*, vol. ii. (1904), 19-21; H. C. Lea, *A History of the Inquisition of Spain*, vol. i. (1906); Janus, *The Pope and the Council*, 2nd ed. (London, 1869), 376. Biographies:—A. Lepitre, *Adrien VI.* (Paris, 1880); C. A. C. von Höfler, *Papst Adrian VI.* (Vienna, 1880); L. Casartelli, "The Dutch Pope," in *Miscellaneous Essays* (London, 1906). (W. W. R.*)

ADRIAN, SAINT, one of the praetorian guards of the emperor Galerius Maximian, who, becoming a convert to Christianity, was martyred at Nicomedia on the 4th of March 303. It is said that while presiding over the torture of a band of Christians he was so amazed at their courage that he publicly confessed his faith. He was imprisoned, and the next day his limbs were struck off on an anvil, and he was then beheaded, dying in his wife's, St Natalia's, arms. St Adrian's festival, with that of his wife, is kept on the 8th of September. He is specially a patron of soldiers, and is much reverenced in Flanders, Germany and the north of France. He is usually represented armed, with an anvil in his hands or at his feet.

ADRIAN, a city and the county-seat of Lenawee county, Michigan, U.S.A., on the S. branch of Raisin river, near the S.E. corner of the state. Pop. (1890) 8756; (1900) 9654, of whom

1136 were foreign-born; (1906 estimate) 11,104. It is served by five branches of the Lake Shore railway system, and by the Wabash, the Toledo and Western, and the Toledo, Detroit and Ironton railways. Adrian is the seat of Adrian College (1859; co-educational), controlled by the Wesleyan Methodist Church in 1859–1867 and since 1867 by the Methodist Protestant Church, and having departments of literature, theology, music, fine arts, commerce and pedagogy, and a preparatory school; and of St Joseph's Academy (Roman Catholic) for girls; and 1 m. north of the city is the State Industrial Home for Girls (1879), for the reformation of juvenile offenders between the ages of ten and seventeen. Adrian has a public library. The city is situated in a rich farming region; is an important shipping point for live-stock, grain and other farm products; and is especially known as a centre for the manufacture of wire-fences. Among the other manufactories are flouring and grist mills, planing mills, foundries, and factories for making agricultural implements, United States mail boxes, furniture, pianos, organs, automobiles, toys and electrical supplies. The value of the city's factory products increased from $2,124,923 in 1900 to $4,897,426 in 1904, or 130·5%; of the total value in 1904, $2,849,648 was the value of wire-work. The place was laid out as a town in 1828, and according to tradition was named in honour of the Roman emperor Hadrian. It was incorporated as a village in 1836, was made the county-seat in 1838 and was chartered as a city in 1853.

ADRIANI, GIOVANNI BATTISTA (1513–1579), Italian historian, was born of a patrician family of Florence, and was secretary to the republic of Florence. He was among the defenders of the city during the siege of 1530, but subsequently joined the Medici party and was appointed professor of rhetoric at the university. At the instance of Cosimo I. he wrote a history of his own times, from 1536 to 1574, in Italian, which is generally, but according to Brunet erroneously, considered a continuation of Guicciardini. De Thou acknowledges himself greatly indebted to this history, praising it especially for its accuracy. Adriani composed funeral orations in Latin on the emperor Charles V. and other noble personages, and was the author of a long letter on ancient painters and sculptors prefixed to the third volume of Vasari. His *Istoria dei suoi tempi* was published in Florence in 1583; a new edition appeared also in Florence in 1872.

See G. M. Mazzucchelli, *Gli Scrittori d' Italia*, i. p. 151 (Brescia, 1753).

ADRIANOPLE, a vilayet of European Turkey, corresponding with part of the ancient Thrace, and bounded on the N. by Bulgaria (Eastern Rumelia), E. by the Black Sea and the vilayet of Constantinople, S. by the Sea of Marmora and the Aegean Sea and W. by Macedonia. Pop. (1905) about 1,000,000; area, 15,000 sq. m. The surface of the vilayet is generally mountainous, except in the central valley of the Maritza, and along the banks of its tributaries, the Tunja, Arda, Ergene, &c. On the west, the great Rhodope range and its outlying ridges extend as far as the Maritza, and attain an altitude of more than 7000 ft. in the summits of the Kushlar Dagh, Karluk Dagh and Kara-Balkan. Towards the Black Sea, the less elevated Istranja Dagh stretches from north-west to south-east; and the entire south coast, which includes the promontory of Gallipoli and the western shore of the Dardanelles, is everywhere hilly or mountainous, except near the estuaries of the Maritza, and of the Mesta, a western frontier stream. The climate is mild and the soil fertile; but political disturbances and the conservative character of the people tend to thwart the progress of agriculture and other industries. The vilayet suffered severely during the Russian occupation of 1878, when, apart from the natural dislocation of commerce, many of the Moslem cultivators emigrated to Asia Minor, to be free from their alien rulers. Through the resultant scarcity of labour, much land fell out of cultivation. This was partially remedied after the Bulgarian annexation of Eastern Rumelia, in 1885, had driven the Moslems of that country to emigrate in like manner to Adrianople; but the advantage was counterbalanced by the establishment of hostile Bulgarian tariffs. The important silk industry, however, began to revive about 1890, and dairy farming is prosperous; but the condition of the vilayet is far less unsettled than that of Macedonia, owing partly to the preponderance of Moslems among the peasantry, and partly to the nearness of Constantinople, with its Western influences. The main railway from Belgrade to Constantinople skirts the Maritza and Ergene valleys, and there is an important branch line down the Maritza valley to Dédéagatch, and thence coastwise to Salonica. After the city of Adrianople (pop. 1905, about 80,000), which is the capital, the principal towns are Rodosto (35,000), Gallipoli (25,000), Kirk-Kilisseh (16,000), Xanthi (14,000), Chorlu (11,500), Demotica (10,000), Enos (8000), Gumuljina (8000) and Dédéagatch (3000).

ADRIANOPLE (anc. *Hadrianopolis*; Turk. *Edirne*, or *Edreneh*; Slav. *Odrin*), the capital of the vilayet of Adrianople, Turkey in Europe; 137 m. by rail W.N.W. of Constantinople. Pop. (1905) about 80,000, of whom half are Turks, and half Jews, Greeks, Bulgars, Armenians, &c. Adrianople ranks, after Constantinople and Salonica, third in size and importance among the cities of European Turkey. It is the see of a Greek archbishop, and of one Armenian and two Bulgarian bishops. It is the chief fortress near the Bulgarian frontier, being defended by a ring of powerful modern forts. It occupies both banks of the river Tunja, at its confluence with the Maritza, which is navigable to this point in spring and winter. The nearest seaport by rail is Dédéagatch, west of the Maritza; Enos, at the river-mouth, is the nearest by water. Adrianople is on the railway from Belgrade and Sofia to Constantinople and Salonica. In appearance it is thoroughly Oriental—a mass of mean, irregular wooden buildings, threaded by narrow tortuous streets, with a few better buildings. Of these the most important are the Idadieh school, the school of arts and crafts, the Jewish communal school; the Greek college, Zappeion; the Imperial Ottoman Bank and Tobacco Regie; a fire-tower; a theatre; palaces for the prefect of the city, the administrative staff of the second army corps and the defence works commission; a handsome row of barracks; a military hospital; and a French hospital. Of earlier buildings, the most distinguished are the Eski Serai, an ancient and half-ruined palace of the sultans; the bazaar of Ali Pasha; and the 16th-century mosque of the sultan Selim II., a magnificent specimen of Turkish architecture.

Adrianople has five suburbs, of which Kiretchhané and Yilderim are on the left bank of the Maritza, and Kirjik stands on a hill overlooking the city. The two last named are exclusively Greek, but a large proportion of the inhabitants of Kiretchhané are Bulgarian. These three suburbs —as well as the little hamlet of Demirtash, containing about 300 houses all occupied by Bulgars—are all built in the native fashion; but the fifth suburb, Karagatch, which is on the right bank of the Maritza, and occupies the region between the railway station and the city, is Western in its design, consisting of detached residences in gardens, many of them handsome villas, and all of modern European type. In all the communities schools have multiplied, but the new seminaries are of the old non-progressive type. The only exception is the Hamidieh school for boys—a government institution which takes both boarders and day-scholars. Like the Lyceum of Galata Serai in Constantinople, it has two sets of professors, Turkish and French, and a full course of education in each language, the pupils following both courses. The several communites have each their own charitable institutions, the Jews being specially well endowed in this respect. The Greeks have a literary society, and there is a well-organized club to which members of all the native communities, as well as many foreigners, belong.

The economic condition of Adrianople was much impaired by the war of 1877–78, and was just showing signs of recovery when, in 1885, the severance from it of Eastern Rumelia by a Customs cordon rendered the situation worse than ever. Adrianople had previously been the commercial headquarters of all Thrace, and of a large portion of the region between the Balkans and the Danube, now Bulgaria. But the separation of Eastern Rumelia isolated Adrianople, and transferred to Philippopolis at least two-thirds of its foreign trade which, as regards sea-borne merchandise, is carried on through the port of Burgas (*q.v.*). The city manufactures silk, leather, tapestry, woollens, linen and cotton, and has an active general trade. Besides fruits and agricultural produce, its exports include raw silk, cotton, opium, rose-water, attar of roses, wax and the dye known as Turkey red. The surrounding country is extremely fertile, and its wines are the best produced in Turkey. The city is supplied with fresh water by means of an aqueduct carried by arches over an extensive valley. There is also a fine stone bridge over the Tunja.

Adrianople was originally known as Uskadama, Uskudama or Uskodama, but was renamed and enlarged by the Roman emperor Hadrian (117–138). In 378 the Romans were here defeated by the Goths. Adrianople was the residence of the Turkish sultans from 1361, when it was captured by Murad I., until 1453, when Constantinople fell. It was occupied by the Russians in 1829 and 1878 (see Russo-Turkish Wars).

ADRIATIC SEA (ancient *Adria* or *Hadria*), an arm of the Mediterranean Sea separating Italy from the Austro-Hungarian, Montenegrin and Albanian littorals, and the system of the Apennine mountains from that of the Dinaric Alps and adjacent ranges. The name, derived from the town of Adria, belonged originally only to the upper portion of the sea (Herodotus vi. 127, vii. 20, ix. 92; Euripides, *Hippolytus*, 736), but was gradually extended as the Syracusan colonies gained in importance. But even then the Adriatic in the narrower sense only extended as far as the Mons Garganus, the outer portion being called the Ionian Sea: the name was sometimes, however, inaccurately used to include the Gulf of Tarentum, the Sea of Sicily, the Gulf of Corinth and even the sea between Crete and Malta (Acts xxvii. 27). The Adriatic extends N.W. from 40° to 45° 45′ N., with an extreme length of nearly 500 m., and a mean breadth of about 110 m., but the Strait of Otranto, through which it connects at the south with the Ionian Sea, is only 45 m. wide. Moreover, the chain of islands which fringes the northern part of the eastern shore reduces the extreme breadth of open sea in this part to 90 m. The Italian shore is generally low, merging, in the north-west, into the marshes and lagoons on either hand of the protruding delta of the river Po, the sediment of which has pushed forward the coast-line for several miles within historic times. On islands within one of the lagoons opening from the Gulf of Venice, the city of that name has its unique situation. The east coast is generally bold and rocky. South of the Istrian peninsula, which separates the Gulfs of Venice and Trieste from the Strait of Quarnero, the island-fringe of the east coast extends as far south as Ragusa. The islands, which are long and narrow (the long axis lying parallel with the coast of the mainland), rise rather abruptly to elevations of a few hundred feet, while on the mainland, notably in the magnificent inlet of the Bocche di Cattaro, lofty mountains often fall directly to the sea. This coast, though beautiful, is somewhat sombre, the prevalent colour of the rocks, a light, dead grey, contrasting harshly with the dark vegetation, which on some of the islands is luxuriant. The north part of the sea is very shallow, and between the southern promontory of Istria and Rimini the depth rarely exceeds 25 fathoms. Between Sebenico and Ortona a well-marked depression occurs, a considerable area of which exceeds 100 fathoms in depth. From a point between Curzola and the north shore of the spur of Monte Gargano there is a ridge giving shallower water, and a broken chain of a few islets extends across the sea. The deepest part of the sea lies east of Monte Gargano, south of Ragusa, and west of Durazzo, where a large basin gives depths of 500 fathoms and upwards, and a small area in the south of this basin falls below 800. The mean depth of the sea is estimated at 133 fathoms. The *bora* (north-east wind), and the prevalence of sudden squalls from this quarter or the south-east, are dangers to navigation in winter. Tidal movement is slight. (See also Mediterranean.)

For the "Marriage of the Adriatic," or more properly "of the sea," a ceremony formerly performed by the doges of Venice, see the article Bucentaur.

ADSCRIPT (from Lat. *ad*, on or to, and *scribere*, to write), something written *after*, as opposed to "subscript," which means written *under*. A labourer was called an "adscript of the soil" (*adscriptus glebae*) when he could be sold or transferred with it, as in feudal days, and as in Russia until 1861. Carlyle speaks of the Java blacks as a kind of adscripts.

ADULLAM, a Canaanitish town in the territory of the tribe of Judah, perhaps the modern ʽAid-el-Mā, 7 m. N.E. of Beit-Jibrīn. It was in the stronghold ("cave" is a scribal error) of this town that David took refuge on two occasions (1 Sam. xxii. 1; 2 Sam. v. 17). The tradition that Adullam is in the great cave of Khareiṭûn (St Chariton) is probably due to the crusaders. From the description of Adullam as the resort of "every one that was in distress," or "in debt," or "discontented," it has often been humorously alluded to, notably by Sir Walter Scott, who puts the expression into the mouth of the Baron of Bradwardine in *Waverley*, chap. lvii., and also of Balfour of Burley in *Old Mortality*. In modern political history the expression "cave of Adullam" (hence "Adullamites") came into common use (being first employed in a speech by John Bright on the 13th of March 1866) with regard to the independent attitude of Robert Lowe (Lord Sherbrooke), Edward Horsman and their Liberal supporters in opposition to the Reform Bill of 1866. But others had previously used it in a similar connexion, *e.g.* President Lincoln in his second electoral campaign (1864), and the Tories in allusion to the Whig remnant who joined C. J. Fox in his temporary secession. From the same usage is derived the shorter political term "cave" for any body of men who secede from their party on some special subject.

ADULTERATION (from Lat. *adulterare*, to defile or falsify), the act of debasing a commercial commodity with the object of passing it off as or under the name of a pure or genuine commodity for illegitimate profit, or the substitution of an inferior article for a superior one, to the detriment of the purchaser. Although the term is mainly used in connexion with the falsification of articles of food, drink or drugs, and is so dealt with in this article, the practice of adulteration extends to almost all manufactured products and even to unmanufactured natural substances, and (as was once suggested by John Bright) is an almost inseparable—though none the less reprehensible—phase of keen trade competition. In its crudest forms as old as commerce itself, it has progressed with the growth of knowledge and of science, and is, in its most modern developments, almost a branch—and that not the least vigorous one—of applied science. From the mere concealment of a piece of metal or a stone in a loaf of bread or in a lump of butter, a bullet in a musk bag or in a piece of opium, it has developed into the use of aniline dyes, of antiseptic chemicals, of synthetic sweetening agents in foods, the manufacture of butter from cocoa-nuts, of lard from cotton-seed and of pepper from olive stones. Its growth and development has necessitated the employment of multitudes of scientific officers charged with its detection and the passing of numerous laws for its repression and punishment. While for all common forms of fraud the common law is in most cases considered strong enough, special laws against the adulteration of food have been found necessary in all civilized countries. A vigorous branch of chemical literature deals with it; there exist scientific societies specially devoted to its study; laboratories are maintained by governments with staffs of highly trained chemists for its detection; and yet it not only develops and flourishes, but becomes more general, if less virulent and dangerous to health.

There are numerous references to adulteration in the classics. The detection of the base metal by Archimedes in Hiero's crown, by the light specific gravity of the latter, is a well-known instance. Vitruvius speaks of the adulteration of minium with lime, Dioscorides of that of opium with other plant juices and with gum, Pliny of that of flour with white clay. Both in Rome and in Athens wine was often adulterated with colours and flavouring agents, and inspectors were charged with looking after it.

In England, so far back as the reign of John (1203), a proclamation was made throughout the kingdom, enforcing the legal obligations of assize as regards bread; and in the following reign the statute (51 Hen. III. Stat. 6) entitled "the pillory and tumbrel" was framed for the express purpose of protecting the public from the dishonest dealings of bakers, vintners, brewers, butchers and others. This statute is the first in which the adulteration of human food is specially noticed and prohibited; it seems to have been enforced with more or less rigour until the time of Anne, when it was repealed (1709). According to the *Liber Albus* it was strictly observed in the days of Edward I., for it states that: "If any default shall be found in the bread of a baker in the city, the first time, let him be drawn upon a hurdle from the Guildhall to his own house through the great street where there be most people assembled, and through the great streets which are most dirty, with the faulty loaf hanging from his neck; if a second time he shall be found committing the same offence, let him be drawn from the Guildhall through the great street of Cheepe in the manner aforesaid to the pillory, and let him be put upon the pillory, and remain there at least one hour in the day; and the third time that such default shall be found, he shall be drawn, and the oven shall be pulled down, and the baker made to foreswear the trade in the city for ever." The assize of 1634 provides that "if there be any manner of person or persons, which shall by any false wayes or meanes, sell any meale under the kinge's subjects, either by mixing it deceitfully or sell any musty or corrupted meal, which may be to the hurte and infection of man's body, or use any false weight, or any deceitful wayes or meanes, and so deceive the subject, for the first offence he shall be grievously punished, the second he shall loose his meale, for the third offence he shall suffer the judgment of the pillory and the fourth time he shall foreswere the town wherein he dwelleth." Vintners, spicers, grocers, butchers, regrators and others were subject to the like punishment for dishonesty in their commercial dealings—it being thought that the pillory, by appealing to the sense of shame, was far more deterrent of such crimes than fine or imprisonment. In the reign of Edward the Confessor a knavish brewer of the city of Chester was taken round the town in the cart in which the refuse of the privies had been collected. Ale-tasters had to look after the ale and test it by spilling some on to a wooden seat, sitting on the wet place in their leathern breeches, the stickiness of the "residue obtained by evaporation" affording the evidence of purity or otherwise. If sugar had been added the taster adhered to the bench; pure malt beer was not considered to yield an adhesive extract. In 1553, the lord mayor of London ordered a jury of five or six vintners to rack and draw off the suspected wine of another vintner, and to ascertain what drugs or ingredients they found in the said wine or cask to sophisticate the same. At another time eight pipes of wine were ordered to be destroyed because, on racking off, bundles of weeds, pieces of sulphur match, and "a kind of gravel mixture sticking to the casks" had been found.

Similar records have come down from the continental European countries. In 1390 an Augsburg wine-seller was sentenced to be led out of the city with his hands bound and a rope round his neck; in 1400 two others were branded and otherwise severely punished; in 1435 "were the taverner Christian Corper and his wife put in a cask in which he sold false wine, and then exposed in the pillory. The punishment was adjudged because they had roasted pears and put them into new sour wine, in order to sweeten the wine. Some pears were hung round their necks like unto a Paternoster." In Biebrich on the Rhine, in 1482, a wine-falsifier was condemned to drink six quarts of his own wine; from this he died. In Frankfurt, casks in which false wine had been found were placed with a red flag on the knacker's cart, "the jailer marched before, the rabble after, and when they came to the river they broke the casks and tumbled the stuff into the stream." In France successive *ordonnances* from 1330 to 1672 forbade the mixing of two wines together under the penalty of a fine and the confiscation of the wine.

Modern British Legislation.—In modern times the English parliament has dealt frequently with the subject of food adulteration. In 1725 it was provided that "no dealer in tea or manufacturer or dyer thereof, or pretending so to be, shall counterfeit or adulterate tea, or cause or procure the same to be counterfeited or adulterated, or shall alter, fabricate or manufacture tea with terra-japonica, or with any drug or drugs whatsoever; nor shall mix or cause or procure to be mixed with tea any leaves other than the leaves of tea or other ingredients whatsoever, on pain of forfeiting and losing the tea so counterfeited, adulterated, altered, fabricated, manufactured or mixed, and any other thing or things whatsoever added thereto, or mixed or used therewith, and also the sum of £100." Six years afterwards, in 1730–1731, a further act was passed prescribing a penalty for "sophisticating" tea; it recites that several ill-disposed persons do frequently dye, fabricate or manufacture very great quantities of sloe leaves, liquorice leaves, and the leaves of tea that have been before used, or the leaves of other trees, shrubs or plants in imitation of tea, and do likewise mix, colour, stain and dye such leaves and likewise tea with terra-japonica, sugar, molasses, clay, logwood, and with other ingredients, and do sell and vend the same as true and real tea, to the prejudice of the health of his majesty's subjects, the diminution of the revenue and to the ruin of the fair trader. This act provides that for every pound of adulterated tea found in possession of any person, a sum of £10 shall be forfeited. It was followed by one passed in 1766–1767, which increased the penalty to imprisonment for not less than six nor more than twelve months. As regards coffee, an act of 1718 recited that "divers evil-disposed persons have at the time or soon after the roasting of coffee made use of water, grease, butter or such-like materials, whereby the same is rendered unwholesome and greatly increased in weight," and a penalty of £20 is enacted. In 1803 an act refers to the addition of burnt, scorched or roasted peas, beans or other grains or vegetable substances prepared in imitation of coffee or cocoa, to coffee or cocoa, and fixes the penalty for the offence at £100, but subsequently permission was given to coffee or cocoa dealers also to deal in scorched or roasted corn, peas, beans or parsnips whole and not ground, crushed or powdered, under certain excise restrictions. An act passed in 1816 relating to beer and porter provides that no brewer of or dealer in or retailer of beer "shall receive or have in his possession, or make or mix with any worts or beer, any liquor, extract or other preparation for the purpose of darkening the colour of worts or beer, other than brown malt, ground or unground, or shall have in his possession or use, or mix with any worts or beer any molasses, honey, liquorice, vitriol, quassia, coculus-indiae, grains of paradise, guinea-pepper or opium, or any extracts of these, or any articles or preparation whatsoever for or as a substitute for malt or hops." Any person contravening was liable to a penalty of £200, and any druggist selling to any brewer or retail dealer any colouring or malt substitute was to be fined £500. It was only in 1847 that brewers were allowed to make for their own use, from sugar, a liquor for darkening the colour of worts or beer and to use it in brewing.

All the laws hitherto referred to were mainly passed in the interest of the inland revenue, and their execution was left entirely in the hands of the revenue officers. It was but natural that they should look primarily after the dutiable articles and not after those that brought no revenue to the state. About the middle of the 19th century many articles, however, paid import duty; butter, for instance, paid 5s. per hundredweight; cheese from 1s. 6d. to 2s. 6d.; flour or meal of all kinds, 4½d.; ginger, 10s.; isinglass, 5s.; and so on. Sensational and doubtless largely exaggerated statements were from time to time published concerning the food supply of the nation. F. C. Accum (1769–1838) by his *Treatise on Adulterations of Food and Culinary Poisons* (1820), and particularly an anonymous writer of a book entitled *Deadly Adulteration and Slow Poisoning unmasked, or Disease and Death in the Pot and the Bottle, in which the blood-empoisoning and life-destroying adulterations of wines, spirits, beer, bread, flour, tea, sugar, spices, cheesemongery, pastry, confectionery, medicines, &c. &c., are laid open to the public* (1830), roused the public attention. In 1850 a physician, Dr. Arthur H. Hassall, had the happy idea of looking at ground coffee through the microscope. Eminent chemists had previously found great difficulty in establishing any satisfactory chemical distinction between coffee, chicory and other adulterants of coffee; the microscope immediately showed the structural difference of the particles, however small. The results of Hassall's examinations were embodied in a paper which was read before the Botanical Society of London and was reported in *The Times*, 1850. A paper on the microscopic examination of sugar, showing the presence in that article of innumerable living mites, followed and attracted much attention. Hassall was in consequence commissioned by Thomas Wakley (1795–1862), the owner of the *Lancet*, to extend his examination to other articles of food, and for a period of nearly four years reports of the *Lancet Analytical Sanitary Commission* were regularly published, the names and addresses of hundreds of manufactures and tradesmen selling adulterated articles being fearlessly given. The responsibility incurred was immense, but the assertions of the journal were so well founded upon fact that they were universally accepted as accurately representing the appalling state of the food supply. As instances may be cited, that of thirty-four samples of coffee only three were pure, chicory being present in thirty-one, roasted corn in twelve, beans and potato-flour each in one; of thirty-four samples of chicory, fourteen were adulterated with corn, beans or acorns; of forty-nine samples of bread, every one contained alum; of fifty-six samples of cocoa, only eight were pure; of twenty-six milks, fourteen were adulterated; of twenty-eight cayenne peppers, only four were genuine, thirteen containing red-lead and one vermilion; of upwards of one hundred samples of coloured sugar-confectionery, fifty-nine contained chromate of lead, eleven gamboge, twelve red-lead, six vermilion, nine arsenite of copper and four white-lead.

In consequence of the *Lancet's* disclosures a parliamentary committee was appointed in 1855, the labours of which resulted in 1860 in the Adulteration of Food and Drink Act, the first act that dealt generally with the adulteration of food. The first section of this enacted "that every person who shall sell any article of food or drink with which, to the knowledge of such person, any ingredient or material injurious to the health of persons eating or drinking such article has been mixed, and every person who shall sell as pure or unadulterated any article of food or drink which is adulterated and not pure, shall for every such offence, on summary conviction, pay a penalty not exceeding £5 with costs." In the case of a second offence the name, place of abode and offence might be published in the newspapers at the offender's expense. As the act, however, left it optional to the district authorities to appoint analysts or not, and did not provide for the appointment of any officer upon whom should rest the duty of obtaining samples or of prosecuting offenders, it virtually remained a dead letter till 1872, when the Adulteration of Food and Drugs Act came into force, prescribing a penalty not exceeding £50 for the sale of injurious food and, for a second offence, imprisonment for six months with hard labour. Inspectors were empowered to make purchases of samples to be submitted for analysis, but appointment of analysts was still left optional. The definition of an adulterated article given in that act was essentially that still accepted at the present time, namely, "any article of food or drink or any drug mixed with any other substances, with intent fraudulently to increase its weight or bulk, without declaration of such admixture to any purchaser thereof before delivering the same." The adoption of the act was sporadic, and, outside London and a few large towns, the number of proceedings against offenders remained exceedingly small. Nevertheless complaints soon arose that it inflicted considerable injury and imposed heavy and undeserved penalties upon some respectable tradesmen, mainly owing to the "want of a clear understanding of what does and does not constitute adulteration," and in some cases to conflicting decisions and the inexperience of analysts.

Act of 1860.

1872.

Again a parliamentary committee was appointed which took a mass of evidence, the outcome of its inquiries being the Sale of Food and Drugs Act 1875, which is in force at the present day, subject to amendments and additions made at later dates. This act avoided the term "adulteration" altogether and endeavoured to give a clearer description of punishable offences:—

1875.

Section 6. "No person shall sell to the purchaser any article of food or any drug which is not of the nature, substance and quality of the article demanded by the purchaser under a penalty not exceeding £20; provided that an offence shall not be deemed to be committed under this section in the following cases: (1) where any matter or ingredient not injurious to health has been added to the food or drug because the same is required for the production or preparation thereof as an article of commerce, in a state fit for carriage or consumption, and not fraudulently to increase the bulk, weight or measure of the food or drug, or conceal the inferior quality thereof; (2) where the food or drug is a proprietary medicine, or is the subject of a patent in force and is supplied in the state required by the specification of the patent; (3) where the food or drug is compounded as in the act mentioned; (4) where the food or drug is unavoidably mixed with some extraneous matter in the process of collection or preparation."

Section 8. "No person shall be guilty of any such offence as aforesaid in respect to the sale of an article of food or a drug mixed with any matter or ingredient not injurious to health, and not intended fraudulently to increase its bulk, weight or measure, or conceal its inferior quality, if at the time of delivering such article or drug he shall supply to the person receiving the same a notice, by a label distinctly and legibly written or printed on or with the article or drug, to the effect that the same is mixed."

The act made the appointment of analysts compulsory upon the city of London, the vestries, county quarter sessions and town councils or boroughs having a separate police establishment. For the protection of the vendor, samples that had been purchased by the inspectors for analysis were to be offered to be divided into three parts, one to be submitted to the analyst, the second to be given to the vendor to be dealt with by him as he might deem fit, and the third to be retained by the inspector, and, at the discretion of the magistrate hearing any summons, to be submitted, in case of dispute, to the commissioners of inland revenue for analysis by the chemical laboratory at Somerset House. The public analyst had to give a certificate, couched in a prescribed form, to the person submitting any sample for analysis, which certificate was to be taken as evidence of the facts therein stated, in order to render the proceedings as inexpensive as practicable. If the defendant in any prosecution could prove to the satisfaction of the court that he had purchased the article under a warranty of genuineness, and that he sold it in the same state as when he purchased it, he was to be discharged from the prosecution, but no provision was made that in that event the giver of the warranty should be proceeded against.

Section 6, quoted above, gave rise to an immense amount of litigation, and already in 1879 it was found necessary to pass an amending act, making it clear that if a purchase was effected by an inspector with the intent to get the purchased article analysed, he was as much "prejudiced" if obtaining a sophisticated article as a private purchaser who purchased for his own use and consumption. The amending act also dealt in some small measure with a difficulty which immediately after passing the act was found to arise in ascertaining whether any article was "of the nature, substance and quality demanded by the purchaser" — "in determining whether an offence has been committed under section 6 by selling spirits not adulterated otherwise than by the admixture of water, it shall be a good defence to prove that such admixture has not reduced the spirit more than twenty-five degrees under proof for brandy, whisky or rum, or thirty-five under proof for gin." Almost insuperable difficulties as to the meaning of "nature, substance and quality" subsequently arose as regards every conceivable food material. As it was obviously impossible for parliament

1879.

to define every article, to lay down limits of composition within which it might vary, to specify the substances or ingredients that might enter into it, to limit the proportions of the unavoidable impurities that might be contained in it, the duty to do all this was left to the individual analysts. An enormous number of substances had to be analysed until sufficient evidence had been accumulated for the giving of correct opinions or certificates. Endless disputes unavoidably arose, friction with manufacturers and traders, unfortunately also with the referees at the inland revenue, who for many years were altogether out of touch with the analysts. Conflicting decisions come to by various benches of magistrates upon similar cases, allowing of the legal sale of an article in one district which in another had been declared illegal, rendered the position of merchants often unsatisfactory. It was not recognized by parliament until almost a quarter of a century had elapsed that it was not enough to compel local authorities to get samples analysed, but that it was also the duty of parliament to lay down specific and clear instructions that might enable the officers to do their work. This has only been very partially done even at the present time.

Difficulties of administration.

A curious condition of things arose out of the definition of "food" given in the act of 1875: "The term food shall include every article used for food or drink by man, other than drugs or water." It had been the practice of bakers to add alum to the flour from which bread was manufactured, in order to whiten the bread, and to permit the use of damaged and discoloured flour. This practice had been strongly condemned by chemists and physicians, because it rendered the bread indigestible and injurious to health. Shortly after the passing of the Food Act this objectionable practice was stamped out by numerous prosecutions, and alumed bread now no longer occurs. A large trade, however, continued to be carried on in baking powders consisting of alum and sodium bicarbonate. It was naturally thought that, as baking powder is sold with the obvious intention that it may enter into food, the vendors could also be proceeded against. The high court, however, held that, baking powder in itself not being an article of food, its sale could not be an offence under the Food Act. This anomaly was removed by a later act.

Under section 6 of the act of 1875 a defendant could be convicted, even if he had no guilty knowledge of the fact that the article he had sold was adulterated. In the repealed Adulteration Act of 1872 the words "to the knowledge of" were inserted, and they were found fatal to obtaining convictions. The general rule of the law is that the master is not criminally responsible for the acts of his servants if they are done without his knowledge or authority, but under the Food Act it was held (*Brown* v. *Foot*, 1892, 66 L.T. 649) that a master was liable for the watering of milk by one of his servants, although he had published a warning to them that they would be dismissed if found doing so. Milk might be adulterated during transit on the railway without the knowledge of the owner or receiver and yet the vendor was liable to conviction.

When it is brought to the knowledge of a purchaser that the article sold to him is not of the nature, substance or quality he demanded, the sale is not to the prejudice of the purchaser. The notice may be given verbally or by a label supplied with the article. A common law notice may also be given. In *Sandys* v. *Small*, 1878, 3 Q.B.D. 449, a publican had displayed a placard within the inn to the effect that the spirits sold in his establishment were watered. This was held, as it were, to contract him out of the Food Act. Similarly, in the case of butters that had been adulterated with milk, the vendors, by giving a general notice in the shop, evaded punishment under the act. A notice, is, however, of no avail if given under section 8 of the act, if the admixture has been made for fraudulent purposes. In *Liddiart* v. *Reece*, 44 J.P. 233, 1880, an inspector asked for coffee and received a packet with a label describing it as a mixture of coffee and chicory. It was sold at the price of coffee. It turned out to be a mixture containing 40% of chicory. The high court held that this was an excessive quantity, and was added for the purpose of fraudulently increasing the bulk or weight. In another case, however (*Otter* v. *Edgley*, 1893, 57 J.P. 457), where an inspector had asked for French coffee and had been supplied with a mixture containing 60% of chicory, the article being labelled as a mixture, the high court held that there was no evidence of fraud, and, in the case of cocoa, a mixture containing as little as 30% of cocoa and 70% of starch and sugar, the label stating it to be a mixture, was held to have been legally sold (*Jones* v. *Jones*, 1894, 58 J.P. 653). In this case the label notifying the admixture was hidden by a sheet of opaque white paper, nor had the purchaser's attention been called to it, but the price of the article was much lower than that of pure cocoa.

It is seen from these few instances, taken at random out of scores, that this clause of the act was far from clear and was very variously interpreted at the courts. The warranty clause (clause 25) also gave rise to an immense amount of litigation. In the earlier high court decisions a very narrow interpretation was given to the term "written warranty," but in later years a wider view prevailed. A general contract to supply a pure article is not a sufficient warranty unless with every delivery there is something to identify the delivery as part of the contract. An invoice containing merely a description of an article as "lard" or "pepper" is not a warranty; but if there be added the words "guaranteed pure" it is a sufficient warranty. A label upon an article is not in itself a warranty, but a label bearing the words "pure" or "unadulterated," coupled with an invoice which could be identified with the label, together were held to form an effective warranty.

As many thousands of samples were annually submitted by inspectors under the act to the analysts who had been appointed in 237 boroughs and districts, a very large number of cases led to disputes of law or fact, about seventy high court cases being decided within eighteen years of the passing of the act. While these cases related to a variety of different articles and conditions, dairy produce, namely milk and butter, led to the greatest amount of litigation. It may seem to be a simple matter to ascertain whether a vendor of milk supplies his customer with milk of the "nature, substance and quality demanded," but milk is subject to great variations in composition owing to a large number of circumstances which will be considered below.

Margarine Act.

Not many years after the passing of the Food Act of 1875 the sale of butter substitutes assumed very large proportions, and so seriously prejudiced dairy-farmers that, as regards these, an act was passed which was not exactly an amendment of the Sale of Food and Drugs Act, although it embodied a good many provisions of that act. It was called the Margarine Act 1887. It provided that every package of articles made in imitation of butter should be labelled "margarine" in letters 1½ inches square. The vendor, however, was protected if he could show a warranty or invoice, whereas in the Sale of Food and Drugs Act he was not protected by invoice merely. Inspectors might take samples of "any butter or substitute purporting to be butter" without going through the form of purchase. The maximum penalty was raised from £20 as provided by the Food Act, to £50 in the case of a first and to £100 in the case of repeated conviction. The Margarine Act is the first statute that makes reference to and sanctions the use of preservatives, concerning which a good deal will have to be said farther on.

Select committee, 1894.

In the course of twenty years of administration of the Food Acts so many difficulties had arisen in reference to the various points referred to, that in 1894 a select committee was appointed to inquire into the working of the various acts and to report whether any, and if so what, amendments were desirable. During three sessions the committee sat and took voluminous evidence. They reported that where the acts had been well administered they had been most beneficial in diminishing adulteration offences. Forms of adulteration which were common prior to the passing of the 1875 act, such as the introduction of alum into bread, and the colouring of confectionery with poisonous material, had almost entirely disappeared. A close connexion had been shown to exist between the extent of adulteration and the number of articles submitted for analysis under the acts, the proportion of adulterated samples being found to diminish as the number of samples taken relatively to the population increased. Thus, in 1890, in Somersetshire one sample had been analysed for every 370 persons, the percentage of adulterated samples in those taken for analysis being as low as 3·6; in Gloucestershire one to 770 persons with 6·2 of adulteration; in Bedfordshire one to 821 with 7·1; in Derbyshire one to 3164 with 17·1 %, and in Oxford one sample to 14,963 inhabitants with no less than 41·7 % of adulterated samples. The number of samples of articles annually submitted to analysis, according to the returns obtained by the Local Government Board, steadily increased from the commencement onward. Whereas in 1877, 14,706 samples, and in 1883, 19,648 samples were analysed, in 1904–1905 the number was no less than 84,678, or an average of one sample to 384 inhabitants for the whole country. In the five years 1877–1881 the proportion found adulterated was 16·2 %; in the following five years ending with 1886, the percentage was 13·9; in the five years ending 1891, the percentage was 11·7; and in the year 1904 the percentage was only 8·5. The select committee found that wide local differences in the administration of the acts existed, and that in many parts of the country the local authorities had failed to exercise their powers. In one metropolitan district, eight members of the local authority had been convicted of offences under the acts, upon evidence obtained by their own inspector. The result was that the duties of the inspector of the acts were afterwards controlled by a committee of that local authority, who decided the cases in which prosecutions should be undertaken, and the administration of the acts was "little better than a farce." No power existed to compel local authorities to carry out the acts. The committee came to the conclusion that in many cases the responsibility for the adulteration of articles of food did not rest with the retailer but with the wholesale dealer or manufacturer; that the law punished petty offences and left great ones untouched; that it fined a small retailer and left the wholesale offender scot free. As regards warranty, they thought that the precedent created by the Margarine Act should be followed generally, and that invoices and equivalent documents should have the force of warranties. They found that a considerable proportion of the food imports were adulterated, out of 890 samples of butter taken by the customs in 1895 no less than 106 being impure, and they recommended that in addition to tea, which by section 30 of the act of 1875 was to be systematically analysed by the customs, prior to being passed for distribution, samples of all food imports should be taken and examined by the customs. The committee further found that the penalties imposed under the acts had for the most part been trifling and quite insufficient to serve as deterrents, the profits derived from the sale of adulterated articles being out of proportion great to the insignificant fines imposed, and they recommended that for the second offence the penalty of £5 should be the minimum one, and that in respect to third or subsequent offences imprisonment without the option of a fine might be inflicted. The important question of food standards was considered at great length. The absence of legal standards or definitions of articles of food had occasioned great difficulty in numerous cases, but as no authority was provided by the existing acts that might fix such standards, they recommended the formation of a scientific authority or court of reference composed of representatives of the laboratory of the Inland Revenue, of the Local Government Board, the Board of Agriculture, the General Medical Council, the Institute of Chemistry, the Pharmaceutical Society, of other scientific men and of the trading and manufacturing community, who should have the duty of fixing standards of quality and purity of food to be confirmed by a secretary of state.

Act of 1899.

The committee's deliberations and recommendations resulted in the Sale of Food and Drugs Act 1899. This unfortunately was not a comprehensive act superseding the previous acts, but was an additional and amending one, so that at the present time four food acts run parallel and are together in force, rendering the subject from a legal point of view one of extreme complexity. In this act the growing influence of the Board of Agriculture and the desire to assist farmers and dairymen more decisively than previously are clearly apparent. Section 1 empowers the customs to take samples of consignments of imported articles of food and enjoins them to communicate to the Board of Agriculture the names of the importers of adulterated goods, any article of food to be considered adulterated or impoverished if it has been mixed with any other substance (other than preservative or colouring matter, of such a nature and such a quantity as not to render the article injurious to health), or if any part of it has been abstracted to the detriment of the article. Margarine or cheese containing margarine has to be conspicuously marked as such; condensed, separated or skim milk has to be clearly labelled "machine-skimmed milk" or "skimmed milk," as the case may be. The next sections give to the Local Government Board and the Board of Agriculture a roving commission to see that the acts are properly enforced throughout the kingdom so as to apply the acts more equally throughout the country than heretofore, and in default of local authorities carrying out their duties empower the government departments mentioned to execute and enforce the acts at the expense of the local authorities. The importance of a regular and conscientious control of the public food supply by the local authorities was thus for the first time, after forty years of experimental legislation, fully acknowledged. In recognition of the great difficulties experienced for many years by analysts in their endeavour to fix minimum percentages for the fat and other milk constituents, and their inability to do so without statutory powers, the Board of Agriculture is authorized by section 4 to make regulations "for determining what deficiency in any of the normal constituents of genuine milk, cream, butter or cheese, or what addition of extraneous matter or proportion of water" in any of these materials shall raise a presumption, until the contrary is proved, that these articles are not genuine. In pursuance of these powers the Board of Agriculture did in 1901 issue their milk regulations, adopting officially the minima agreed upon by public analysts, and in 1902 the sale of butter regulations, which fixed 16 % as the maximum of water that might be contained in butter. It is important to note that the fact of a sample of milk falling short of the standard is not conclusive evidence of adulteration, but it justifies the institution of proceedings and casts the onus of proving that the sample is genuine upon the defendant. The Margarine Act of 1887 was extended to margarine cheese, the obligatory labelling of margarine packages was more precisely regulated, margarine manufacturers and dealers in that article were compelled to keep a register open to inspection by the Board of Agriculture, showing the quantity and designation of each consignment, and power was given to officers of the board to enter at all reasonable times manufactories of margarine and margarine cheese. The amount of butter-fat that might be present in margarine was limited to 10 %, while under the Margarine Act of 1887 an unlimited admixture might have been made, provided that the mixture, no matter how large the percentage of butter, was sold as margarine. As is further explained below, the difficulty of distinguishing without chemical aid between pure butter and margarine containing a considerable percentage of butter is very great, and fraudulent sales continued to be common after the passing of the Margarine Act. The labelling section of the Food Act 1875 (§ 8), which had been systematically circumvented, was modified, a label being no longer recognized as distinctly and legibly written or printed, unless it is so written or printed that the notice of mixture given by the label is not obscured by other matter on the label, though labels that had been continuously in use for at least seven years before the commencement of the act were not interfered with. In consequence of the admitted unfairness of asking for a portion of the contents of a properly labelled tin or package and then instituting proceedings because no declaration of admixture had been made, it was enacted that no person shall be required to sell any article exposed for sale in an unopened tin or packet, except in the unopened tin or packet in which it is contained. This removed a grievance which had long been felt both by retailers and manufacturers, and is a provision of growing importance with the continually increasing sale of articles put up in factories. The warranty provisions, which, as before stated, had given rise to much litigation, were more clearly defined. A notice that a defendant would rely for his defence upon a warranty had to be given within seven days of the service of the summons or the defence would not be available, and the warrantor was empowered to appear at the hearing and to give evidence so that no man's name could, as sometimes previously happened, be dragged into a case without due notice to him. A warranty or invoice given by a person resident outside the United Kingdom was no longer recognized as a defence, unless the defendant could prove that he had taken reasonable steps to ascertain and did in fact believe in the accuracy of the statement contained in the warranty. This prevented collusion between a foreign shipper and an importer; and, lastly, the definition of "food" was widened (in view of the baking-powder decision) so that the term food "shall include every article used for food or drink by man, other than drugs or water, and any article which ordinarily enters into or is used in the composition or preparation of human food, and shall also include flavoring matters and condiments."

The act of 1899 embodies, with one exception, the most important recommendations of the Food Products Committee, the exception being the omission of instituting a board of reference that might deal with difficulties as they arose, guide analysts and public authorities in fixing limits for articles other than milk and butter, and take up the important questions of preservatives and colouring matters and such like. An occurrence which almost immediately followed the passing of the act showed in the strongest manner the necessity of such guiding board—namely, the outbreak of arsenical poisoning in the Midlands in the latter part of 1900.

Arsenic in foods.

In the month of June 1900 there occurred, mainly in the Midlands but also in other parts of England and Wales, an outbreak of an illness variously described as "alcoholism," "peripheral neuritis" or "multiple neuritis." This affected about 6000 persons and resulted in about 70 deaths. It was soon ascertained that the sufferers were all beer drinkers, and several of them were employees of a local brewery, the majority of whom had suffered for some months past. Although suspicion fell early upon beer, some considerable time elapsed before Dr E. S. Reynolds of Manchester discovered arsenic in dangerous proportions in the beer. Steps were immediately taken by brewers and sanitary authorities to ensure that this arsenical beer was withdrawn from sale, and, as a result, the epidemic came speedily to an end. In all instances where this epidemic of sickness had been traced to particular breweries, the latter had been users of brewing sugars—glucose and invert sugar—supplied by a single firm. The quantity of arsenic detected in specimens of these brewing sugars was in some cases very large, amounting to upward of four grains per pound. The implicated brewing sugars were found to have become contaminated by arsenic in course of their manufacture through the use of sulphuric acid, some specimens of which contained as much as 2·6% of arsenic. The acid had been made from highly arsenical iron pyrites, and as the manufacturers of the glucose had not specifically contracted with the acid makers for pure acid, the latter, not knowing for what purpose the acid was to be used, had felt themselves justified in supplying impure acid. A royal commission was appointed in February 1901, with Lord Kelvin as chairman, to inquire into the matter, and an enormous amount of attention was naturally given to it by chemists and medical men. It was soon found that arsenic was very widely disseminated in two classes of food materials, namely, such as had been dried or roasted in gases resulting from the combustion of coal, and such as had been more or less chemically manufactured. All coal contains iron pyrites, and this mineral again is contaminated with arsenic. When the coal is burned the fumes are arsenical and part of the arsenic condenses and deposits. Malt dried in English malt kilns was found to be almost invariably arsenical, and there cannot be a doubt that English beers had for many years past been thus contaminated. At the present time coal virtually free from arsenic is selected for malting, or Newlands' process, consisting of the admixture with coal of lime which renders the arsenic non-volatile, is adopted, and malt free from all but the merest traces of arsenic is manufactured. Part of the arsenic remains in the coal-ashes and wherever these deposit arsenic can be traced. Sir Edward Frankland had, many years previously, detected arsenic in the London atmosphere. Chicory roasted with coal, steaks and chops grilled over an open fire, thus obtain a minute arsenical dosing. In sugar refineries carbonic acid gas is, at one stage of the process, passed through the liquor for the purpose of precipitating lime or strontia. When this carbonic acid is derived from coal the sugar often shows traces of arsenic. When arsenical malt or sugar infusion is fermented, as in brewing, the yeast precipitates upon itself a considerable proportion of the impurity, thus partly cleaning the beer, but all preparations made from yeast—yeast-extracts resemble to some extent meat extracts, with which they are sometimes fraudulently mixed—are thus exposed to arsenical contamination. On the continent of Europe malt is not dried in kilns with direct access of combustion gases but on floors heated from beneath, and continental beers therefore have not been found arsenical. The second class of causes of contamination consists of chemicals. The most important chemical product is sulphuric acid. This used to be made from brimstone or native volcanic sulphur, which is virtually free from arsenic. But since about 1860 sulphuric acid has been more largely made from iron or copper pyrites. Pyrites-acid is always arsenical, but can, by suitable treatment, be easily freed from that impurity. For many purposes acid that has not been purified is employed. In the Leblanc process of manufacture the first step is the conversion of salt into sodium sulphate by sulphuric acid. The hydrochloric acid which is formed carries with it most of the arsenic of the sulphuric acid. Wherever such hydrochloric acid is used it introduces arsenic; thus, in the separation of glycerin from soap lyes, the alkali of the latter is neutralized with hydrochloric acid and glycerin is in consequence frequently highly arsenical. So is the soda produced in the Leblanc process, and every one of the numerous soda salts made from soda is liable to receive its share. All acids liberated from their salts by sulphuric acid, such as phosphoric, tartaric, citric, boracic, may be, and sometimes are, thus contaminated. All superphosphates, made by the action of crude sulphuric acid upon bones or other phosphatic materials, and sulphate of ammonia, made from gas-liquor and acid, that is to say, two of the most important manurial materials, are arsenical, and the poison is thus spread far and wide over meadows and fields, and can be traced in the soil wherever artificial manures have been applied. The crops sometimes take up arsenic to a slight extent, but happily the plant is more selective than man, and no serious amount of poison absorption appears to be possible. The risk of contamination is, of course, much greater with substances which, like glucose, are not further purified by crystallization, but retain whatever impurity is introduced into them. Glucose is not only used in beer, in which by legal enactments it is permitted to be used, but is also substituted for sugar in a number of food products, and is liable to carry into them its contamination. Sugar confectionery, jams and marmalade, honey, and such like, are often admixed with glucose. It is difficult to say in the present state of the law whether such admixture amounts to adulteration. It was clearly made originally for fraudulent purposes, but usage and high court decisions have gradually given the practice an air of respectability. Vinegar of sorts is also made from a glucose liquor produced by the action of sulphuric acid upon maize or other starchy material, and is, in its turn, exposed to arsenic contamination. There is hardly a chemical substance which has directly or indirectly come into contact with sulphuric acid that is not at times arsenical. Thus, while artificial colours, now so much used for the dyeing of food products, are no longer prepared—as was rosaniline (the parent substance of so many aniline dyes) at an early stage of its manufacture—with arsenic acid, yet they are often contaminated indirectly from sulphuric acid. Furthermore, hardly any metal that results from the smelting of any ore with coal is free from arsenic, iron in particular, as employed for pots and pans and implements, being highly arsenical. From the iron the many chemical preparations which contain or are made with the aid of iron salts may be arsenicated. The general presence of arsenic from some of these causes has been known for many years; outbreaks of arsenical poisoning have been due to it at various times, but neglect, forgetfulness and human shortsightedness let the matter go into oblivion, and it is safe to predict, in spite of all attention which has been given to the subject, of the panic which was created by the beer-poisoning outbreak, of the shock and injury caused to manufacturers of many kinds, and of the watchfulness aroused in officers of health and analysts, that as long as the production of food materials or substances that go into food materials is not left to the care of nature, and as long as man adds the products of his ingenuity to our food and drink, so long will "accidents," like the Manchester poisoning, from time to time recur. We now search for arsenic; some other time it is lead, or antimony, or selenium, that will do the mischief. Man does what he can according to his light, but he sees but a little patch of the sky of knowledge, while the plant or the animal building up its body from the plant has learned by inheritance to avoid the assimilation of matters noxious to it. Strictly speaking, arsenical poisoning does not belong to the subject of adulteration. It is not due to wilfulness but to stupidity, but it affords a lesson which cannot be taken too much to heart, that mankind, by relying too much upon "science" in feeding, is on a path that is fraught with considerable danger.

To safeguard consumers, as far as practicable, the royal commission made important recommendations concerning amendments of the Food Acts; these, as at present interpreted and administered, were reported to be unsatisfactory for the purpose of protecting the consumer against arsenic and other deleterious substances in food. "As a rule public analysts receive samples in order that they may pronounce upon their genuineness or otherwise, knowing nothing of the local circumstances which led to their being taken, of their origin or the reasons for sending them. The term 'genuine' in this sense means that the analyst has not detected such objectionable substances as he has considered it necessary to look for in the sample submitted to him. Obviously, the value of the statement that the sample is 'genuine' depends upon the extent to which the analyst has means of knowing what are the objectionable substances which it is liable to contain. In present circumstances he has not sufficient information on this point." It was also pointed out that the application of the Food Acts to prevention of contamination of foods by deleterious substances was materially hindered by want of an official authority with the duty of dealing with the various medical, chemical and technical questions involved, and that the absence of official standards militated against the efficiency of the existing acts. The commission advised that a special officer be appointed by the Local Government Board to obtain by inquiries from various sources, such information as would enable the board to direct the work of local authorities in securing greater purity of food; and they further recommended that the board or court of reference, which had been advised by the Committee on Food Products Adulteration, should be established. Pending the establishment of official standards in respect of arsenic under the Food Acts, they were of opinion that penalties should be imposed upon any vendor of beer or any other liquid food, or of any liquor entering into the composition of food, if that liquid be shown by adequate test to contain one-hundredth of a grain or more of arsenic in the gallon, and with regard to solid food, no matter whether it be consumed habitually in large or small quantities, or whether it be taken by itself (like golden syrup), or mixed with water or other substances (like chicory or yeast extract)—if the substance contain one-hundredth of a grain of arsenic or more to the pound. The board of reference, most urgently needed for the protection of the public and for the guidance of manufacturers and officers, has yet to be created.

Preservatives in food.

While from time immemorial certain articles of food have been preserved by salting, smoking, drying, or by the addition of sugar and in some cases of saltpetre, during the last quarter of the 19th century the use of chemicals acting more powerfully as antiseptics or preservatives extended enormously, particularly in England. A very large fraction of the British food supply being obtained from abroad, a proportionately great difficulty exists in obtaining the food in an entirely fresh and untainted condition. While refrigeration and cold-storage has been the chief factor in enabling the meat and other highly perishable foods to be imported, other steps, ensuring preservation of goods that are collected from farmers and brought together at shipping ports, are necessary to prevent decomposition prior to such goods coming into cold store. Thus it is well-nigh impossible to collect butter from farms in Australia or New Zealand far distant from the coast without the addition of some chemical preservative. Heavily salted goods no longer appeal to the modern palate, and, with the progress of specialized labour, the inhabitants, especially of great towns, have become accustomed to resort to manufactured provisions instead of the home-made and home-cooked food. Manufacturers of many articles of preserved food gradually adopted the use of chemical preservatives, and at the present time the practice has become so general that it may be said that practically every person in the United Kingdom who has passed the suckling stage consumes daily more or less food containing chemical preservatives. The Food Act allows of the addition of any ingredient, not injurious to health, if it be required for the production or preparation of the food, or as an article of commerce, in a state fit for carriage. The legality or otherwise of the use of chemical preservatives, therefore, hinges upon their innocuousness. Upon theoretical considerations it is clear that a substance which is capable of acting as an antiseptic must act injuriously upon bacteria, fungi or yeasts, and as the human body is, generally speaking, less resistant to poisons than the low organisms in question, it would seem to follow that antiseptics are bound to affect it injuriously. It is, of course, a question of dose and proportion. It has further been said that all antiseptics possess some sort of medicinal action, and however valuable they may be in disease when administered under the control of a competent physician, they have no business to be given indiscriminately to sick and healthy alike by purveyors of food. The result of a general desire on the part of importers and manufacturers of food materials, of the officers under the Food Act, of the medical profession and of the public, resulted after many years of agitation and complaint and after numerous conflicting magisterial decisions, in the appointment in 1899, by the president of the Local Government Board, of a departmental committee to inquire into the use of preservatives and colouring matters in food, with the reference to report: first, whether the use of such materials or any of them, in certain quantities, is injurious to health, and, if so, in what proportion does their use become injurious, and, second, to what extent and in what amounts are they used at the present time. After the examination of a great number of witnesses a report was issued in 1901. Perhaps the most important conclusion was that the instances of actual harm which were alleged to have occurred from the consumption of articles of food and drink chemically preserved were few in number, and were not at all supported by conclusive evidence. During the period which has elapsed since chemically preserved food has been used, the mortality as a whole has declined, and while this naturally cannot be put to the credit of the preservatives but is largely due to better feeding in consequence of the introduction of cheaper foods, which are rendered possible to some extent by the use of preservatives, it conclusively establishes the fact that no obvious harm has been done to the health of the community. The committee made certain recommendations which are the most authoritative pronouncements upon the subject. They are as follows:—That the use of formaldehyde or formalin, or preparations thereof, in food or drinks, be absolutely prohibited, and that salicylic acid be not used in a greater proportion than one grain per pint in liquid food and one grain per pound in solid food, its presence in all cases to be declared. That the use of any preservatives or colouring matter whatever in milk offered for sale in the United Kingdom be constituted an offence under the Sale of Food and Drugs Act. That the only preservative which it shall be lawful to use in cream be boric acid, or mixtures of boric acid and borax, and in amount not exceeding 0·25 % expressed as boric acid, the amount of such preservative to be notified by a label upon the vessel. That the only preservative permitted to be used in butter and margarine be boric acid, or mixtures of boric acid and borax, to be used in proportions not exceeding 0·5 % expressed as boric acid. That in the case of all dietetic preparations intended for the use of invalids or infants, chemical preservatives of all kinds be prohibited.

Borax.

As the most commonly used chemical preservative is boric acid, free or in the form of borax, which is extensively employed in butter, cream, ham, sausages, potted meats, cured fish, and sometimes in jams and preserved fruit, the arguments for and against its employment deserve more detailed attention. It cannot be looked upon in the light of common adulteration because, in any case, the quantity used is but an inconsiderable fraction, and the cost of it is generally greater than that of the food itself. It is not used to hide any traces of decomposition that may have taken place or to efface its effects. On the other hand, it cannot be said to be "required for the production or preparation" of the articles with which it is mixed, since a fraction at least of similar articles are made without preservative. It enables food to be kept from decomposition, but it also lessens the need for cleanliness and encourages neglect and slovenliness in factories. It has no taste, or only a very slight one, hence does not manifest itself to the consumer in the same way as does common salt, and cannot therefore be avoided by him should he desire to do so. Its preservative action, that is, its potency, is very slight in comparison with most other preservatives; its potential injuriousness to man must be proportionately small. It is practically without interference upon salivary, peptic or tryptic digestion, unless given in large quantities. Experiments made by F. W. Tunnicliffe and R. Rosenheim upon children showed that neither boric acid nor borax, administered in doses of from 15 to 23 grains per diem, exerted any influence upon proteid metabolism or upon the assimilation of phosphatized materials. The fat assimilation was, if anything, improved, and the body weight increased, and the general health and well-being was in no way affected. On the other hand, evidence was adduced that in some cases digestive disturbances, after continuous administration of from 15 to 40 grains, were observable, nausea and vomiting in some, and skin irritation, in one case resulting in complete baldness, in others.

Although it is in most cases very difficult to trace any gastric disturbance to any particular article of food or one of its ingredients, so as to exclude all other possible causes of disturbance, a fairly good case has been made out by a number of medical practitioners against boracic acid, taken in an ordinary diet and not for experimental purposes. The most exhaustive investigation which has as yet been made was carried out by Dr H. W. Wiley, chief chemist to the United States department of agriculture. A large number of young men who had offered themselves as subjects for the investigations, were boarded as a special "hygienic table," but otherwise continued their usual vocations during the whole period of the experiment. They were placed upon their honour to observe the rules and regulations prepared by the department and to use no other food or drink than that provided, water excepted, and any water consumed away from the hygienic table was to be measured and reported. They were to continue their regular habits and not to indulge in any excessive amount of labour or exercise. Weight, temperature and pulse rate were continuously recorded. The periods during which the subjects of the experiment were kept under observation varied from thirty to seventy days, periods of rest being given during which they were permitted to eat moderately at tables other than the experimental one. There was a good and ample diet. The observations were divided into three periods: the fore period, the preservative period and the after period, during the whole of which time the rations of each member were weighed or measured and the excreta collected. Before the "fore" period was commenced a note was made of the quantities of food voluntarily consumed by each of the candidates, and from these the proper amount necessary in each case to maintain a comparatively constant body weight was calculated. When a suitable result was thus arrived at, the same quantity of food was given daily during the "preservative" and "after" periods. The preservative was given in the forms of borax and of boric acid, at first mixed with butter, but subsequently in gelatine capsules. This was found to be necessary from the fact that when the preservative was mixed with the food and concealed in it some of the members of the table evinced dislike of the food with which it was supposed to be incorporated; those who thought that the preservative was in the butter were disposed to find the butter unpalatable, and the same was true with those who thought it might be in the milk or coffee, while, when the preservative was given openly, much less disturbance was created. The preservative was given at first in small doses such as might be consumed in commercial food that had been preserved with borax; gradually the quantities were increased in order to reach the limit of toleration for each individual. All food was weighed, measured and analysed, the same being the case with the excreta. The blood was examined periodically as regards colouring matter and number of corpuscles. Everything was done to keep up the general health of the members and to do away with all unfavourable mental influences due to the circumstances. During the time of the experiment analyses were made of 2550 food samples and 1175 samples each of urine and faeces. The general results were as follows: there was no tendency to excite diarrhoea, and the nitrogen-metabolism was but very little influenced, if anything being slightly decreased. As regards phosphorus the combined results of all observations indicated that the preservative increased the excretion of phosphorus to a small extent, from 97·3 % in the "fore" period, to 103·1 in the "preservative" period. The metabolism of fat was uninfluenced; there was an increase of the solid matters in the faeces and a decrease of those in the urine, from which Dr Wiley concluded that the preservatives interfered with the process of digestion and absorption. No influence was exerted on the corpuscles and the haemoglobin of the blood. The effect of boracic acid and borax on the general health varied with the amount administered, quantities not exceeding half a gramme (7½ grains) of boracic acid, or its equivalent of borax, producing no immediate effects, but the long-continued administration of such small doses seemed to produce the same results as the use of large doses over a shorter period. There was a tendency to diminish the appetite and to produce a feeling of fulness and uneasiness in the stomach and sometimes actual nausea, also one of fulness in the head manifested as a dull headache which disappeared when the preservative was dropped. The continued administration of large doses, 60 to 75 grains per day, resulted in most cases in loss of appetite, inability to perform work of any kind and general unfitness. In most cases 45 grains per day could be taken for some time, but gradually injurious effects were observed. In some cases 30 and even 15 grains per day appeared to cause illness, but it is acknowledged that these persons may have been suffering from influenza. The administration of 7·5 grains was declared by Dr Wiley to be too much for the normal man to receive regularly, although for a limited period there might be no danger to health. Dr Wiley concludes his report: "It appears, therefore, that both boric acid and borax, when continuously administered in small doses for a long period or when given in large quantities for a short period, create disturbance of appetite, of digestion and of health."

Dr Wiley's conclusions were adversely criticized by Dr O. Liebreich, who carefully studied on the spot all the conditions of the experiment and the documents relating to the investigation. He pointed out that the results were so indefinite and the number of persons under control so small that "one case of self-deception or of forgetfulness only would throw into absolute uncertainty the solution of the whole question"; that no lasting injury to health was found in spite of transient disturbances attributed by Dr Liebreich to other causes, and that all persons declared themselves to be in better physical condition after seven months than they had been before. On the whole the balance of evidence seems to be that while no acute injury is likely to result from boron compounds in food, they are liable to produce slighter digestive interferences.

Formaldehyde.

Other chemical substances that are in use for the purpose of preserving food materials may be treated more shortly. Formaldehyde, coming into commerce in the form of a 40 % solution under the name of formalin, was for a time largely used in milk. It certainly has very great antiseptic properties, as little as 1 part in 50,000 parts checking the growth of organisms in milk for some hours, but as the substance combines with albuminous matters and hardens them to an extraordinary degree, rendering, for instance, gelatine perfectly insoluble in water, it exerts an inhibitory effect on the digestive ferments. It injures salivary, peptic and pancreatic digestion. A set of five kittens fed with milk containing 1 part in 50,000 of formaldehyde for seven weeks were strongly retarded in growth, three ultimately dying, while four control kittens fed on pure milk flourished. In even moderate doses formalin produces severe pains in the abdomen and has caused death. It is now generally recognized as a substance that is admirably adapted for disinfecting a sick-room, but quite improper and unsuitable for food preservation.

Salicylic acid.

Salicylic acid or orthohydroxybenzoic acid is either obtained from oil of winter-green or is made synthetically by Kolbe's process from phenol and carbonic acid. Artificial salicylic acid generally contains impurities (creasotic acids) which act very injuriously upon health. When pure, salicylic acid employed as a food preservative has never produced decided injurious effects, although administered by itself in fairly strong solution it acts as an irritant to the stomach and kidneys, and sometimes causes skin eruptions. It is a powerful drug in larger doses and requires careful administration, especially as about 60 % of the persons to whom it is administered show symptoms known as "salicylism," namely, deafness, headache, delirium, vomiting, sometimes haemorrhage or heart-failure. It is doubtful whether pure salicylic acid produces these symptoms. When present in proportion of 1 to 1000 it inhibits the growth of moulds and yeasts. In jams 2 grains per pound and in beverages 7 grains to a gallon are considered by manufacturers to be sufficient for preservative purposes. It is used mainly in articles of food or drink containing sugar, that is to say, in jams and preserved fruit, lime and lemon juices, syrups, cider, British wines and imported lager. Its use in butter, potted meat, milk or cream, in which it was not infrequently met with formerly, is now quite exceptional. It has already been stated that the preservative committee recommended its permissive use in small proportions. To some extent benzoic acid and benzoates have taken the place of salicylic acid and salicylates, partly because salicylic acid can readily be detected analytically, while benzoic acid is not quite easily discoverable. Its antiseptic potency is about equal to that of salicylic acid, and the arguments for or against its use are similar to those relating to the latter.

For the preservation of meat and beer, lime juice and dried fruit, sulphur dioxide (sulphurous acid) and some of the sulphites have long been employed. Sulphuring of hops and disinfection of barrels by burning brimstone matches is an exceedingly old practice. Burning sulphur is well known as a gaseous disinfectant of rooms, bacteria being killed in air containing 1 % of the gas. As the taste and smell of sulphurous acid and of sulphites are very pronounced it follows that but small quantities can be added to food or drink. About 1 part in 4000 or 5000 of beer is the usual amount. While, in larger quantities, the sulphites have decided physiological activity and are apt to produce nephritis, there is not any evidence that they have ever caused injurious effects in alcoholic liquors. The excise authorities have tacitly sanctioned their employment in breweries, although the Customs and Inland Revenue Act 1885 declares that a brewer of beer shall not add any matter or thing thereto except finings or other matter or thing sanctioned by the commissioners of Inland Revenue, and although sulphites are used in all breweries, the Board of Inland Revenue do neither sanction nor interfere. An antiseptic with a pronounced taste is obviously a safer one in the hands of a non-medical person than one virtually devoid of taste, like boric, salicylic or benzoic acids or their salts.

Other preservatives.

Sodium fluoride, a salt possessing powerfully antiseptic properties, but also at the same time clearly injurious to health and interfering with salivary and peptic digestion, has been found in butter, imported mainly from Brittany, in quantities quite inadmissible in food under any circumstances. A few other chemical preservatives are occasionally used. Hydrogen peroxide has been found affective in milk sterilization, and if the substance is pure, no serious objection can be raised against it. Saccharine, and other artificial sweetening agents, having antiseptic properties, are taking the place of sugar in beverages like ginger-beer and lemonade, but the substitution of a trace of a substance that provides sweetness without at the same time giving the substance and food value of sugar is strongly to be deprecated.

The employment of chemical preservative matters in articles intended for human consumption threatens to become a grave danger to health or well-being. Each dealer in food contributes but a little; each one claims that his particular article of food cannot be brought into commerce without preservative, and each condemns the use of these substances by others. There is doubtless something to be said for the practice, but infinitely more against it. It cheapens food by allowing its collection in districts far away, but the chief gainer is not the public as a whole but the manufacturer and the wholesale merchant. Our body has by inheritance acquired habits and needs that are quite foreign to chemical interference. Some day, artificially prepared foods, containing liberal quantities of matters that are not now food ingredients, may conceivably compare with natural food products, but that day is not yet, and meantime it ought to be clearly the duty of the state to see that the evil is checked. The intention which has introduced this form of adulteration may be more or less beneficent, but in practice it is almost wholly evil.

Colouring matter in food.

A similar criticism applies to the continually extending use of colouring matter in food. Civilized man requires his food not only to be healthy and tasty, but also attractive in appearance. It is the art of the cook to prepare dishes that please the eye. This is a difficult art, for the various colouring matters which are naturally present in meat and fish, in fruit, legumes and green vegetables are of a delicate and changeable nature and easily affected or destroyed by cooking. Many years ago some artful, if stupid, cook found that green vegetables like peas or spinach, when cooked in a copper pan, by preference a dirty one, showed a far more brilliant colour than the same vegetables cooked in earthenware or iron. The manufacturer who puts up substances like peas in pots or tins for sale produces the same effect which the cook in her ignorance innocently obtained, by the wilful addition of a substance known to be injurious to health, namely, sulphate of copper. The copper combines with the chlorophyll, forming copper phyllocyanate, which, by reason of its insolubility in the gastric juice, is comparatively innocuous. Preserved peas and beans have been for so many years "coppered" in this manner that it is difficult to induce the public to accept these vegetables when possessed of their natural colour only. Several countries endeavoured to abolish the objectionable practice, but the public pressure has been too great, and to-day the practice is almost universal. In England the amount of copper corresponds to from one to two grains per pound of the vegetable calculated as crystallized copper sulphate. The opinion of the departmental committee was clearly expressed that the practice should be prohibited. No effect has been given to the recommendation.

Milk is naturally almost white with a tint of cream colour. When adulterated with water this tint changes to a bluish one. To hide this tell-tale of a fraud, a yellow colouring matter used to be added by London milkmen. Very gradually this practice, which had its origin in fraud, has extended to all milk sold in London. The consumer, mis-educated into believing milk to be yellow, now requires it to be so. Large dairy companies have endeavoured to wean the public of its error, without success. From milk the practice extended to butter; natural butter is sometimes yellowish, mostly a faint fawn, and sometimes almost white. In agricultural districts this is well known and taken as a matter of course. In big towns, where the connexion of butter and the cow is not well known, the consumer requires butter to be of that colour which he imagines to be butter-colour. Anatto, turmeric, carrot-juice used formerly to be employed for colouring milk, butter and cheese, but of late certain aniline dyes, mostly quite as harmless physiologically as the vegetable dyes just mentioned, are largely being used. The same aniline dyes are also employed in the manufacture of an imitation Demerara sugar from white beet sugar crystals. Aniline dyes are very frequently used by jam-makers; the natural colour of the fruit is apt to suffer in the boiling-pan, and unripe, discoloured or unsound fruit can be made brilliant and enticing by dye. The brilliant colours of cheap sugar confectionery are almost invariably produced by artificial tar-colours. Most members of this class of colouring matters are quite harmless, especially in the small quantities that are required for colouring, but there are a few exceptions, picric acid, dinitrocresol, Martius-yellow, Bismarck brown and one of the tropaeolins being distinctly poisonous. On the whole, the employment of powerful aniline dyes is an advance as compared with the use of the vicious and often highly poisonous mineral colours which Hassall met with so frequently in the middle of the 19th century. Mineral colours, with very few exceptions, are no longer used in food. Oxide of iron or ochre is still very often found in potted meats, fish sauces and chocolates; dioxide of manganese is admixed with cheap chocolates. All lump sugar of commerce is dyed. Naturally it has a yellow tint. Ultramarine is added to it and counteracts the yellowness. In the same way our linen is naturally yellow and only made to look white by the use of the blue-bag.

The same idea underlies both practices, and indeed the use of all colouring matters in manufactured articles, namely, to make them look better than they would otherwise. Within bounds, this is a reasonable and laudable desire, but it also covers many sins—poor materials, bad workmanship, faulty manufacturing and often fraud. Like sugar, flour and rice are sometimes blued to make them look white. All vinegar, most beers, all stout, are artificially coloured with burnt sugar or caramel. The line dividing the legitimate and laudable from the fraudulent and punishable is so thin and difficult to draw that neither the law nor its officers have ventured to draw it, and yet it is a matter which urgently requires regulation at the hands of the state. Practices which, when new, admit of regulation are almost ineradicable when they have become old and possessed of "vested rights." Recognizing this, the departmental committee, like the royal commission on arsenical poisons, recommended that "means be provided, either by the establishment of a separate court of reference, or by the imposition of more direct obligation on the Local Government Board, to exercise supervision over the use of preservatives and colouring matters in foods and to prepare schedules of such as may be considered inimical to the public health."

Metallic impurities.

In close connexion with this subject is the occasional occurrence of injurious metallic impurities in food-materials. Tin chloride is used in the West Indies to produce the yellow colour of Demerara sugar. The old processes of sugar-boiling left some of the brown syrup attached to the crystals, giving them both their colour and their delicious aroma; with the introduction of modern processes affording a much greater yield of highly refined sugar, white sugar only was the result. The consumer, accustomed to yellow sugar, had the colour artificially supplied by the action of the tin compound upon the sugar. At the present time all Demerara sugar, with the exception of that portion that is dyed with aniline dye, has had its colour artificially given it and consequently contains strong traces of tin. Soda-water, lemonade and other artificial aerated liquors are liable to tin or lead contamination, the former proceeding from the tin pipes and vessels, the latter from citric and tartaric acids and cream of tartar used as ingredients, these being crystallized by their manufacturers in leaden pans. Almost all "canned" goods contain more or less tin as a contamination from the tin-plate. While animal foods do not attack the tin to any great extent, their acidity being small, almost all vegetable materials, especially fruits and tomatoes, powerfully corrode the tin covering of the plate, dissolving it and becoming impregnated with tin compounds. It is quite easy to obtain tin-reactions in abundance from every grain of tinned peaches, apples or tomatoes. These tin compounds are by no means innocuous; yet poisoning from tinned vegetable foods is of rare occurrence. On the whole, tin-plate is a very unsuitable material for the storage and preservation of acid goods. Certain enamels, used for glazing earthenware or for coating metal cooking pots, contain lead, which they yield to the food prepared in them. Food materials that have been in contact with galvanized vessels sometimes are contaminated with zinc. Zinc is also not infrequently present in wines.

Results of English Food Acts.

The effect of the application of the food laws has been entirely beneficial. Not only has the percentage proportion of samples found adulterated largely declined, but the gross forms of adulteration which prevailed in the middle of the 19th century have almost vanished. Plenty of fraud still prevails, but poisoning by reckless admixture is of exceedingly rare occurrence. Whilst formerly milk was not infrequently adulterated with an equal bulk of water, few fraudulent milk men now venture to exceed in addition of 10 or 15%. A bird's-eye view over the effect is obtained from the following figures for England and Wales:—

Year.	Number of Samples.		Percentage of Adulteration.
	Examined.	Adulterated.	
1877	14,706	2,826	19·2
1879	17,049	2,535	14·8
1884	22,951	3,311	14·4
1889	26,956	3,096	11·5
1894	39,516	4,060	10·3
1899	53,056	4,970	9·4
1904	84,678	7,173	8·5

The details of the working of the Food Acts in 1904 in England and Wales are set out in the table on the next page.

United States.—Each separate state has food laws of its own. From the 1st of January 1907 the "American National Pure Food Law," applicable to the United States generally, came into force, without superseding the State food laws, the only effect of the National Law being the legalization of shipments of any food which complies with the provisions of the National Law into any state from another state, even though the food is adulterated within the meaning of the state law. The law applies to every person in the United States who receives food from another state and offers it for sale in the original unbroken packages in which he receives it, and if it is adulterated or misbranded within the meaning of the National Law he can be punished for having received it and offering it for sale in the original unbroken package to the same extent as the person who shipped it to him can be punished. The mere fact that he is a citizen of a state selling food within that state will not excuse him; and he will be subject to prosecution to the same extent as he would be if he uttered counterfeit money. Retailers, however, can protect themselves from prosecution when they sell goods in original unbroken packages by procuring a written guarantee, signed by the person from whom they received the goods, such guarantee stating that the goods are not adulterated within the meaning of the National Law. The guarantee must also contain the name and address of the wholesale vendor, but unless the parties signing the guarantee are residents of the United States the guarantee is void. The law affects all foods shipped from one state or district into another and also all foods intended for export to a foreign country. It also affects all food products manufactured or offered for sale in any territory or the District of Columbia, wherever such foods may have been produced. The law does not affect foods manufactured and sold wholly within one state, nor such as have been shipped from another state but not in the original package. While thus the National Food Law is mainly intended to regulate the food traffic between the different states, and leaves to the states freedom to regulate their internal traffic, it must gradually tend to unify the present complicated state food legislation, and it is therefore here more usefully considered than would be the separate state laws.

Table showing working of British Food Acts, 1904.

	Samples Examined.	Found Adulterated.	Percentage Adulterated.
Milk	36,413	4,031	11·1
Butter	15,124	867	5·7
Cheese	2,176	20	0·9
Margarine	1,169	83	7·1
Lard	2,489	4	0·2
Bread	473	1	0·2
Flour	476	3	0·6
Tea	486	.	..
Coffee	2,550	161	6·3
Cocoa	477	42	8·8
Sugar	901	49	5·4
Mustard	812	39	4·8
Confectionery and Jam	1,303	72	5·5
Pepper	2,393	43	1·8
Wine	308	54	17·5
Beer	1,065	75	7·0
Spirits	6,938	832	12·0
Drugs:—			
Camphorated Oil	395	24	6·1
Sweet Spirit of Nitre	243	66	27·2
Sulphur	131	7	5·3
Cream of Tartar	441	88	20·0
Glycerin.	192	21	10·9
Rhubarb preparations	96	5	5·2
Seidlitz Powders	81	3	3·7
Linseed	70	1	1·4
Magnesia	48	9	18·8
Mercury preparations	28	4	14·3
Cod Liver Oil	245	7	2·9
Iron Pills	16	..	..
Compound Liquorice Powder	111	2	1·8
Tincture of Iodine	23	4	17·4
Other Drugs	1,124	124	11·0
Total Drugs	3,214	365	11·3
Other Articles:—			
Ginger	704	..	..
Syrup and Treacle	183	8	4·4
Baking Powder	281	11	3·9
Vinegar	773	57	7·4
Arrowroot	467	3	0·6
Oatmeal	359	..	..
Sago	227	14	6·2
Olive Oil	306	9	2·9
Dripping and Fat	85	1	1·2
Sundries.	2,496	329	13·2
Total other Articles	5,881	432	7·3
All Articles	84,678	7,173	8·5

The definition of adulteration as set forth in sec. 7 is as follows:—" For the purpose of this act an article shall be deemed to be adulterated: *In the case of drugs*: (1) If, when a drug is sold under or by a name recognized in the United States Pharmacopoeia or National Formulary, it differs from the standard of strength, quality or purity, as determined by the test laid down in the United States Pharmacopoeia or National Formulary official at the time of investigation; provided that no drug defined in the United States Pharmacopoeia or National Formulary shall be deemed to be adulterated under this provision if the standard of strength, quality or purity be plainly stated upon the bottle, box or other container thereof although the standard may differ from that determined by the test laid down in the United States Pharmacopoeia or National Formulary. (2) If its strength or purity fall below the professed standard or quality under which it is sold. *In the case of confectionery*: If it contains terra alba, barytes, talc, chrome yellow or other mineral substance or poisonous colour or flavour, or other ingredient deleterious or detrimental to health, or any vinous, malt or spirituous liquor or compound or narcotic drug. *In the case of food*: (1) If any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength. (2) If any substance has been substituted wholly or in part for the article. (3) If any valuable constituent of the article has been wholly or in part abstracted. (4) If it be mixed, coloured, powdered, coated or stained in a manner whereby damage or inferiority is concealed. (5) If it contain any added poisonous or other added deleterious ingredient which may render such article injurious to health: provided that when in the preparation of food products for shipment they are preserved by any external application applied in such manner that the preservation is necessarily removed mechanically, or by maceration in water, or otherwise, and directions for removal of said preservations shall be printed on the covering of the package, the provisions of the act shall be construed as applying only when said products are ready for consumption. (6) If it consists in whole or in part of a filthy, decomposed or putrid animal or vegetable substance, or any portion of an animal unfit for food, whether manufactured or not, or if it is the product of a diseased animal or one that has died otherwise than by slaughter. . . ."

Whatever vagueness attaches to these definitions is intended to be removed by secs. 3 and 4, which provide that the secretaries of the Treasury, of Agriculture, and of Commerce and Labour " shall make uniform rules and regulations for carrying out the provisions of the act, including the collection and examination of specimens of food and drugs," which examination " shall be made in the bureau of chemistry of the department of agriculture, or under the direction and supervision of such bureau, for the purpose of determining from such examinations whether such articles are adulterated or misbranded within the meaning of the act." Contravention of the act is punishable for the first offence by a fine not exceeding 500 dollars or 1 year's imprisonment or both, and for each subsequent offence by a fine not less than 1000 dollars or 1 year's imprisonment or both. Under an act of congress, approved March 1903, the bureau of agriculture established standards of purity for food products, " to determine what are regarded as adulterations therein for the guidance of the officials of the various states and of the courts of justice." The elaborate set of food definitions and standards worked out under the guidance of the chief of the bureau, Dr H. W. Wiley, have also received legal sanction and form a corollary to the National Food Law. For each of the more important articles of food an official definition of its nature and composition has thus been established, of the utmost value to food officers, manufacturers and merchants not only in the United States but throughout the world. A few of these definitions may here find a place:—

" Lard is the rendered fresh fat from slaughtered healthy hogs. Leaf-lard is the lard rendered at moderately high temperatures from the internal fat of the abdomen of the hog, excluding that adherent to the intestines. Standard lard and standard leaf-lard are lard and leaf-lard respectively, free from rancidity, containing not more than 1% of substances other than fatty acids, not fat, necessarily incorporated therewith in the process of rendering, and standard leaf-lard has an iodine number not greater than 60. Milk is the lacteal secretion obtained by the complete milking of one or more healthy cows, properly fed and kept, excluding that obtained within 15 days before and 5 days after calving. Standard milk is milk containing not less than 12 % of total solids and not less than 8½ % of solids not fat, nor less than 3¼ % of milk-fat. Standard skim-milk is skim-milk containing not less than 9¼ % of milk-solids. Standard condensed milk and standard sweetened condensed milk are condensed milk and sweetened condensed milk respectively, containing no less than 28 % of milk-solids, of which not less than one-fourth is milk-fat. Standard milk-fat or butter-fat has a Reichert-Meissl number not less than 24 and a specific gravity at 40° C. not less than 0·905. Standard butter is butter containing not less than 82·5 % of butter-fat. Standard whole-milk cheese is cheese containing in the water-free substance not less than 50 % of butter-fat. Standard sugar contains at least 99·5 % of sucrose. Standard chocolate is chocolate containing not more than 3 % of ash insoluble in water, 3·5 % of crude fibre, and 9 % of starch, nor less than 45 % of cocoa-fat."

Numerous other standards with details too technical for reproduction here have also been fixed.

German Empire.—The law of the 14th of May 1879, largely based upon the English Food and Drugs Act 1875, regulates the trade in food. Each town or district appoints a public analyst, and there is a state laboratory in Berlin directly under the control of the ministry of the interior with advisory functions. The ministry, under the advice of this department, issues from time to time regulations concerning the sale of or details specifying the mode of analysis of various products of food or drink. Both in the United States and in Germany, therefore, the executive officers (public analysts) have some authoritative official department for guidance and information.

Particular Articles Adulterated

We will now proceed to consider adulteration as practised during recent years in the more important articles of food.

Milk.—Milk adulteration means in modern times either addition of water, abstraction of cream, or both, or addition of chemical preservative. The old stories of the use of chalk or of sheep's brains are fables. Owing to the wide variation to which milk is naturally subjected in composition, it is exceedingly difficult to establish beyond doubt whether any given sample is in the state in which it came from the cow or has been impoverished. The composition of cow's milk varies with many conditions. (1) The race of the animal: the large cows of the plains yielding a great quantity of poor milk, the smaller cows from hilly districts less amount of rich milk. Hence, milk from Dutch cows compares very unfavourably with that of Jerseys or short-horns. Watery and acid foods like mangolds and brewers' grains produce a more aqueous milk than do albuminous and fatty foods like oil-cakes. (2) Sudden change of food, of weather and of temperature. (3) Nervous disturbances to which even a cow is subject, as, for instance, at shows, may greatly influence the composition of the milk. The portion obtained at the beginning of a milking is poorer in fat than that yielded towards the end. Morning milk is as a rule poorer in fat than evening milk. Soon after calving the animal gives a richer product than at later periods, both the quantity and the composition declining towards the end of the lactation. The variations due to these different circumstances may be very great, as is seen from the following analyses, fairly representing the maximum, minimum and mean composition of the milk of single cows:—

	Minimum.	Maximum.	Mean.
Specific Gravity	1·0264	1·0370	1·0316
Fat	1·67 %	6·47 %	3·59 %
Casein	1·79 %	6·29 %	3·02 %
Albumen	0·25 %	1·44 %	0·50 %
Milk Sugar (lactose)	2·11 %	6·12 %	4·78 %
Salts	0·35 %	1·21 %	0·71 %
Water	80·32 %	90·69 %	87·40 %

In market milk such wide variations are not so liable to occur, as the milk from one animal tends to average that from another, but even in the milk from herds of cows the variations may be considerable. The average composition of genuine milk supplied by one of the largest dairy companies in London, as established by the analysis of 120,000 separate samples recorded by Dr P. Vieth, is fat 4·1 %, other milk solids ("solids not fat" or "non-fatty solids") 8·8 %, total dissolved matters (total solids) 12·9 %, the variations being from 3·6 to 4·6 % in the fat and 8·6 to 9·1 % in the solids not fat. It is clear that the 4·6 % of fat could be reduced, by skimming, to 3·0 %, and the 9·1 % of solids not fat to 8·5 % by addition of water, without bringing the composition of the milk thus adulterated outside that of genuine milk. In reality even wider limits of variation must be reckoned with, because small farmers sell the milk of single cows, and this, as shown above, may fluctuate enormously. The Board of Agriculture, in pursuance of the powers conferred upon it by the Food Act 1899, issued in 1901 "The Sale of Milk Regulations," which provide that where a sample of milk (not being milk sold as skimmed or separated or condensed milk) contains less than 3 % of milk-fat, or less than 8·5 % of non-fatty solids, it shall be presumed, until the contrary is proved, that the milk is not genuine. But even in these cases it is open to the vendor to show, if he can, that the deficiency was due to natural causes or to unavoidable circumstances. The courts have held that when deviations are the result of negligence or ignorance the vendor is nevertheless liable to punishment. Thus, when a vendor omits to stir up the contents of a pan so as to prevent the cream from rising to the top, he may be punished, if by such omission the milk becomes altered in composition so as no longer to comply with the regulations; or, when a farmer allows an undue interval between the milkings whereby the composition of the milk may be affected, he may be liable for the consequences. As the limits embodied in the milk regulations were necessarily fixed at figures lower than those which are usually afforded by genuine milk, and as it is a comparatively simple matter to ascertain the percentage of fatty and non-fatty solids, a strong tendency exists to bring down commercial milk to the low limits of the regulations without coming into collision with the law. The fat of milk is its most valuable and most important constituent. The exact determination of the percentage of fat is therefore the chief problem of the milk-analyst. All analyses made prior to the year 1885 are more or less inexact, because a complete separation of the fat from the other milk constituents had not been obtained. In that year M. A. Adams, by the simple and ingenious expedient of spreading a known volume of the milk to be analysed upon a strip of blotting-paper and extracting the paper, together with the dried milk, by a fat solvent, such as ether or benzene, succeeded in completely removing the fat from the other constituents. Since that time simpler and more rapid means have been based upon centrifugal separation of the fat. When a measured quantity of milk is mixed with strong sulphuric acid, which dissolves the casein and other nitrogenous constituents of the milk, but leaves the fat-globules quite untouched, the latter can easily be separated in a centrifugal, in the form of an oil the volume of which can be ascertained in a suitably constructed and graduated glass vessel, and thus the percentage ascertained very rapidly and accurately; such centrifugal contrivances constructed by H. Leffman, N. Gerber and others are now in general use in dairies, and cheese and butter factories. The amount of "total solids" contained in milk, that is to say, of all constituents other than water, is speedily ascertained by evaporating the water from a measured or weighed portion of milk and drying the residue obtained in a water-oven to constant weight. By subtracting from the percentage of total solids that of the fat the amount of "solids not fat" results, and by cautiously burning off the organic substances, the salts or mineral matters are left. When the percentage of "solids not fat" is less than 8·5 a simple proportion sum suffices to show what percentage of water must be present to reduce the "solids not fat" to the amount found. As the added water also reduces proportionately the percentage of mineral matter natural to normal milk (about 0·71 to 0·73%), the determination of the ash affords valuable assistance to the analyst. When the amount of ash is higher than normal, tests must be made for borax, soda or other mineral matters that are often added as preservatives or acid neutralizers. Borax is easily tested for by dissolving the milk ash in a drop or two of dilute hydrochloric acid, moistening a strip of yellow turmeric paper with the solution and drying it, when, in the presence of even very minute quantities of borax, the yellow colouring matter of the turmeric paper will be changed into a brilliant red-brown. Formaldehyde (which in 40% water solution forms the formalin of commerce) in milk affords a bright purple colour when the milk containing it is mixed with sulphuric acid containing a trace of an iron salt.

Condensed milk is milk that has been evaporated under reduced pressure with or without the addition of sugar. Generally one part of condensed milk corresponds to three parts of the original milk. There is no case on record of adulteration of unsweetened condensed milk, but sweetened milk has in the past been frequently prepared either from machine-skimmed or partly skimmed milk and sold as whole-milk. As sweetened condensed milk is largely used by the poorer part of the population for the feeding of infants, and as the fat of milk is, as stated before, its most valuable constituent, this class of fraud was a particularly mischievous one, and led to the inclusion in the Food Act of 1899 of a special proviso that every tin or other receptacle containing condensed, separated or skimmed milk must bear a conspicuous label showing the nature of the contents. As the bulk of condensed milk consumed in England is imported from abroad, the customs authorities now exercise a strict supervision over the imports, and object to the importation of such condensed milk as contains less than 9% of milk-fat. The average composition of sweetened condensed milk may be taken, with slight variations, to be: water 24·6%, fat 11·4%, casein and albumen 10%, milk-sugar 11·7%, cane-sugar 40·3%, mineral matters 2·0%.

Cream.—There are not any regulations nor official standards relating to this article, the value of which depends upon its contents in fat. Good stiff cream obtained by centrifugal skimming may contain as much as 60% of milk-fat, but generally dairymen's cream has only about 40%. On the other hand, milk that is abnormally rich in fat is in some places sold as cream. Attempts to compel dairymen to work up to any stated minimum of fat have failed, the English courts holding that cream is not an article that has any standard of quality, but varies with the character of the cows from which the milk is obtained and the food on which they are fed. Therefore, as regards the most important portion of cream, the amount of fat, adulteration does not exist unless there is a substitution for the milk-fat by an emulsified foreign fat, but cases of this description are exceedingly rare. On the other hand, such additions of foreign materials, like starch paste or gelatine, which have for object the giving of an appearance of richness to a naturally poor and dilute article, are not uncommon. While formerly the sale of cream was entirely in the hands of milkmen, there has been of late a tendency to regard cream as an article coming within the range of grocery goods. To enable this perishable article to be kept in a grocery store it has to receive an addition of preservative, as a rule boric preservative, in excessive amount. The purchaser may take it that all cream sold by others than milkmen, and much of that even, is thus preserved and should be shunned. The limit of boric preservative that might be permitted, but which is nearly always exceeded, is one-quarter of 1%.

Butter.—Of all articles of food butter has most fully received the attention of the sophisticator, because it is the most costly of the ordinary articles of diet, and because its composition is so intricate and variable that its analysis presents extraordinary difficulties and its nature exceptional and various opportunities for admixture with foreign substances. It is the intention of the producer of butter to separate the fatty portion of the milk as completely as is practicable from the other constituents of the milk without destroying the fat-globules. This can only be done by churning, by which operation the milk-globules are caused more or less to adhere to each other without losing their individual existence. Owing to this subdivision of the fat, and perhaps to the composition of the fat itself, butter is a more digestible fatty article of food than lard or oil. It is not possible by mechanical means to remove the whole of the water and curd of the milk from the butter; indeed "overworking" the butter with the object of removing the water as completely as possible ruins the structure to such an extent as to make the product unmerchantable. In well-made butter there are contained about 85% of pure milk-fat, from 12 to 13% of water, and 2 or 3% of curd and albumen, milk-sugar or its product of transformation—lactic acid,—and phosphates and other milk-salts. In some kinds of butter, Russian for instance, the percentage of water is rather less. Generally, by churning at a low temperature, a drier, at higher temperatures at wetter, butter is obtained. The curd must be got rid of as completely as practicable if the product is to have reasonable keeping properties. To prevent rapid decomposition salt in various quantities is added. Considering that 100 lb (10 gallons) of milk yield only from 3½ to 4 lb of properly made butter, it is obvious that a great inducement exists to increase the yield either by leaving an undue proportion of water or curd, or by adding an excessive quantity of salt. In some parts of Ireland the butter is worked up with warm brine into so-called pickle butter, whereby it becomes both watered and salted in one operation. Until lately, when the English Board of Agriculture fixed a limit of 16 for the percentage of water that may legitimately be present in butter, this kind of debasement could not easily be dealt with, but even now, where a legal water-limit exists, the addition of water either as such, or in the shape of milk or of condensed milk, is very commonly practised, more or less care being taken not to exceed the legalized limit. It is obvious that there is an ample margin of profit for the mixer who starts with Russian butter containing 10% of water and works it up with milk, fresh or condensed, to 16%, all the other milk-constituents, namely, sugar, curd and salt, thus introduced counting as "butter" in the eyes of the law. A very considerable number of butter-factors in London and in other parts of England thus dilute dry butter and consider this a legitimate operation so long as they keep within the legal water-limit. Nay, they may even exceed this, if only they give to their adulterated article a euphonious name, which, while legally notifying the admixture, raises in the mind of the ignorant purchaser the belief that he is purchasing something particularly choice and excellent. "Milk-blended butter," with as much as 24 or more per cent of water and as little as 68 % of fat, is still largely sold to purchasers who think that they are obtaining extra value for their money; several attempts to deal with the scandal by legislature having led to no result. The introduction of water into butter is also practised on a large scale in the United States, where a branch of trade in "renovated" butter has sprung up. In the States a considerable quantity of butter is produced by small farmers, and by the time the product comes into the market—the addition of chemical preservatives to prevent decomposition not being permitted—the butter has so much deteriorated in quality that it fetches a very low price. It is bought up by factors, the fat melted out and washed, then again worked up with water and salt, care being generally taken to leave about 16% of water in the product, which finds a ready sale in England. It may here be pointed out that England imports an enormous quantity of butter from the continent of Europe, the colonies, Siberia and America, the imports, less exports, averaging during 1903–1906 no less than 203,300 tons annually, and the total consumption (home produce plus imports) 366,441 tons, the consumption per head of population being 19·2 lb per annum. In butter, as in most other articles of food, adulteration with water is the most common, most profitable, and least risky form of fraud. Great fortunes are thus made out of water.

There is an altogether different class of butter adulteration which concerns itself with the substitution of other fatty matters for the whole or part of the really valuable portion of the butter-fat. Margarine is the legalized and therefore legitimate butter-surrogate, prepared by churning any suitable fat with milk into a cream, solidifying the latter by injection into cold water and working the lumps together, precisely as is done in the case of the churned cream of milk. The substitution of margarine for butter is frequent, in spite of all legal enactments directed against this fraud, the semblance between butter and margarine being so great that a trained palate is necessary to distinguish the two articles. Much more frequent and much more difficult to deal with is the sale of mixtures of butter and of margarine. In order to show the difficulties inherent to this subject, it will be necessary to consider the chemical nature of butter-fat, and to compare it with other fats that may enter into the composition of margarine. Butter-fat is butter freed from water, curd and salt and extraneous matter. Like the greater number of natural fats it consists of a mixture of triglycerides, that is, combinations of glycerin with substances of the nature of acids. These acids, in the case of fats other than butter-fat, are mainly oleic, palmitic and stearic acids. Butter-fat, in addition to these, contains other acids which sharply distinguish it from the vast majority of other fats and, with the exception of cocoa-nut oil, from those substances which are or may be used to mix with butter, by the circumstance that a considerable proportion of its acids, when separated by chemical means from the glycerin, are readily soluble in water, or may be easily volatilized either alone or in a current of steam, whereas the acids separated from the foreign fats are practically both insoluble and non-volatile. This fundamental principle serves at once to distinguish, for example, between butter and margarine, and has been made use of by analysts not only for this purpose but also with a view to determine the relative amounts of butter and margarine in a mixture of these substances. Thus butter-fat contains about 88%, more or less, of "insoluble fatty acids," while margarine contains about 95.5%; 5 grammes of butter-fat when chemically decomposed yield an amount of volatile fatty acids which requires about 26 cubic centimetres (more or less) of deci-normal alkali solution for neutralization, while margarine requires mostly less than 1 cubic centimetre (Wollny or Reichert-Meissl method). There are other differences between the two kinds of fat: the specific gravity of butter-fat is higher than that of most other fats; its power of refracting a ray of light is less; the "iodine absorption" of butter-fat is smaller than that of many other fatty matters, and so on. But the composition of perfectly genuine butter-fat varies within somewhat wide limits. The milk from a cow fed on good and ample food in warm weather yields a fat that is rich in characteristic butter-constituents, while a poorly fed animal, kept in the open till late in the autumn, when the nights are cold, gives milk exceptionally poor in fat, the differences expressed as "insoluble fatty acids" lying between 86 and 91%, and in volatile acids, expressed as "Wollny" numbers, between 18 and 36. Generally, therefore, summer butter is rich and autumn butter poor in volatile acids, or, geographically, Australian butter is more frequently high, Siberian often exceedingly low in these acids. The food of the animal also may, under certain conditions, yield a notable proportion of its fatty matter to the butter; cows that have, for instance, been fed upon large quantities of cotton-seed cake yield butter in which the cotton-seed oil may be traced, and the same holds good with other fatty foods. All these, and other circumstances, combine to render the detection of small quantities of foreign fats that have been fraudulently added to butter almost a matter of impossibility. This is perfectly well known to unscrupulous butter dealers, and an enormous amount of adulteration is known to be practised. Even small amounts of adulteration could, nevertheless, often be discovered while margarine manufacturers employed considerable proportions of vegetable oils in their products, some of these oils furnishing characteristic chemical reactions allowing of their discovery. Here some firms of margarine manufacturers came to the aid of the butter-mixer and produced margarine containing nothing but animal fat, so-called "neutral" margarine being freely offered for fraudulent purposes. There is one fat besides butter which contains "volatile fatty acids," namely, cocoa-nut oil. Since means have been found to deprive this fat of its strong cocoa-nut odour and taste, it has largely been used in the adulteration of butter, and margarine containing cocoa-nut oil and other fatty substances has freely been manufactured and sold specially for butter adulteration. The seat of this class of fraud is mainly in Holland. Analysts happily found means to detect this oil when present above 10%, and numerous prosecutions made mixers more careful. Abundant evidence, however, exists showing that the simultaneous addition of water or milk so as to keep the water limit below 16% and that of margarine entirely composed of animal fats below 10% leaves a large margin of profit with a very small chance of detection. For the moment at least analysis has had the worst of it in the battle between honesty and "business methods."

Margarine itself is a legitimate article of commerce (when sold with due notice to the purchaser), but is frequently adulterated. As regards the fats used in its manufacture there does not exist any legal restriction, and as long as the fat is in a state fit for human consumption the manufacturer can make whatever mixture he pleases. In general there is no reason to think that any bad or disgusting fats are finding their way into the factories, which in most countries are under proper supervision; the old stories about recovered grease from all sorts of offal are quite without foundation. But a considerable percentage of solid paraffin has been met with as an admixture of the fatty part of margarine. As the fatty portion of the article is the only one of value, some manufacturers make great efforts to produce margarine with as small a percentage of fatty matter as possible, either by incorporating excessive amounts of water or of milk—margarines with over 30% of water being met with—or by introducing sugar, glucose, starch, gelatinous matter, in fact anything that is cheaper than fat. The English law imposes a limitation upon the percentage of butter-fat that may be contained in margarine, but at present at least the tendency of manufacturers is all for having as little butter or other valuable fat in margarine as is practicable, and not to err on the other side. For the purpose of facilitating the discovery of margarine when it has been fraudulently added to butter, some countries (Germany, Belgium, Sweden) insist upon the use of from 5 to 10% of sesame oil (from the seed of *Sesamum orientale* or *S. indicum*, belonging to the family of Bignoniaceae) in the manufacture of such margarine as is to be consumed within the countries in question. This oil yields a characteristic red colour when it, or any mixture containing it, is shaken with an hydrochloric solution of either sugar or furfurol, and is intended to serve as an "ear-marking" substance. The addition of a little starch or arrowroot, easily discoverable chemically or by the microscope, is also required by Belgium, but in the absence of any international agreement these ear-marking additions are of little practical use. It is, however, interesting to point out that, while complying with the regulations of the governments, margarine manufacturers of the countries named have found an easy way of rendering the regulations quite nugatory: they add methyl-orange, a colouring matter which itself produces a red colour with acid and quite obscures the red colour obtained by the official test for sesame oil.

Cheese may be legitimately made from full-milk, milk that has been enriched by addition of cream, or from milk that has been more or less skimmed. It varies consequently very widely in composition, so-called cream cheese containing not less than 60% of fat; Stilton upwards of 40%; Cheddar about 30%; Dutch, Parmesan and some Swiss and Danish less than 20%. The amount of water varies with the kind and age of the cheese and may be as low as 20 and as high as 60%. Under these circumstances it is impracticable to lay down any hard-and-fast rules as to the composition of cheese. When, however, cheese is made from skimmed milk and the fat is replaced by margarine, as is the case in so-called "filled" or margarine cheeses, the sale of these amounts to an adulteration, unless the presence of the foreign substance is declared. It may at first sight appear strange that the person who robs milk of its most valuable portion, the cream, may prepare a legitimate article of food from the remainder, while he who to that remainder adds something to replace the fat does an illegitimate act, but it must be taken into consideration that the replacement is frequently made with fraudulent intent and that the ordinary purchaser cannot by taste or smell distinguish the adulterated from the genuine article, while there is no difficulty in recognizing skim-milk cheese.

Lard.—Between the years 1880 and 1890 a gigantic fraudulent trade in adulterated lard was carried on from the United States. A great proportion of the American lard imported into England was found to consist of a mixture of more or less real lard with cotton-seed oil and beef-stearine. Cotton-seed oil is one of the cheapest vegetable oils fit for human consumption, beef-stearine the hard residue obtained in the manufacture of oleo-margarine after the more fluid fat has been pressed from the beef fat. These mixtures were made so skilfully by large Chicago manufacturers that for some years they escaped detection. A bill introduced in 1888 into the American Senate to stop this imposture directed general attention to the subject, and energetic measures, taken both in America and in England, quickly put an end to it. From the memorial presented in the United States Senate in support of the bill, it appeared that in about 1887 the annual production of lard in the States was estimated at 600 million pounds, of which more than 35% was adulterated. Compounds were made containing only a small quantity of lard or none at all, yet were sold as "choice refined lard" or under other eulogistic names. Many lard substitutes, chiefly made from cotton-seed oil, are still met with, but are mostly sold in a legitimate manner. From the germ of maize—which must be separated from the starchy portion of the seed before the latter can be manufactured into glucose—the oil (maize-oil) is expressed, and this now is used as a lard adulterant, its detection being far more difficult than that of cotton-seed oil.

Oils.—For very many years all oils were considered to be composed of olein, that is to say, the triglyceride of oleic acid, with small quantities of impurities; chemists, therefore, to distinguish oils of various origin, confined themselves to tests for these impurities, employing so-called colour reactions based upon the change of colour of the oil by various reagents such as sulphuric, nitric or phosphoric acids. These reactions were exceedingly indefinite and unsatisfactory and oil adulteration was prevalent and almost undiscoverable. It has been found, however, that the old ideas concerning the believed uniformity in the nature and constitution of oils were erroneous. Some oils, indeed, do consist of olein, almond oil being a type, others contain a glyceride of an acid which is distinguished from oleic acid by containing one molecule less hydrogen, called linoleic acid. To this class belong cotton-seed and sesame oils. Others again include a glyceride of an acid containing still less hydrogen, linolenic acid (linseed and similar drying oils), and lastly the liver oils are still poorer in hydrogen. These various acids or the oils contained in them combine with various percentages of iodine, oleic acid absorbing the smallest proportion (about 80%). For each oil the iodine absorption is a fairly constant quantity; this number, together with the determination of the amount of caustic alkali needed for complete saponification, the thermal rise with strong sulphuric acid or with bromine, the refraction of light and the specific gravity, now enable the analyst to form a fair idea of the nature of any sample under examination, and, in consequence of this advance in knowledge, adulteration of oils has much declined. The most common adulterant of the more valuable oils, like olive oil, is cotton-seed oil. The oils expressed from the sesame seed or the earth-nut (arachis oil) are also frequently admixed with olive oil. Almond oil is adulterated with the closely allied oils from the peach-kernel or the pine-seed. Deodorized paraffin hydrocarbons also enter sometimes as adulterants into edible oils. There is, however, a marked improvement in the purity of oils generally.

Flour and *bread* as sold in England are almost invariably genuine. The old forms of adulteration, such as the use of alum for the production of a white but indigestible loaf from bad flour, have disappeared. The only admixture which has been met with during recent years is maize-meal in American produce. This is of inferior food value to wheat-meal.

Sugar in its various forms can hardly be said to be subject to adulteration by the addition of inferior substitutes. One single case of such substitution analogous to the proverbial but probably mythical sanding of sugar occurred between 1880 and 1905 in England, some crushed marble having been found in a consignment of German sugar in a large British establishment. There have, however, been numerous prosecutions for a fraud of another class, namely, the substitution of dyed beetroot sugar for Demerara sugar. Formerly the sugar produced by the old imperfect and wasteful methods of manufacture was more or less yellow or brown from adhering molasses. Sugar, as now obtained, be it from cane or beet, is white; yet the public is so wedded to its customs that white sugar except as lump or castor sugar does not find a ready sale. The manufacturer is obliged to colour his product yellow by artificial means, that is to say, either by the addition of a little aniline dye, harmless in itself, or, as in the West Indies, mostly by the use of a small quantity of chloride of tin, so-called "bloomer." European refined beet-sugar coloured with aniline dye to distinguish it from Demerara cane sugar is sold under the name of "yellow crystals." These, although richer in real sugar than Demerara, are without the delicious aroma of cane syrup which belongs to the latter, and are not infrequently fraudulently substituted for Demerara.

Marmalade and Jams.—In the preparation of marmalade and jams, which articles were for a long time made from fruit and sugar only, a part of the sugar, from 10 to 15 %, is often now replaced by starch glucose. This material, consisting mainly of a mixture of dextrose and dextrin, is of much less sweetening power than ordinary sugar and mostly cheaper. It is said to prevent the crystallization which frequently used to occur in some jams. The use of glucose has been declared by the High Court (*Smith* v. *Wisden*, 1901) to be legitimate, the court holding that as there was no recognized standard for the composition of marmalade the addition of saccharine material not injurious to health could not constitute an offence. Artificial colouring matters and chemical preservatives are almost constant ingredients of jams. To such fruits which, when boiled with sugar, do not readily yield a jelly (strawberries, raspberries) an addition of apple juice is frequently made in the manufacture of jam, without much objection; the pulp of the apple, however, is sometimes bodily added as an adulterant.

Tea.—In consequence of the proviso contained in the Food Act of 1875 that tea was to be examined by the Customs on importation, such tea as was found to be admixed with other substance or exhausted tea being refused entry into England, the adulteration of tea has been virtually suppressed. Great numbers of samples are annually examined by the Customs, and a not inconsiderable proportion of these are condemned because they are either damaged or dirty, their use for the manufacture of theine being permitted, only sound and genuine tea coming to the British public. The practice, very common a generation ago, of artificially colouring tea green with a mixture of Prussian blue and turmeric, has quite vanished with the decline of the consumption of green tea.

Coffee.—A few cases of artificially manufactured coffee berries, made from flour and chicory, have been observed, but it would not be fair to speak of a practice of adulteration regarding coffee berries. Not infrequently coffee is roasted with the addition of some fatty matter or paraffin or sugar, to give to the roasted coffee a glossy appearance. These additions as a rule are small in amount. Ground coffee is often sold adulterated with chicory, sugar or caramel. Other adulterations, reference to which is found in literature relating to the second half of the 19th century, do not seem now to occur.

Cocoa and *chocolate* are liable to a number of fraudulent or questionable additions. In the cheaper qualities of cocoa-powder sugar and starch—the latter in the form of sago flour or arrowroot—are admixed in very large proportions, and, in order to give to such mixtures something like the appearance of genuine cocoa, red oxide of iron is added. This almost invariably is more or less arsenical. Cocoa-shell, a perfectly valueless material, is mixed in a very finely ground state with cocoa of the commoner kind. Owing to the enormous increase in the consumption of so-called chocolate-creams, which are masses of sugar confectionery coated with a cocoa-paste containing a large proportion of the fat of cocoa (cocoa-butter), the quantity of cocoa-butter that is obtained in the manufacture of cocoa-powders is no longer sufficient to cover the demand. Substitutes of cocoa-butter prepared from cocoa-nut oil are manufactured on a large scale, and all enter without acknowledgment into chocolates or chocolate creams. As there are not any regulations touching the composition of chocolate, sugar or starch or both are used in chocolate manufacture, and especially in that of chocolate powders in often excessive quantities. In the Dutch mode of manufacture of cocoa-powders an addition of from 3% to 4% of an alkaline salt is made for the purpose of rendering the cocoa "soluble," or, more strictly, for putting it into such a physical condition that it does not settle in the cup. This addition does not, as is often alleged, render the cocoa alkaline, and is not made with any fraudulent object; several countries, however, have passed regulations fixing the maximum of the addition which may thus legitimately be made. Most of the cocoa-powders sold in England are prepared in accordance with the Dutch method.

Wine.—If under this term a beverage is understood which consists of nothing but fermented grape juice, a great proportion of the wine consumed in England is not genuine wine. All port and sherry comes into commerce after having received an addition of spirit, generally made from potatoes; port and sherry would not be what they are and as they have been for generations unless they were thus fortified. The practice can now hardly be classed among adulterations. A well-fermented wine made from the juice of properly matured grapes does not require any added alcohol in order that it should keep; imperfectly made wine is liable to turn sour; the addition of alcohol prevents this. French wines, both red and white, are hardly subject to adulteration. In wine-growing countries like France wine is so cheap and plentiful that it would be difficult to manufacture an imitation beverage cheaper than genuine wine. In Germany the conditions are different, the districts from which those wines that are exported are nominally derived being small and insufficient to cover the world's demands. The addition of sugar solution or of starch sugar is allowed within limits by German law, which not even requires that notification to the purchaser be made of the addition, and it is notorious that a very large proportion of the wine sold under the name of "hock" and some of that coming from the Moselle are thus diluted, sugared and lengthened, or, in plain terms, adulterated. Wines from the Palatinate which under their own names would not sell out of Germany are often passed off as hocks. As there is but little German red wine the law also permits this to be lengthened by the addition of white wine. For the removal of part of the acid from sour wine produced in bad vintages the addition of precipitated chalk is also permitted. Attention has been drawn in England to the very serious fact that German wines sometimes contain salts of zinc in small quantities. These are introduced by a fining agent protected by a German patent, consisting of solutions of sulphate of zinc and potassium ferrocyanide, which, when added together in "suitable proportions," produce a precipitate of zinc-ferrocyanide which carries down all turbidity in the wine and is supposed to leave neither zinc nor ferrocyanide behind in solution. As a matter of fact, one or other of these highly objectionable substances is almost invariably left behind. The use of artificial colouring matters in wines does not appear now to occur.

Beer cannot be said to be adulterated, although it is well known that materials often very different from those which the general public believe to be the proper raw materials for the manufacture of beer, namely, water, malt and hops, are largely used. By the Customs and Inland Revenue Act 1885, sec. 4, beer is defined as any liquor "which is made or sold as a description of beer, or as a substitute for beer, and which on analysis of a sample thereof shall be found to contain more than 2% of proof spirit." That is to say, beer is legally anything that is sold as beer provided that it has 2% of proof spirit. There is not any restriction upon the materials that are employed provided that they are not positively poisonous. For Inland Revenue purposes, however, a prohibition has been made against the admixture of anything to beer after it has been manufactured, and excise prosecutions of publicans for watering beer are not infrequent. Formerly there was a restriction on the amount of salt that might be present in beer; this no longer exists. On the other hand it cannot be said that any injurious materials are being used by brewers, the brewing industry being, broadly speaking, most efficiently supervised and controlled by scientifically trained men. The addition to beer of bisulphate of lime, which is almost universally practised in England, is not an adulteration in the ordinary acceptation of the term. The thin beer which has taken the place of the strong ales of the past generation contains an insufficiency of alcohol to ensure keeping qualities, and it is difficult to see how modern English beers could be sold without the addition of some sort of preservative.

Non-Alcoholic Drinks.—The same remark applies to a good many of so-called temperance beverages. Of these again it is hardly proper to speak as liable to adulteration. So-called soda-water is very often devoid of soda and is only carbonated water, but the term "soda-water" is a survival from the times when this was a medicinal beverage and when soda was prescribed to be present in definite amount by the pharmacopoeia. Potash and especially lithia waters very frequently contain only mere traces of the substances from which they derive their names. The sweetness of ginger-beer and often of lemonade is no longer due to sugar, as used to be the case, but to saccharine (the toluol derivative), which is possessed of sweetness but not of nourishment; and since, as an antiseptic, it may affect the digestion, its use in these beverages is to be deprecated.

Vinegar ought to be the product obtained by the successive alcoholic and acetous fermentation of a sugary liquor. When this is obtained from malt or from malt admixed with other grain the vinegar is called a malt vinegar. Often, however, acid liquors pass under that name which have been made by the action of a mineral acid upon any starchy material such as maize or tapioca, with or without the addition of beet sugar. Dilute acetic acid, obtained from wood, is very frequently used as an adulterant of vinegar. When properly purified such acid is unobjectionable physiologically, but it is improper to sell it as vinegar. Adulteration of vinegar by sulphuric or other acids, formerly a common practice, is now exceedingly rare.

Spirits.—By the Sale of Food and Drugs Act Amendment Act, whisky, brandy and rum must not be sold of a less alcoholic strength than 25 under proof (corresponding to 43% of alcohol by volume), and gin 35 under proof (37% alcohol). For many years the only form of adulteration recorded by public analysts related to the alcoholic strength, the undue dilution of spirits with water being, of course, a profitable form of fraud. No addition of any injurious matters to commercial spirits has been observed. It was, however, well known that a very considerable proportion of so-called brandies was not the product of the grape, but that spirits of other origin were frequently admixed with grape brandy. A report which appeared in 1902 in the *Lancet* on "Brandy, its production at Cognac and the supply of genuine brandy to this country," served as a stimulus to public analysts to analyse commercial brandies, and convictions of retailers for selling so-called brandy followed. It was shown that genuine brandy made in the orthodox style from wine in pot-stills contained a considerable proportion of substances other than alcohol to which the flavour and character of brandy is due; among these flavouring materials combinations of a variety of organic acids with alcohols (chemically described as "esters") predominate. For the present a brandy is not considered genuine unless it contains in 100,000 parts (calculated free from water) at least 60 parts of "esters." As a consequence a trade has sprung up in artificially produced esters, sold for the purpose of adding them to any spirit to fraudulently convert it into a liquor passing as "brandy." The inquiries into the nature of brandy led to investigations into whisky. Formerly whisky was made from grain only and obtained by pot-still distillation, that form of "still" yielding a product containing a comparatively large proportion of volatile matters other than alcohol. For many years past, however, improved stills—so-called patent stills—have been adopted, enabling manufacturers to obtain a purer and far stronger product, saving carriage and storage. Attempts were made in England in 1905–1907 to restrict the term "whisky" solely to the pot-still product. But the question was referred in 1908 to a Royal Commission which reported against such a restriction. A common form of adulteration of whisky is the addition to it of spirit made on the Continent mainly from potatoes. This spirit is almost pure alcohol and is quite devoid of the injurious properties which are popularly but falsely attributed to it. The substitution of this—a very cheap and quite flavourless material—for one which owes its value more to its flavour than to its alcoholic contents, is clearly fraudulent.

Drugs.—To the adulteration of drugs but very brief reference can here be made. It is satisfactory to record that but very few of the great number of drugs included in the pharmacopoeias are liable to serious adulteration, and there are very few cases on record during recent years where real fraudulent adulteration was involved. The numerous preparations used by druggists are mostly prepared in factories under competent and careful supervision, and the standards laid down in the British Pharmacopoeia are, broadly speaking, carefully adhered to. The occurrence of unlooked-for impurities, such as that of arsenic in sodium-phosphate or in various iron preparations, can hardly be included in the list of adulterations. In the making up of prescriptions, however, a good deal of laxity is displayed; thus, the Local Government Board report of the years 1904–1905 refers to an instance of a quinine mixture containing 23 grains of quinine-sulphate instead of 240 grains. A certain latitude in the making up of physicians' prescriptions must necessarily be allowed, but much too frequently the reasonable limit of a 10% error over or under the amount of drug prescribed is exceeded. Certain perishable drugs, such as sweet spirits of nitre, or others liable to contain from their mode of manufacture metallic impurities, form the subjects of frequent prosecutions. The element of intentional fraud which characterizes many forms of food adulteration is happily generally absent in the case of drugs. (O. H.*)

ADULTERY (from Lat. *adulterium*), the sexual intercourse of a married person with another than the offender's husband or wife. Among the Greeks, and in the earlier period of Roman law, it was not adultery unless a married woman was the offender. The foundation of the later Roman law with regard to adultery was the *lex Julia de adulteriis coercendis* passed by Augustus about 17 B.C. (See *Dig.* 48. 5; Paull. *Rec. Sent.* ii. 26; Brisson, *Ad Leg. Jul. de Adult.*) In Great Britain it was reckoned a spiritual offence, that is, cognizable by the spiritual courts only. The common law took no further notice of it than to allow the party aggrieved an action of damages. In England, however, the action for "criminal conversation," as it was called, was nominally abolished by the Matrimonial Causes Act 1857; but by the 33rd section of the same act, the husband may claim damages from one who has committed adultery with his wife in a petition for dissolution of the marriage, or for judicial separation. In Ireland the action for criminal conversation is still retained. In Scotland damages may be recovered against an adulterer in an ordinary action of damages in the civil court, and the latter may be found liable for the expenses of an action of divorce if joined with the guilty spouse as a co-defender.

Adultery on the part of the wife is, by the law of England, a ground for divorce, but on the part of the husband must be either incestuous or bigamous, or coupled with cruelty or desertion for two or more years. In the United States adultery is everywhere ground of divorce, and there is commonly no prohibition against marrying the paramour or other re-marriage by the guilty party. Even if there be such a prohibition, it would be unavailing out of the state in which the divorce was granted; marriage being a contract which, if valid where executed, is generally treated as valid everywhere. Adultery gives a cause of action for damages to the wronged husband. It is in some states a criminal offence on the part of each party to the act, for which imprisonment in the penitentiary or state prison for a term of years may be awarded.

In England, a *complete* divorce or dissolution of the marriage could, until the creation of the Court of Probate and Divorce, be obtained only by an act of parliament. This procedure is still pursued in the case of Irish divorces. In Scotland a complete divorce may be effected by proceedings in the Court of Session, as succeeding to the old ecclesiastical jurisdiction of the commissioners. A person divorced for adultery is, by the law of Scotland, prohibited from intermarrying with the paramour. In France, Germany, Austria and other countries in Europe, as well as in some of the states of the United States, adultery is a criminal offence, punishable by imprisonment or fine. (See DIVORCE.)

AD VALOREM (Lat. for "according to value"), the term given in commerce to a duty which is levied by customs authorities on goods or commodities in proportion to their value. An ad valorem duty is the opposite of a specific duty, which is chargeable on the measure or weight of goods. The United States is the one important country which has adopted in its tariff an extensive system of ad valorem duties, though it has not altogether disregarded specific duties; in some cases, indeed, the two are combined. Ad valorem duties, in the United States, are levied according to the saleable value of the goods in the country of their origin, and it is usual to require at the port of entry the production of an invoice with full particulars as to the place where, time when, and person from whom the goods were purchased, and the actual cost of the goods and the charges on them. Such an invoice is countersigned by the consul of the country for which the goods are intended. On arrival at the port of consignment the invoice is sworn to by the importer. The goods are then valued by an appraiser, and if the valuation of the appraiser exceeds that which appears on the invoice, double duty is levied, subject to appeal to a general appraiser and to boards of general appraisers.

It has been argued that, theoretically, an ad valorem duty is preferable to a specific duty, inasmuch as it falls in proper proportion alike on the high-priced and low-priced grades of a commodity, and, no matter how the value of any article fluctuates, the rate of taxation automatically adjusts itself to the new value. In practice, however, ad valorem duties lead to great inequalities, and are very difficult to levy; while the relative value of two commodities may remain apparently unchanged under an ad valorem duty, yet owing to the difference in the cost of production, or through the different proportions of fixed and circulating capital employed in their manufacture, an ad valorem tax will be felt much more severely by one commodity than by another. Again, there is always a difficulty in obtaining a true valuation on the exported goods, for values from their very nature are variable; while specific duties remain steady, and the buyer can always ascertain exactly what he will have to pay. The opening to fraud is also very great, for where, as in the United States, the object of the duty is to keep out foreign goods, every valuation at the port of shipment will be looked upon with the utmost suspicion, while it will always be a temptation to the foreign seller to undervalue, a temptation in many cases encouraged by the importer, for it lessens his tax, while the seller's market is increased. The staff of appraisers which must necessarily be kept at each port of entry considerably raises the expense, to say nothing of the annoyance and delay caused both to importers and foreign shippers.

The term "ad valorem" is used also of stamp duties. By the Stamp Act 1891 certain classes of instruments, *e.g.* awards, bills of exchange, conveyances or transfers, leases, &c., must be stamped in England with the proper ad valorem duty, that is, the duty chargeable according to the value of the subject matter of the particular instruments or writings. (See STAMP DUTIES.)

ADVANCEMENT, a term technically used in English law for a sum of money or other benefit, given by a father during his lifetime to his child, which must be brought into account by the child on a distribution of the father's estate upon an intestacy on pain of his being excluded from participating in such distribution. The principle is of ancient origin; as regards goods and chattels it was part of the ancient customs of London and the province of York, and as regards land descending in coparcenary it has always been part of the common law of England under the name of *hotch-pot* (*q.v.*). The general rule was established by the Statutes of Distribution. The conditions under which cases of advancement arise are as follows: There must be a complete intestacy; the intestate estate must be that of the father; and the advancement must have been made in the lifetime of the father. Land which belongs or would belong to a child as heir at law or customary heir need not be brought in to the common fund, even though such land was given during the father's life. The widow can gain no advantage from any advancement. No child can be forced to account for his or her advancement, but in default thereof he will be excluded from a share in the intestate's estate. As to what is an advancement there has been much conflict of judicial opinion. According to one view, nothing is an advancement unless it be given "on marriage or to establish the child in life." The other and probably the correct view is that any considerable sum of money paid to a child at that child's request is an advancement; thus payment of a son's debts of honour has been held to be an advancement. On the other hand, trivial gifts and presents to a child are undoubtedly not advancements.

ADVANTAGE, that which gives gain or helps forward in any way. The Fr. *avant* (before) shows the origin and meaning of this word, the *d* having subsequently crept in and corrupted the spelling. It is often contracted to "vantage." In some games (*e.g.* lawn tennis) the term "vantage" is used technically in scoring ("deuce" and "vantage"; "vantage sets"). A position which gives a better chance of success than its surroundings is called a "vantage ground." In an unfavourable sense the word "advantage" is used to express a mean use made of some favourable condition (*e.g.* to take advantage of another man's misfortunes).

ADVENT (Lat. *Adventus*, sc. *Redemptoris*, "the coming of the Saviour"), a holy season of the Christian church, the period of preparation for the celebration of the nativity or Christmas. In the Eastern church it lasts from St Martin's Day (11th of November), and in other churches from the Sunday nearest to St Andrew's Day (30th of November) till Christmas. It is uncertain at what date the season began to be observed. A canon of a council at Saragossa in 380, forbidding the faithful to be absent from church during the three weeks from the 17th of December to the Epiphany, is thought to be an early reference to Advent. The first authoritative mention of it is in the Synod of Lerida (524), and since the 6th century it has been recognized as the beginning of the ecclesiastical year. With the view of directing the thoughts of Christians to the first coming of Christ as Saviour, and to his second coming as Judge, special lessons are prescribed for the four Sundays in Advent. From the 6th century the season was kept as a period of fasting as strict as that of Lent; but in the Anglican and Lutheran churches the rule is now relaxed. In the Roman Catholic church Advent is still kept as a season of penitence. Dancing and festivities are forbidden, fasting enjoined and purple vestments are worn in the church services.

In many countries Advent was long marked by diverse popular observances, some of which even still survive. Thus in England, especially the northern counties, there was a custom (now extinct) for poor women to carry round the "Advent images," two dolls dressed one to represent Christ and the other the Virgin Mary. A halfpenny was expected from every one to whom these were exhibited, and bad luck was thought to menace the household not visited by the doll-bearers before Christmas Eve at the latest.

In Normandy the farmers still employ children under twelve to run through the fields and orchards armed with torches, setting fire to bundles of straw, and thus it is believed driving out such vermin as are likely to damage the crops. In Italy among other Advent celebrations is the entry into Rome in the last days of Advent of the Calabrian pifferari or bagpipe players, who play before the shrines of the Holy Mother. The Italian tradition is that the shepherds played on these pipes when they came to the manger at Bethlehem to do homage to the Saviour.

ADVENTISTS, SECOND, members of religious bodies whose distinctive feature is a belief in the imminent physical return of Jesus Christ. The first to bear the name were the followers of William Miller, and adherents have always been more numerous in America than in Europe. There is a body of Seventh Day Adventists who observe the old Sabbath (Saturday) rather than the Christian Sunday. They counsel abstemious habits, but set no time for the coming of Christ, and so are spared the perpetual disappointments that overtake the ordinary adventist. They have some 400 ministers and 60,000 members.

ADVENTITIOUS (from Lat. *adventicius*, coming from abroad), a quality from outside, in no sense part of the substance or circumstance: a man's clothes, or condition of life, his wealth or his poverty, are called by Carlyle "adventitious wrappages," as being extrinsic, superadded and not a natural part of him. In botany the word means that which is not normal to the plant, which appears irregularly and accidentally, *e.g.* buds or roots out of place, or strange spots and streaks not native to the flower.

ADVENTURE (from Lat. *res adventura*, a thing about to happen), chance, and especially chance of danger; so a hazardous enterprise or remarkable incident. Thus an "adventurer," from meaning one who takes part in some speculative course of action, came to mean one who lived by his wits and a person of no character. The word is also used in certain restricted legal connexions. *Joint adventure*, for instance, may be distinguished from partnership (*q.v.*). A *bill of adventure* in maritime law (now apparently obsolete) is a writing signed by the shipmaster declaring that goods shipped in his name really belong to another, to whom he is responsible. The *bill of gross adventure* in French maritime law is an instrument making a loan on maritime security.

ADVERTISEMENT, or Advertising (Fr. *avertissement*, warning, or notice), the process of obtaining and particularly of purchasing publicity. The business of advertising is of very recent origin if it be regarded as a serious adjunct to other phases of commercial activity. In some rudimentary form the seller's appeal to the buyer must, however, have accompanied the earliest development of trade. Under conditions of primitive barter, communities were so small that every producer was in immediate personal contact with every consumer. As the primeval man's wolfish antipathy to the stranger of another pack gradually diminished, and as intercourse spread the infection of larger desires, the trapper could no longer satisfy his more complicated wants by the mere exchange of his pelts for his lowland neighbour's corn and oil. A began to accept from B the commodity which he could in turn deliver to C, while C in exchange for B's product gave to A what D had produced and bartered to C. The mere statement of such a transaction sufficiently presents its clumsiness, and the use of primitive forms of coin soon simplified the original process of bare barter. It is reasonable to suppose that as soon as the introduction of currency marked the abandonment of direct relations between purchaser and consumer an informal system of advertisement in turn rose to meet the need of publicity. At first the offer of the producer must have been brought to the trader's attention, and the trader's offer to the notice of the consumer, by casual personal contact, supplemented by local rumour. The gradual growth of markets and their development into periodical fairs, to which merchants from distant places resorted, afforded, until printing was invented, the only means of extended advertisement. In England, during the 3rd century, Stourbridge Fair attracted traders from abroad as well as from all parts of England, and it may be conjectured that the crying of wares before the booths on the banks of the Stour was the first form of advertisement which had any marked effect upon English commerce. As the fairs of the middle ages, with the tedious and hazardous journeys they involved, gradually gave place to a more convenient system of trade, the 15th century brought the invention of printing, and led the way to the modern development of advertising. The Americans, to whom the elaboration of newspaper advertising is primarily due, had but just founded the first English-speaking community in the western hemisphere when the first newspaper was published in England. But although the first periodical publication containing news appeared in the month of May 1622, the first newspaper advertisement does not seem to have been published until April 1647. It formed a part of No. 13 of *Perfect Occurrences of Every Daie journall in Parliament, and other Moderate Intelligence*, and it read as follows:—

> A Book applauded by the Clergy of *England*, called *The Divine Right of Church Government*, Collected by sundry eminent Ministers in the Citie of *London*; Corrected and augmented in many places, with a briefe Reply to certain *Queries* against the Ministery of *England*; Is printed and published for *Joseph Hunscot* and *George Calvert*, and are to be sold at the Stationers' Hall, and at the Golden Fleece in the Old Change.

Among the *Mercuries*, as the weekly newspapers of the day were called, was the *Mercurius Elencticus*, and in its 45th number, published on the 4th of October 1648, there appeared the following advertisement:—

> The Reader is desired to peruse a Sermon,
> Entituled *A Looking-Glasse for Levellers*,
> Preached at St. Peters, Paules Wharf, on Sunday, Sept. 24th 1648,
> by Paul Knell, Mr. of Arts. Another Tract called *A Reflex*
> *upon our Reformers, with a prayer for the Parliament.*

In an issue of the *Mercurius Politicus*, published by Marchmont Nedham, who is described as "perhaps both the ablest and the readiest man that had yet tried his hand at a newspaper," there appeared in January 1652 an advertisement, which has often been erroneously cited as the first among newspaper advertisements. It read as follows:—

> Irenodia Gratulatoria, a heroic poem, being a congratulatory panegyrick for my Lord General's return, summing up his successes in an exquisite manner. To be sold by John Holden, in the New Exchange, London, Printed by Thomas Newcourt, 1652.

The article "On the Advertising System," published in the *Edinburgh Review* for February 1843, contains the fullest account of early English advertising that has ever been given, and it has been very freely drawn upon by all writers who have since discussed the subject. But it describes this advertisement in the *Mercurius Politicus* as "the very first," and the discovery of the two earlier instances above quoted was due to the researches of a contributor to *Notes and Queries*.

In *The Crosby Records*, the commonplace-books of William Blundell, there is an interesting comment, dated 1659, on the lack of advertising facilities at that period—

> It would be very expedient if each parish or village might have some place, as the church or smithy, wherein to publish (by papers posted up) the wants either of the buyer or the seller, as such a field to be let, such a servant, or such a service, to be had, &c. There was a book published in London weekly about the year 1657 which was called (as I remember) *The Publick Advice*. It gave information in very many of these particulars.

A year later the same diarist says—

> There is an office near the Old Exchange in London called the office of Publick Advice. From thence both printed and private information of this useful nature are always to be had. But what they print is no more than a leaf or less in a diurnal. I was in this office. The diurnal consisted of sixteen pages quarto in 1689.

In No. 62 of the *London Gazette*, published in June 1666, the first advertisement supplement was announced—

> An Advertisement—Being daily prest to the Publication of Books, Medicines, and other things not properly the business of a Paper of Intelligence, This is to notifie, once for all, that we will not charge the *Gazette* with Advertisements, unless they be matter of State: but that a Paper of Advertisements will be forthwith printed apart, & recommended to the Publick by another hand.

In No. 94 of the same journal, published in October 1666, there appeared a suggestion that sufferers from the Great Fire should avail themselves of this means of publicity—

> Such as have settled in new habitations since the late Fire, and desire for the convenience of their correspondence to publish the place of their present abode, or to give notice of Goods lost or found, may repair to the corner House in Bloomsbury on the East Side of the Great Square, before the House of the Right Honourable the Lord Treasurer, where there is care taken for the Receipt and Publication of such Advertisements.

The earlier advertisements, with the exception of formal notices, seem to have been concerned exclusively with either books or quack remedies. The first trade advertisement, which does not fall within either of these categories, was curiously enough the first advertisement of a new commodity, tea. The following advertisement appeared in the *Mercurius Politicus*, No. 435, for September 1658—

> That excellent and by all Physitians approved China Drink, called by the Chineans *Tcha*, by other nations *Tay*, alias *Tee*, is sold at the Sultaness Head, a cophee-house in Sweetings Rents, by the Royal Exchange, London.

The history of slavery, of privateering and of many other curious incidents and episodes of English history during the 17th and 18th centuries might be traced by examination of the antiquated advertisements which writers upon such subjects have already collected. In order that space may be found for some consideration of the practical aspects of modern advertising, the discussion of its gradual development must be curtailed. Nor is it necessary to preface this consideration by any laboured statement of the importance which advertising has assumed.

It is a matter of common knowledge that several business houses are to be found in Great Britain, and a larger number in the United States, who spend not less than £50,000 a year in advertising, while one patent medicine company, operating both in England and the United States, has probably spent not less than £200,000 in Great Britain in one year, and an English cocoa manufacturer is supposed to have spent £150,000 in Great Britain. Some of the best works of artists as distinguished as Sir John Millais, Sir H. von Herkomer and Mr Stacy Marks have been scattered broadcast by advertisers. The purchase of Sir John Millais' picture "Bubbles" for £2200 by the proprietors of a well-known brand of soap is probably the most remarkable instance of the expenditure in this direction which an advertiser may find profitable. There are in London alone more than 350 advertising agents, of whom upwards of a hundred are known as men in a considerable way of business. The statements which from time to time find currency in the newspapers with regard to the total amount of money annually spent upon advertising in Great Britain and in the United States are necessarily no better than conjectures, but no detailed statistics are required in order to demonstrate what every reader can plainly see for himself, that advertising has definitely assumed its position as a serious field of commercial enterprise.

Advertising, as practised at the beginning of the 20th century, may be divided into three general classes:—

1. Advertising in periodical publications.
2. Advertising by posters, signboards (other than those placed upon premises where the advertised business is conducted), transparencies and similar devices.
3. Circulars, sent in quantities to specific classes of persons to whom the advertiser specially desired to address himself.

It may be noted at the outset that advertising in periodical publications exercises a reflex influence upon these publications. The daily, weekly and monthly publications of the day are accustomed to look to advertisements for so large a part of their revenue that the purchaser of a periodical publication receives much greater value for his money than he could reasonably expect from the publisher if the aggregate advertising receipts did not constitute a perpetual subsidy to the publisher. It is not to be supposed, however, that the receipts from the sale of a paper cover all its expenses and that the advertising revenue is all clear profit. The average newspaper reader would be amazed if he knew at how great a cost the day's news is laid before him. A dignified journal displays no inclination to cry from the housetops the vastness of its expenditure, but from time to time an accident enables the public to obtain information in this connexion. The evidence taken by a recent Copyright Commission disclosed that the expenditure of the leading English journal upon foreign news alone amounted to more than £50,000 in the course of one year, and that a year not characterized by any great war to swell the ordinary volume of cable despatches.

In the case of daily papers sold at the minimum price, it is not less obvious that the costliness of news service renders advertising revenue indispensable, for although these less important journals spend less money, the price at which they are supplied to the news agents is very small in proportion to the cost of their production. If, however, this thought be pursued to its logical conclusion, the advertiser must admit that he in turn receives, from those among newspaper readers who purchase his wares, prices sufficiently high to cover the cost of his advertising. So that the reader is in the curious position of directly paying a certain price for his newspaper, receiving a newspaper fairly worth more than that price, while this price is supplemented by the indirect incidence of a sort of tax upon many of the commodities he consumes. On the other hand, a great part of the advertisements in a daily newspaper have themselves an interest and utility not less than that possessed by the news. The man who desires to hire a house turns to the classified lists which the newspaper publishes day after day, and servants and employers find one another by the same means. The theatrical announcements are so much a part of the news that even if a journal were not paid for their insertion they could not be altogether omitted without inconvenience to the reader. In the main, however, it is the advertiser who seeks the reader, not the reader who seeks the advertiser, and the care with which advertisements are prepared, and the certainty with which the success or failure of a trader may be traced to his skill or want of skill as an advertiser, show that the proper use of advertising is one of the most indispensable branches of commercial training.

Poster and sign advertisements.

Before discussing in detail the methods of advertising in periodical publications it may be well to complete, for the use of the general reader, a brief survey of the whole subject by examining the two other classes of advertisement. The most enthusiastic partisan of advertising will admit that posters and similar devices are very generally regarded by the public as sources of annoyance. A bold headline or a conspicuous illustration in a newspaper advertisement may for a moment force itself upon the reader's attention. In the French, and in some English newspapers, where an advertisement is often given the form of an item of news, the reader is distressed by the constant fear of being hoodwinked. He begins to read an account of a street accident, and finds at the end of the paragraph a puff of a panacea for bruises. The best English and American journals have refused to lend themselves to this sort of trickery, and in no one of the best journals printed in the English language will there be found an advertisement which is not so plainly differentiated from news matter that the reader may avoid it if he sees fit to do so. On the whole, then, newspaper advertisements ask, but do not compel attention. The whole theory of poster advertising is, on the other hand, one of tyranny. The advertiser who pays for space upon a boarding or wall, although he may encourage a form of art, deliberately violates the wayfarer's mind. A trade-mark or a catch-word presents itself when eye and thought are occupied with other subjects. Those who object to this class of advertisement assert, with some show of reason, that an advertisement has no more right to assault the eye in this fashion than to storm the ear by an inordinate din; and a man who came up behind another man in the street, placed his mouth close to the other's ear, and bawled a recommendation of some brand of soap or tobacco, would be regarded as an intolerable disturber of public peace and comfort. Yet if the owner of a house sees fit to paint advertisements upon his walls, his exercise of the jealously guarded rights of private property may not lightly be disturbed. For the most part, both law and public opinion content themselves with restraining the worst excesses of the advertiser, leaving many sensitive persons to suffer. The National Society for Checking the Abuses of Public Advertising (known as SCAPA), founded in 1893 in London, was organized for purposes which it describes as follows:—

> The society aims at protecting the picturesque simplicity of rural and river scenery, and promoting a regard for dignity and propriety of aspect in towns—with especial reference to the abuses of spectacular advertising.
>
> It seeks to procure legislation whereby local representative bodies would be enabled to exercise control, by means of by-laws framed with a view to enabling them, at any rate, to grant relief in cases of flagrant and acknowledged abuse.
>
> It is believed that, when regulation is applied in cases where local conditions are peculiarly favourable, the advantage will be so apparent that, by force of imitation and competition, the enforcement of a reasonable standard will gradually become common. The degree of restraint will, of course, depend upon the varying requirements of different places and positions. No hard-and-fast rule is suggested; no particular class of advertisement is proscribed; certainly no general prohibition of posters on temporary hoardings is contemplated. Within the metropolitan area sky signs have already been prohibited, and it is hoped that some corresponding check will be placed on the multiplication of the field boards which so materially diminish the pleasure or comfort of railway journeys.
>
> The society regards with favour the imposition of a moderate tax or duty for imperial or local purposes on exposed advertisements not coming within certain categories of obviously necessary notices. The difficulty of inducing a chancellor of the exchequer to move in a matter where revenue is not the primary consideration is not overlooked. But it is thought that any impost would materially reduce the volume of exposed advertisements, and would at once extinguish the most offensive and the most annoying class, *i.e.* the quack advertisements by the road sides and the bills stuck by unauthorized persons on trees, walls and palings.
>
> Members are recommended to make it known that there exists an active repugnance to the present practice of advertising disfigurement, by giving preference, in private transactions, to makers and dealers who do not employ objectionable methods, and by avoiding, as far as possible, the purchase of wares which, in their individual opinion, are offensively puffed. Action on these lines is advised rather for its educational than for its immediately deterrent effect; although, in the case of many of the more expensive commodities, makers would undoubtedly be much influenced by the knowledge that they would lose, rather than gain, custom.
>
> The foregoing proposals are based on the following estimate of the conditions of the problem. It is believed that the present licence causes discomfort or loss of enjoyment to many, and that, in the absence of authoritative restriction, it must grow far beyond its present limits; that beauty or propriety of aspect in town and country forms as real a part of the national wealth as any material product, and that to save these from impairment is a national interest; that the recent developments of vexatiously obtrusive advertising have not grown out of any necessities of honourable business, but are partly the result of a mere instinct of imitation, and partly are a morbid phase of competition by which both the consumers and the trade as a whole lose; that restriction as regards the size and positions of advertising notices would not be a hardship to those who want publicity—since all competitors would be treated alike, each would have the same relative prominence; that, as large sums of public money are expended on institutions intended to develop the finer taste, and on edifices of elaborate design, it must be held inconsistent with established public policy to permit the sensibilities thus imparted to be wounded, and architectural effect to be destroyed at the discretion of a limited class.

The influence of this society is to be seen in many of the restrictions which have been imposed upon advertisers since its work began. About a year after its foundation the London County Council abolished (under statutory powers obtained from Parliament) advertisements coming within the definition of sky-signs in the London Building Act of 1894. These specifications are as follows:—

> "Sky sign" means any word, letter, model, sign, device, or representation in the nature of an advertisement, announcement, or direction supported on or attached to any post, pole, standard, framework, or other support, wholly or in part upon, over, or above any building or structure, which, or any part of which, sky sign shall be visible against the sky from any point in any street or public way, and includes all and every part of any such post, pole, standard, framework, or other support. The expression "sky sign" shall also include any balloon, parachute, or similar device employed wholly or in part for the purposes of any advertisements or announcement on, over, or above any building, structure, or erection of any kind, or on or over any street or public way.

The act proceeds to exclude from its restrictions flagstaffs, weathercocks and any solid signs not rising more than 3 feet above the roof.

Another by-law of the London County Council, in great measure due to the observations made at coroners' inquests, protects the public against the annoyances and the perils to traffic occasioned by flashlight and searchlight advertisements. This by-law reads as follows:—

> No person shall exhibit any flashlight so as to be visible from any street and to cause danger to the traffic therein, nor shall any owner or occupier of premises permit or suffer any flashlight to be so exhibited on such premises.
>
> The expression "flashlight" means and includes any light used for the purpose of illuminating, lighting, or exhibiting any word, letter, model, sign, device, or representation in the nature of an advertisement, announcement, or direction which alters suddenly either in intensity, colour, or direction.
>
> No person shall exhibit any searchlight so as to be visible from any street, and to cause danger to the traffic therein, nor shall any owner or occupier of premises permit or suffer any searchlight to be so exhibited on such premises.
>
> The expression "searchlight" means and includes any light exceeding 500-candle power, whether in one lamp or lantern, or in a series of lamps or lanterns used together and projected as one concentrated light, and which alters either in intensity, colour, or direction.

Advertising vans were so troublesome in London as to be prohibited in 1853; the "sandwich-man" has in the City of London and many towns been ousted from the pavement to the gutter, from the more crowded to the less crowded streets, and as the traffic problem in the great centres of population becomes more urgent, he will probably be altogether suppressed.

Hoardings are now so restricted by the London Building Acts that new hoardings cannot, except under special conditions, be erected exceeding 12 feet in height, and no existing hoardings can be increased in height so as to exceed that limit.

The huge signs which some advertisers, both in England and the United States, have placed in such positions as to mar the landscape, have so far aroused public antagonism that there is reason to hope that this form of nuisance will not increase.

In 1899 Edinburgh obtained effective powers of control over all sorts of advertising in public places, and this achievement has been followed by no little agitation in favour of a Parliamentary enactment which should once for all do away with the defacing of the landscape in any part of the United Kingdom.

In 1907 an act was passed (Advertisements Regulation Act) of a permissive character purely, under which a local authority is enabled to make by-laws, subject to the confirmation of the Home Secretary, regulating (1) the erection of hoardings, &c., exceeding 12 feet in height, and (2) the exhibition of advertisements which might affect the "amenities" of a public place or landscape.

The English law with regard to posters has undergone very little change. The Metropolitan Police Act 1839 (2 and 3 Vict. cap. 47) first put a stop to unauthorized posting, and the Indecent Advertisements Act of 1889 (§ 3) penalized the public exposure of any picture or printed or written matter of an indecent or obscene nature. But in general practice there is hardly any limitation to the size or character of poster advertisements, other than good taste and public opinion. On the other hand, public opinion is a somewhat vague entity, and there have been cases in which a conflict has arisen as to what public opinion really was, when its legally authorized exponent was in a position to insist on its own arbitrary definition. Such an instance occurred some few years ago in the case of a large poster issued by a well-known London music-hall. The Progressive majority on the London County Council, led by Mr (afterwards Sir) J. M'Dougall, a well-known "purity" advocate, took exception to this poster, which represented a female gymnast in "tights" posed in what was doubtless intended for an alluring and attractive attitude; and, in spite of any argument, the fact remained that the decision as to renewing the licence of this music-hall rested solely with the Council. In showing that it would have no hesitation in provoking even a charge of meddling prudery, the Council probably gave a salutary warning to people who were inclined to sail rather too near the wind. But in Great Britain and America, at all events (though a doubt may perhaps exist as to some Continental countries), the advertiser and the artist are restrained, not only by their own sense of propriety, but by fear of offending the sense of propriety in their customers.

Posters and placards in railway stations and upon public vehicles still embarrass the traveller who desires to find the name of a station or the destination of a vehicle. In respect of all these abuses it is a regrettable fact that unpopularity cannot be expected to deter the advertiser. If a name has once been fixed in the memory, it remains there long after the method of its impression has been forgotten, and the purpose of advertisements of the class under discussion is really no more than the fixing of a trade name in the mind. The average man or woman who goes into a shop to buy soap is more or less affected by a vague sense of antagonism towards the seller. There is a rudimentary feeling that even the most ordinary transaction of purchase brings into contact two minds actuated by diametrically opposed interests. The purchaser, who is not asking for a soap he has used before, has some hazy suspicion that the shopkeeper will try to sell, not the article best worth the price, but the article which leaves the largest margin of profit; and the purchaser imagines that he in some measure secures himself against a bad bargain when he exercises his authority by asking for some specific brand or make of the commodity he seeks. If he has seen any one soap so persistently advertised that his memory retains its name, he will ask for it, not because he has any reason to believe it to be better or cheaper than others, but simply because he baffles the shopkeeper, and assumes an authoritative attitude by exerting his own freedom of choice. This curious and obscure principle of action probably lies at the root of all poster advertising, for the poster does not set forth an argument as does the newspaper advertisement. It hardly attempts to reason with the reader, but merely impresses a name upon his memory. It is possible, by lavish advertising, to go so far in this direction that the trade-mark of a certain manufacturer becomes synonymous with the name of a commodity, so that when the consumer thinks of soap or asks for soap, his concept inevitably couples the maker's name with the word "soap" itself. In order that the poster may leave any impression upon his mind, it must of course first attract his attention. The assistance which the advertiser receives from the artist in this connexion is discussed in the article POSTER.

Advertisement by circular.

The fact that the verb "to circularize" was first used in 1848, sufficiently indicates the very recent origin of the practice of plying possible purchasers with printed letters and pamphlets. The penny postage was not established in England until 1840; the halfpenny post for circulars was not introduced until 1855. In the United States a uniform rate of postage at two cents was not established until 1883. In both countries cheap postage and cheap printing have so greatly encouraged the use of circulars that the sort of people whom the advertiser desires to reach—those who have the most money to spend, and whose addresses, published in directories, indicate their prosperous condition—are overwhelmed by tradesmen's price-lists, appeals from charitable institutions, and other suggestions for the spending of money. The addressing of envelopes and enclosing of circulars is now a recognized industry in many large towns both in Great Britain and in the United States. It seems, however, to be the opinion of expert advertisers that what is called "general circularizing" is unprofitable, and that circulars should only be sent to persons who have peculiar reason to be interested by their specific subject-matter. It may be noted, as an instance of the assiduity with which specialized circularizing is pursued, that the announcement of a birth, marriage or death in the newspapers serves to call forth a grotesque variety of circulars supposed to be adapted to the momentary needs of the recipient.

In concluding this review of methods of advertising, other than advertisements in periodical publications, we may add that the most extraordinary attempt at advertisement which is known to exist is to be found at the churchyard at Godalming, Surrey, where the following epitaph was placed upon a tombstone:—

Sacred
To the memory of
Nathaniel Godbold Esq.
Inventor & Proprietor
of that excellent medicine
The Vegetable Balsam
For the Cure of Consumptions & Asthmas.
He departed this Life
The 17th. day of Decr. 1799
Aged 69 years.
Hic Cineres, ubique Fama.

Advertising in periodical publications.

The preparation of advertisements for the periodical press has within the last twenty years or so become so important a task that a great number of writers and artists—many of the latter possessing considerable abilities—gain a livelihood from this pursuit. The ingenuity displayed in modern newspaper advertising is unquestionably due to American initiative. The English newspaper advertisement of twenty years ago consisted for the most part of the mere reiteration of a name. An advertiser who took a column's space supplied enough matter to fill an inch, and ingenuously repeated his statement throughout the column. Such departures from this childlike method as were made were for the most part eccentric to the point of incoherence. It may, however, be said in defence of English advertisers, that newspaper publishers for a long time sternly discountenanced any attempt to render advertisements attractive. So long as an advertiser was rigidly confined to the ordinary single-column measure, and so long as he was forbidden to use anything but the smallest sort of type, there was very little opportunity for him to attract the reader's attention. The newspaper publisher must always remember that the public buy a newspaper for the sake of the news, not for the sake of the advertisements, and that if the advertisements are relegated to a position and a scope, in respect of display, so inferior that they may be overlooked, the advertiser cannot afford to bear his share of the cost of publication. Of late *The Times*, followed by almost all newspapers in the United Kingdom, has given the advertiser as great a degree of liberty as he really needs, and many experienced advertisers in America incline to the belief that the larger licence accorded to American advertisers defeats its own ends. The truth would seem to be that the advertiser will always demand, and may fairly expect, the right to make his space as fantastic in appearance as that allotted to the editor. When some American editors see fit to print a headline in letters as large as a man's hand, and to begin half-a-dozen different articles on the first page of a newspaper, continuing one on page 2, another on page 4, and another on page 6, to the bewilderment of the reader, it can hardly be expected that the American advertiser should submit to any very strict code of decorum. The subject of the relation between a newspaper proprietor and his advertisers cannot be dismissed without reference to the notable independence of advertisers' influence, which English and American newspaper proprietors authorize their editors to display. Whenever an insurance company or a bank goes wrong, the cry is raised that all the editors in Christendom had known for years that the directors were imbeciles and rogues, but had conspired to keep mute for the sake of an occasional advertisement. When the British public persisted, not long ago, in paying premium prices for the shares of over-capitalized companies, the crash had no sooner come than the newspapers were accused of having puffed promotions for the sake of the money received for publishing prospectuses. As a matter of fact, in the case of the best dailies in England and America, the editor does not stand at all in awe of the advertiser, and time after time the Money Article has ruthlessly attacked a promotion of which the prospectus appeared in the very same issue. It is indeed to the interest of the advertiser, as well as to the interest of the reader, that this independence should be preserved, for the worth of any journal as an advertising medium depends upon its possessing a *bona fide* circulation among persons who believe it to be a serious and honestly conducted newspaper. All advertisers know that the minor weeklies, which contain nothing but trade puffs, and are scattered broadcast among people who pay nothing for their copies, are absolutely worthless from the advertiser's point of view. The most striking difference between the periodical press of Great Britain and that of America is, that in the former country the magazines and reviews play but a secondary rôle, while in the United States the three or four monthlies possessing the largest circulation are of the very first importance as advertising mediums. One reason for this is that the advertisements in an American magazine are printed on as good paper, and printed with as great care, as any other part of the contents. There are probably very few among American magazine readers who do not habitually look through the advertising pages, with the certainty that they will be entertained by the beauty of the advertiser's illustrations and the quaint curtness of his phrases. Another reason is that the American monthly magazine goes to all parts of the United States, while, owing to the time required for long journeys on even the swiftest trains, no American daily paper can have so general a circulation as *The Times* in the United Kingdom. In comparison with points on the Pacific coast, Chicago does not seem far from New York, yet, with the exception of one frenzied and altogether unsuccessful attempt, no New York daily has ever attempted to force a circulation in Chicago. The American advertiser would, therefore, have to spend money on a great number of daily papers in order to reach as widespread a public as one successful magazine offers him.

There is reason to believe that the English magazine publishers have erred gravely in taking what are known in the trade as "insets," consisting of separate cards or sheets printed at the advertiser's cost, and accepted by the publisher at a specific charge for every thousand copies. This system of insetting has the grave inconvenience that the advertiser finds himself compelled to print as many insets as the publisher asserts that he can use. The publisher, on the other hand, is somewhat at the mercy of too enthusiastic agents and employés, who estimate over-confidently the edition of the periodical which will probably be printed for a certain month, and advertisers have had reason to fear that many of their insets were wasted. The added weight and bulk of the insets cause inconvenience and expense to the newsdealer, as two or three insets printed upon cardboard are equivalent to at least sixteen additional pages. Some newsdealers have further complicated the inset question by threatening to remove insets unless special tribute be paid to them; and with all these difficulties to be considered, many magazine publishers have seriously considered the advisability of altogether discontinuing the practice of taking insets, and of confining their advertisements to the sheets they themselves print. In connexion with this subject, it may be added that many readers habitually shake loose bills out of a magazine before they begin to turn the pages, and that railway stations, railway carriages and even public streets are thus littered with trampled and muddy advertisements. The old practice of distributing handbills in the streets is dying a natural death, more or less hastened by local by-laws, and when the loose bills in magazines and cheap novels have ceased to exist no one will be the loser.

Advertisements in the weekly press are on the whole more successful in England than in America. A few American weeklies cope successfully with the increasing competition of the huge Sunday editions of American daily papers. But even the most successful among them—a paper for boys—has hardly attained the prosperity of some among its English contemporaries in the field of weekly journalism.

The merchant who turns to these pages for practical suggestions concerning the advertising of his own business, can be given no better advice than to betake himself to an established advertising agent of good repute, and be guided by his counsels. The chief part that he can himself play with advantage is to note from day to day whether the agent is obtaining advantageous positions for his announcements. Every advertiser will naturally prefer a right-hand page to a left-hand page, and the right side of the page to the left side of the page; while the advertiser who most indefatigably urges his claims upon the agent will, in the long run, obtain the largest share of the favours to be distributed. To the merchant who inclines to consider advertising in connexion with the broader aspects of his calling, it may be suggested that a new channel of trade demands very serious attention. What is called in England "postal trade," and in America "mail order business," is growing very rapidly. Small dealers in both countries have complained very bitterly of the competition they suffer from the general dealers and from stores made up of departments which, under one roof, offer to the consumer every imaginable sort of merchandise. This general trading, which, on the one hand, seriously threatens the small trader, and on the other hand offers greater possibilities of profit to the proportionately small number of persons who can undertake business on so large a scale, becomes infinitely more formidable when the general dealer endeavours not only to attract the trade of a town, but to make his place of business a centre from which he distributes by post his goods to remote parts of the country. In America, where the weight of parcels carried by post is limited to 4 lb, and where the private carrying companies are forced to charge a very much higher rate for carriage from New York to California than for shorter distances, the centralization of trade is necessarily limited; but it is no secret that, at the present moment, persons residing in those parts of the United Kingdom most remote from London habitually avail themselves of the English parcel post, which carries packages up to 11 lb, in order to procure a great part of their household supplies direct from general dealers in London. A trading company, which conducts its operations upon such a scale as this, can afford to spend an almost unlimited sum in advertising throughout the United Kingdom, and even the trader who offers only one specific class of merchandise is beginning to recognize the possibility of appealing to the whole country.

Legal regulation.

The following is a brief summary of the laws and regulations dealing with advertisements in public places in certain of the countries of Continental Europe and in the United States of America, the chief authority for which is an official return issued by the British Home Office in 1903.

France.—The permission of the owner is alone required for the placing of advertisements on private buildings; but buildings, walls, &c., belonging to the government or local authorities are reserved exclusively for official notices, &c.; these alone can be printed on white paper, all others must be on coloured paper. Municipal authorities control the size, construction, &c., of hoardings used for advertising purposes, and the police have full powers over the exhibition of indecent or other objectionable advertisements. The *Société pour la protection des paysages*, founded in 1901, has for one of its objects the prevention of advertisements which disfigure the scenery or are otherwise objectionable.

Germany.—By §43 of the Imperial Commercial Ordinance permission to post any trade advertisement in a public street, square, &c., must be first obtained from the local police. The police also control (by §55 of the Imperial Press Law 1874) advertisements which are not of a trade character, but this regulation does not affect the right of the federal legislatures to make regulations in regard to them (§30). It would be impossible to give in any detail the police regulations as to advertisements which exist, *e.g.* in Prussia, but the following rules in force in Berlin may be given:—Public advertisements in public streets and places may be posted only on the appliances, such as pillar posts, &c., provided for the purpose. Owners of property may post advertisements on their own property but only such as concern their own interests. Advertisements on public conveyances are forbidden. In 1902 a Prussian law was passed authorizing the police to forbid all advertisement hoardings, &c., which would disfigure particularly beautiful landscapes in rural districts. The Hesse-Darmstadt Act of 1902 prohibits the placing of any advertisements, posters, &c., on a monument officially protected under the act, if it would be likely to injure the appearance of the monument. As instances of the numerous local provisions against the abuse of advertising may be cited those of Augsburg and Lübeck, by which any advertisement that would injure the *Stadtbild* or appearance of the town may be prohibited and removed by the local authority (see G. Baldwin Brown, *The Care of Ancient Monuments*, 1905). Full powers exist under the Imperial Criminal Code for the suppression of indecent or objectionable advertisements.

Austria.—Permission of the police is required for the exhibition of printed notices in public places other than such as are of purely local or industrial interest, such as notices of entertainment, leases, sales, &c., or theatre programmes, and these can only be shown in places approved by the local authorities (Press Law 1862). The press-police act as advertisement censors and determine whether an advertisement can be allowed or not. In Hungary there are no general laws or regulations, but the municipalities have power to issue ordinances dealing with the question.

Italy.—All control rests with the municipal and communal authorities, who may decide on the places where advertisements may or may not be posted, and can prevent hoardings being placed on or near ancient monuments or public buildings.

Switzerland.—The Federal Government has no authority to deal with this question; certain of the cantons have regulations, *e.g.* Lucerne prohibits the public advertising of inferior goods by means of a false description, Basel-Stadt gives the police the power of censoring all advertisements. Many of the communal authorities throughout Switzerland have special restrictions and regulations. In Zurich the police choose the advertising stations, in Berne the municipality possesses a monopoly of the right of erecting advertisements. The Society known as the *Ligue pour la conservation de la Suisse pittoresque* or *Schweitzerischer Heimatschutz* has for one of its objects the preservation of scenery from disfiguring advertisements.

United States.—There is no federal legislation on the subject, the matter being one for regulation by the states, which in most cases have left it to the various municipalities and other local authorities. With regard to indecent and objectionable advertisements some states have special legislation on the matter, others are content with the ordinary criminal laws or police powers or with the law of nuisance or of trespass. Thus control can be exercised over such advertisements as are dangerous to public safety, health or morals. The state of New York prohibits advertisements of lotteries. It would be impossible to give in detail the different laws and regulations passed in the various states or by municipalities. The following are some of the more striking measures adopted in certain of the states. In Massachusetts no advertising signs or devices are allowed on the public highways. Power has been granted to city and town authorities to regulate advertisements in, near or visible from public parks. In the District of Columbia no advertisement is allowed which obstructs a highway, and all distribution of handbills, circulars, &c., in public streets, parks, &c., is prohibited. This prohibition against what are generally known as "dodgers" is very general in the local regulations throughout the states. In Illinois, city councils are empowered on the incorporation of the city to regulate and prevent the use of streets, sidewalks and public grounds for signs, handbills and advertisements, &c., and also the exhibition of banners, placards, in the streets or sidewalks. Chicago has a body of most stringent rules, but they apparently have been found impossible to enforce; thus no advertisement board more than 12 ft. square within 400 ft. of a public park or boulevard, no advertisements other than small ones relating to the business carried on in the premises where the advertisement is posted, or of sales, &c., are allowed in streets where three-quarters of the houses are "residences" only. Prohibition is also extended to the advertisements of those professing to cure diseases or giving notice of the sale of medicines. In Boston there are regulations prohibiting projecting or overhanging signs in the streets, and special rules as to the height at which street signs and advertisements must be placed. The distribution of "dodgers" in the streets is prohibited. Advertisements for places of amusement must be approved by the committee on licences.

Taxation.

France, Belgium, Italy and certain of the cantons in Switzerland impose a tax on advertisements, as do certain of the United States of America, where the form is usually that of a licence duty on billposters or advertising agencies. In many cases in the United States this is imposed by the municipalities. In every case both in Europe and America advertisements in newspapers are not subject to any tax.

With regard to the literature of advertising, in addition to the historical article in the *Edinburgh Review* for February 1843, already mentioned, and that in the *Quarterly Review* for June 1855, the Society for Checking the Abuses of Public Advertising issue a journal, *A Beautiful World*. The *Journal of the Society of Comparative Legislation* (N.S. xvi. 1906) contains an article by W. J. B. Byles on Foreign Law and the Control of Advertisements in Public Places. The advertisers' handbooks, issued by the leading advertising agents, will also be found to contain practical information of great use to the advertiser. (H. R. H.*; C. We.)

ADVICE (Fr. *avis*, from Lat. *ad*, to, and *visum*, viewed), counsel given after consideration, or information from a distance giving particulars of something prospective (*e.g.* "advice" of an imminent battle, or of a cargo due). In commerce it is a common word for a formal notice from one person concerned in a transaction to another.

ADVOCATE (Lat. *advocatus*, from *advocare*, to summon, especially in law to call in the aid of a counsel or witness, and so generally to summon to one's assistance), a lawyer authorized to plead the causes of litigants in courts of law. The word is used technically in Scotland (see ADVOCATES, FACULTY OF) in a sense virtually equivalent to the English term barrister, and a derivative from the same Latin source is so used in most of the countries of Europe where the civil law is in force. The word *advocatus* is not often used among the earlier jurists, and appears not to have had a strict meaning. It is not always associated with legal proceedings, and might apparently be applied to a supporter or coadjutor in the pursuit of any desired object. When it came to be applied with a more specific limitation to legal services, the position of the *advocatus* was still uncertain. It was different from, and evidently inferior to, that of the *juris-consultus*, who gave his opinion and advice in questions of law, and may be identified with the consulting counsel of the present day. Nor is the merely professional advocate to be confounded with the more distinguished *orator*, or *patronus*, who came forward in the guise of the disinterested vindicator of justice. This distinction, however, appears to have arisen in later times, when the profession became mercenary. By the *lex Cincia*, passed about two centuries B.C., and subsequently renewed, the acceptance of remuneration for professional assistance in lawsuits was prohibited. This law, like all others of the kind, was evaded. The skilful debater was propitiated with a present; and though he could not sue for the value of his services, it was ruled that any honorarium so given could not be demanded back, even though he died before the anticipated service was performed. The traces of this evasion of a law may be found in the existing practice of rewarding counsel by fees in anticipation of services.

The term *advocatus* came eventually to be the word employed when the bar had become a profession, and the qualifications, admission, numbers and fees of counsel had become a matter of state regulation, to designate the pleaders as a class of professional men, each individual advocate, however, being still spoken of as patron in reference to the litigant with whose interest he was entrusted. The *advocatus fisci*, or fiscal advocate, was an officer whose function, like that of a solicitor of taxes at the present day, was connected with the collection of the revenue.

The lawyers who practised in the English courts of common law were never officially known as advocates, the word being reserved for those who practised in the courts of the civil and canon law (see DOCTORS' COMMONS). There was formerly an important official termed his majesty's advocate-general, or more shortly, the king's advocate, who was the principal law officer of the crown in the College of Advocates or Doctors' Commons, and in the admiralty and ecclesiastical courts. He discharged for these courts the duties which correspond to those of the solicitor of the treasury (see SOLICITOR). His opinion was taken by the foreign office on international matters, and on high ecclesiastical matters he was also consulted; all orders in council were submitted to him for approval. The office may now be said to be obsolete, for after the resignation of Sir Travers Twiss, the last holder, in 1872, it was not filled up. There was also a second law officer of the crown in the admiralty court called the admiralty advocate. This office has long been vacant. Advocate is also the title still in use in some of the British colonies to denote the chief law officer of the crown there. For instance, in Sierra Leone (until 1896), Lagos and Cyprus he is called the king's advocate; in Malta, crown advocate; in Mauritius, procureur and advocate-general, and in the provinces of India advocate-general. In France, the *avocats*, as a body, were reorganized under the empire by a decree of the 15th of December 1810. There is, however, a distinction between *avocats* and *avoués*. The latter, whose number is limited, act as procurators or agents, representing the parties before the tribunals, draft and prepare for them all formal acts and writings, and prepare their lawsuits for the oral debates. The office of the *avocat*, on the other hand, consists in giving advice as to the law, and conducting the causes of his clients by written and oral pleadings. The number of *avocats* is not limited; every licentiate of law being entitled to apply to the corporation of *avocats* attached to each court, and after presentation to the court, taking the oath of office and passing three years in attendance on some older advocate, to have himself recognised as an advocate.

In Germany the *advocat* no longer forms a distinct class of lawyer. Since 1879, when a sweeping judicature act (*Deutsche Justizgesetzgebung*) reconstituted the judicial system, the *advocat* in his character of adviser, as distinguished from the *procurator*, who formerly represented the client in the courts, has become merged in the *Rechtsanwalt*, who has the dual character of counsellor and pleader.

The advocatus ecclesiae.

In the middle ages the word *advocatus* (Fr. *avoué*, Ger. *Vogt*) was used on the continent as the title of the lay lord charged with the protection and representation in secular matters of an abbey. The office is traceable as early as the beginning of the 5th century in the Roman empire, the churches being allowed to choose *defensores* from the body of advocates to represent them in the courts. In the Frankish kingdom, under the Merovingians, these lay representatives of the churches appear as *agentes*, *defensores* and *advocati*; and under the Carolingians it was made obligatory on bishops, abbots and abbesses to appoint such officials in every county where they held property. The office was not hereditary, the *advocatus* being chosen, either by the abbot alone, or by the abbot and bishop concurrently with the count. The same causes that led to the development of the feudal system also affected the *advocatus*. In times of confusion churches and abbeys needed not so much a legal representative as an armed protector, while as feudal immunities were conceded to the ecclesiastical foundations, these required a representative to defend their rights and to fulfil their secular obligations to the state, *e.g.* to lead the ecclesiastical levies to war. A new class of *advocatus* thus arose, whose office, commonly rewarded by a grant of land, crystallized into a fief, which, like other fiefs, had by the beginning of the 11th century become hereditary.

The French avoués.

In France the *advocati* (*avoués*) were of two classes—(1) great barons, who held the advocateship of an abbey or abbeys rather as an office than a fief, though they were indemnified for the protection they afforded by a domain and revenues granted by the abbey: thus the duke of Normandy was *advocatus* of nearly all the abbeys in the duchy; (2) petty seigneurs, who held their *avoueries* as hereditary fiefs and often as their sole means of subsistence. The *avoué* of an abbey, of this class, corresponded to the *vidame* (*q.v.*) of a bishop. Their function was generally to represent the abbot in his capacity as feudal lord; to act as his representative in the courts of his superior lord; to exercise secular justice in the abbot's name in the abbatial court; to lead the retainers of the abbey to battle under the banner of the patron saint.

In England.

In England the word *advocatus* was never used to denote an hereditary representative of an abbot; but in some of the larger abbeys there were hereditary stewards whose functions and privileges were not dissimilar to those of the continental *advocati*. The word *advocatus*, however, was in constant use in England to denote the patron of an ecclesiastical benefice, whose sole right of any importance was an hereditary one of presenting a parson to the bishop for institution. In this way the hereditary right of presentation to a benefice came to be called in English an "advowson" (*advocatio*).

The *advocatus* played a more important part in the feudal polity of the Empire and of the Low Countries than in France, where his functions, confined to the protection of the interests of religious houses, were superseded from the 13th century onwards by the growth of the central power and the increasing efficiency of the royal administration. They had, indeed, long ceased to be effective for their original purpose; and from the time when their office became a fief they had taken advantage of their position to pillage and suppress those whom it was their function to defend. The medieval records, not in France only, are full of complaints by abbots of their usurpations, exactions and acts of violence.

The German Vogt.

In Germany the title of *advocatus* (*Vogt*) was given not only to the *advocati* of churches and abbeys, but to the officials appointed, from early in the middle ages, by the emperor to administer their immediate domains, in contradistinction to the counts, who had become hereditary princes of the Empire. The territory so administered was known as *Vogtland* (*terra advocatorum*), a name still sometimes employed to designate the strip of country which embraces the principalities of Reuss and adjacent portions of Saxony, Prussia and Bavaria. These imperial *advocati* tended in their turn to become hereditary. Sometimes the emperor himself assumed the title of *Vogt* of some particular part of his immediate domain. In the Netherlands as well as in Germany *advocati* were often appointed in the cities, by the overlord or by the emperor, sometimes to take the place of the bailiff (Ger. *Schultheiss*, Dutch *schout*, Lat. *scultetus*), sometimes alongside this official.

See Du Cange, *Glossarium* (ed. 1883, Niort), s. "Advocati"; A. Luchaire, *Manuel des institutions françaises* (Paris, 1892); Herzog-Hauck, *Realencyklopädie* (ed. Leipzig, 1896), s. "Advocatus ecclesiae," where further references will be found.

ADVOCATES, FACULTY OF, the collective term by which what in England are called barristers are known in Scotland. They professionally attend the supreme courts in Edinburgh; but they are privileged to plead in any cause before the inferior courts, where counsel are not excluded by statute. They may act in cases of appeal before the House of Lords; and in some of the British colonies, where the civil law is in force, it is customary for those who practise as barristers to pass as advocates in Scotland. This body has existed by immemorial custom. Its privileges are constitutional, and are founded on no statute or charter of incorporation. The body formed itself gradually, from time to time, on the model of the French corporations of *avocats*, appointing like them by a general vote, a dean or *doyen*, who is their principal officer. It also differs from the English and Irish societies in that there is no governing body similar to the benchers, nor is there any resemblance to the quasi-collegiate discipline and the usages and customs prevailing in an inn of court. No curriculum of study, residence or professional training was, until 1856, required on entering this profession; but the faculty have always had the power, believed to be liable to control by the the Court of Session, of rejecting any candidate for admission. The candidate undergoes two private examinations—the one in general scholarship, in lieu of which, however, he may produce evidence of his having graduated as master of arts in a Scottish university, or obtained an equivalent degree in an English or foreign university; and the other, at the interval of a year, in Roman, private international and Scots law. He must, before the latter examination, produce evidence of attendance at classes of Scots law and conveyancing in a Scottish university, and at classes of civil law, public or international law, constitutional law and medical jurisprudence in a Scottish or other approved university. He has then to undergo the old academic form of the public impugnment of a thesis on some title of the pandects; but this ceremony, called the public examination, has degenerated into a mere form. A large proportion of the candidate's entrance fees (amounting to £339) is devoted to the magnificent library belonging to the faculty, which literary investigators in Edinburgh find so eminently useful.

ADVOCATUS DIABOLI, devil's advocate, the name popularly given to the promoter of the Faith (*promotor fidei*), and officer of the Sacred Congregation of Rites at Rome, whose duty is to prepare all possible arguments against the admission of any one to the posthumous honours of beatification and canonization. This functionary is first formally mentioned under Leo X. (1513–1521) in the proceedings in connexion with the canonization of St Lorenzo Giustiniani. In 1631 Urban VIII. made his presence, either in person or by deputy, necessary for the validity of any act connected with the process of beatification or canonization (see CANONIZATION). The phrase, "devil's advocate," has by an easy transference come to be used of any one who puts himself up, or is put up, for the sake of promoting debate, to argue a case in which he does not necessarily believe.

ADVOWSON, or ADVOWZEN (through O. Fr. *advouson*, from Lat. *advocatio*, a summons to), the right of presentation to a vacant ecclesiastical benefice, so called because the patron defends or advocates the claims of the person whom he presents. At what period the right of advowson arose is uncertain; it was probably the result of gradual growth. The earliest trace of the practice is found in the decree of the council of Orange, A.D. 441, which allowed a bishop, who had built a church in the diocese of another bishop, to nominate the clerk, but not to consecrate the church. The 123rd Novel of Justinian, promulgated about the end of the 5th century, decreed "that if any man should erect an oratory, and desire to present a clerk thereto by himself or his heirs, if they furnish a competency for his livelihood, and nominate to the bishop such as are worthy, they may be ordained." The 57th Novel empowered the bishop to examine them and judge of their qualifications, and, where those were sufficient, obliged him to admit the clerk. In England, for quite two centuries after its conversion, the clergy administered only *pro tempore* in the parochial churches, receiving their maintenance from the cathedral church, all the appointments within the diocese lying with the bishop. But in order to promote the building and endowment of parochial churches those who had contributed to their erection either by a grant of land, by building or by endowment, became entitled to present a clerk of their own choice to the bishop, who was invested with the revenues derived from such contribution. After the Norman Conquest, when the boundaries between church and state were more clearly marked, it became usual for patrons to appoint to livings not only without the consent, but even against the will, of the bishops.

Advowsons are divided into two kinds, *appendant* and *in gross*. Originally the right of nominating[1] or presenting was annexed to the person who built or endowed the church, but the right gradually became annexed to the manor in which it was built, for the endowment was considered parcel of the manor, the church being built for the use of the inhabitants, and the tithes of the manor being attached to the the church. Consequently where the right of patronage (the right of the patron to present to the bishop the person whom he has nominated to become rector or vicar of the parish to the benefice of which he claims the right of advowson) remains attached to the manor, it is called an advowson *appendant*, and passes with the estate by inheritance or sale without any special conveyance. But where, as is often the case, the right of presentation has been sold by itself, and so separated from the manor, it is called an advowson *in gross*. An advowson may also be partly *appendant*, and partly *in gross*, *e.g.* if an owner granted to another every second presentment, the advowson would be appendant for the grantor's turn and in gross for the grantee's.

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[1] The distinction between *nomination* to a living and *presentation* is to be noted. *Nomination* is the power, by virtue of a manor or otherwise, to appoint a clerk to the patron of a benefice, to be by him presented to the ordinary. *Presentation* is the act of a patron in offering his clerk to the bishop, to be instituted in a benefice of his gift. Nomination and presentation, though generally used in law for the same thing, must be so distinguished, for it is possible that the rights of nomination may be in one person, and the rights of presentation in another.

Advowsons are further distinguished into *presentative* and *collative*. In a *presentative* advowson, the patron presents a clergyman to the bishop, with the petition that he be instituted into the vacant living. The bishop is bound to induct if he find the clergyman canonically qualified, and a refusal on his part is subject to an appeal to an ecclesiastical court either by patron or by presentee. In a *collative* advowson the bishop is himself the patron, either in his own right or in the right of the proper patron, which has lapsed to him through not being exercised within the statutory period of six months after the vacancy occurred. No petition is necessary in this case, and the bishop is said to *collate* to the benefice. Before 1898 there were also *donative* advowsons, but the Benefices Act 1898 made all donations with cure of souls *presentative*. In a *donative* advowson, the sovereign, or any subject by special licence from the sovereign, conferred a benefice by a simple letter of gift, without any reference to the bishop, and without presentation and institution. The incumbent of such a living was to a great extent free from the jurisdiction of the bishop, who could only reach him through the action of an ecclesiastical court.

The Benefices Act of 1898 did not make any substantial change in the legal character of advowsons, which remain practically the same as before the act. Briefly, it prevents the dealing with the right of presentation as a thing apart from the advowson itself; increases the power of the bishops to refuse the presentation of unfit persons, and removes several abuses which had arisen in the transfer of patronage. Under the previously existing law, simony, or "the corrupt presentation of any person to an ecclesiastical benefice for gift, money or reward," renders the presentation void, and subjects the persons privy or party to it to penalties; a presentation to a vacant benefice cannot be sold, and no clerk in holy orders can purchase for himself a next presentation. An advowson may, however, be sold during a vacancy, though that will not give the right to present to that vacancy; and a clerk may buy an advowson even though it be only an estate for life, and present himself on the next vacancy. Under the Benefices Act, advowsons may not be sold by public auction except in conjunction with landed property adjacent to the benefice; transfers of patronage must be registered in the registry of the diocese, and no such transfers can be made within twelve months after the last admission or institution to the benefice. Restrictions had also been imposed on the transfer of patronage of churches built under the Church Building Acts and New Parishes Acts, and on that of benefices in the gift of the lord chancellor, and sold by him in order to augment others; but agreements may be made as to the patronage of such churches in favour of persons who have contributed to their building or enlargement without being void for simony.

The right of presentation may be exercised by its owner whether he be an infant, executors, trustees, coparceners (who, if they cannot agree, present in turn in order of age) or mortgagee (who must present the nominee of the mortgagor), or a bankrupt (who, although the advowson belongs to his creditors, yet has the right to present to a vacancy). Certain owners of advowsons are temporarily or permanently disabled from exercising the right which devolves upon other persons; and the crown as patron paramount of all benefices can fill all churches not regularly filled by other patrons. It thus presents to all vacancies caused by simoniacal presentations, or by the incumbent having been presented to a bishopric or in benefices belonging to a bishopric when the see is vacant by the bishop's death, translation or deprivation. Where a presentation belongs to a lunatic, the lord chancellor presents for him. Where it belongs to a Roman Catholic the right is exercised in his behalf by the university of Oxford if the benefice be situate south of the river Trent, and by that of Cambridge if it be north of that river.

Besides the qualifications required of a presentee by canon law, such as being of the canonical age, and in priest's orders before admission, sufficient learning and proper orthodoxy or morals, the Benefices Act requires that a year shall have elapsed since a transfer of the right of patronage, unless it can be shown that such transfer was not made in view of a probable vacancy; that the presentee has been a deacon for three years; and that he is not unfit for the discharge of his duties by reason of physical or mental infirmity or incapacity, grave pecuniary embarrassment, grave misconduct or neglect of duty in an ecclesiastical office, evil life, or conduct causing grave scandal concerning his moral character since his ordination, or being party to an illegal agreement with regard to the presentation; that notice of the presentation has been given to the parish of the benefice. Except by leave of the bishop or sequestrator, the incumbent of a sequestered benefice cannot be presented. The act also gives to both patron and presentee an alternative mode of appeal against a bishop's refusal to institute or admit, except on a ground of doctrine or ritual, to a court composed of an archbishop of the province and a judge of the High Court nominated for that purpose by the lord chancellor, a course which, however, bars resort being had to the ordinary suits of *duplex querela* or action of *quare impedit*. In case of refusal of one presentee, a lay patron may present another, and a clerical patron may do so after an unsuccessful appeal against the refusal.

Upon institution the church is full against everybody except the crown, and after six months' peaceable possession the clerk is secured in possession of the benefice, even though he may have been presented by a person who is not the proper patron. The true patron can, however, exercise his right to present at the next vacancy, and can reserve the advowson from an usurper at any time within three successive incumbencies so created adversely to his right, or within sixty years. Collation, which otherwise corresponds to institution, does not make the church full, and the true patron can dispossess the clerk at any time, unless he is a patron who collates. Possession of the benefice is completed by induction, which makes the church full against any one, including the crown. If the proper patron fails to exercise his right within six calendar months from the vacancy, the right devolves or lapses to the next superior patron, *e.g.* from an ordinary patron to the bishop, and if he makes similar default to the archbishop, and from him on similar default to the crown. If a bishopric becomes vacant after a lapse has accrued to it, it goes to the metropolitan; but in case of a vacancy of a benefice during the vacancy of the see the crown presents. Until the right of presentation so accruing to a bishop or archbishop is exercised, the patron can still effectually present but not if lapse has gone to the crown.

(See also Benefice; Glebe; Incumbent; Vicar.)

Authorities.—Burn, *Ecclesiastical Law*; Bingham's *Origines Ecclesiasticae, or, the Antiquities of the English Church*; Mirehouse, *On Advowson*; Phillimore, *Ecclesiastical Law*.

ADYE, SIR JOHN MILLER (1819–1900), British general, son of Major James P. Adye, was born at Sevenoaks, Kent, on the 1st of November 1819. He entered the Royal Artillery in 1836, was promoted captain in 1846, and served throughout the Crimean War as brigade-major and assistant adjutant-general of artillery (C.B., brevets of major and lieutenant-colonel). In the Indian Mutiny he served on the staff in a similar capacity. Promoted brevet-colonel in 1860, he was specially employed in 1863 in the N.W. frontier of India campaign, and was deputy-adjutant-general, Bengal, from 1863 to 1866, when he returned home. From 1870 to 1875 Adye was director of artillery and stores at the War Office. He was made a K.C.B. in 1873, and was promoted to be major-general and appointed governor of the Royal Military Academy, Woolwich, in 1875, and surveyor-general of the ordnance in 1880. In 1882 he was chief of staff and second in command of the expedition to Egypt, and served throughout the campaign (G.C.B. and thanks of parliament). He held the government of Gibraltar from 1883 to 1886. Promoted islands, Antiparos, Ios, Amorgos, Syros and Siphnos, were all found to be singularly rich in evidence of the middle-Aegean period. The series of Syran built graves, containing crouching corpses, is the best and most representative that is known in the Aegean. Melos, long marked as a source of early objects, but not systematically excavated until taken in hand by the British School at Athens in 1896, yielded at Phylakope remains of all the Aegean periods, except the Neolithic. A map of Cyprus in the later Bronze Age (such as is given by J. L. Myres and M. O. Richter in *Catalogue of the Cyprus Museum*) shows more than five-and-twenty settlements in and about the Mesaoréa district alone, of which one, that at Enkomi, near the site of Salamis, has yielded the richest Aegean treasure in precious metal found outside Mycenae. E. Chantre in 1894 picked up lustreless ware, like that of Hissarlik, in central Phrygia and at Pteria (*q.v.*), and the English archaeological expeditions, sent subsequently into north-western Anatolia, have never failed to bring back ceramic specimens of Aegean appearance from the valleys of the Rhyndacus, Sangarius and Halys. In Egypt in 1887 W. M. F. Petrie found painted sherds of Cretan style at Kahun in the Fayum, and farther up the Nile, at Tell el-Amarna, chanced on bits of no fewer than 800 Aegean vases in 1889. There have now been recognized in the collections at Cairo, Florence, London, Paris and Bologna several Egyptian imitations of the Aegean style which can be set off against the many debts which the centres of Aegean culture owed to Egypt. Two Aegean vases were found at Sidon in 1885, and many fragments of Aegean and especially Cypriote pottery have been turned up during recent excavations of sites in Philistia by the Palestine Fund. South-eastern Sicily, ever since P. Orsi excavated the Sicel cemetery near Lentini in 1877, has proved a mine of early remains, among which appear in regular succession Aegean fabrics and motives of decoration from the period of the second stratum at Hissarlik. Sardinia has Aegean sites, *e.g.* at Abini near Teti; and Spain has yielded objects recognized as Aegean from tombs near Cadiz and from Saragossa. One land, however, has eclipsed all others in the Aegean by the wealth of its remains of all the prehistoric ages, viz. Crete, so much so that, for the present we must regard it as the fountain-head of Aegean civilization, and probably for long its political and social centre. The island first attracted the notice of archaeologists by the remarkable archaic Greek bronzes found in a cave on Mount Ida in 1885, as well as by epigraphic monuments such as the famous law of Gortyna; but the first undoubted Aegean remains reported from it were a few objects extracted from Cnossus by Minos Kalokhairinos of Candia in 1878. These were followed by certain discoveries made in the S. plain (Messará) by F. Halbherr. W. J. Stillman and H. Schliemann both made unsuccessful attempts at Cnossus, and A. J. Evans, coming on the scene in 1893, travelled in succeeding years about the island picking up trifles of unconsidered evidence, which gradually convinced him that greater things would eventually be found. He obtained enough to enable him to forecast the discovery of written characters, till then not suspected in Aegean civilization. The revolution of 1897–98 opened the door to wider knowledge, and much exploration has ensued, for which see CRETE. Thus the "Aegean Area" has now come to mean the Archipelago with Crete and Cyprus, the Hellenic peninsula with the Ionian isles, and Western Anatolia. Evidence is still wanting for the Macedonian and Thracian coasts. Offshoots are found in the W. Mediterranean, in Sicily, Italy, Sardinia and Spain, and in the E. in Syria and Egypt. About the Cyrenaica we are still insufficiently informed.

II. *General Nature of the Evidence.*—For details of monumental evidence the articles on CRETE, MYCENAE, TIRYNS, TROAD, CYPRUS, &c., must be consulted. The most representative site explored up to now is Cnossus (see CRETE, sect. *Archaeology*), which has yielded not only the most various but the most continuous evidence from the Neolithic age to the twilight of classical civilization. Next in importance come Hissarlik, Mycenae, Phaestus, Hagia, Triada, Tiryns, Phylakope, Palaikastro and Gournia.

A. The *internal* evidence at present available comprises—

(1) *Structures.*—Ruins of palaces, palatial villas, houses, built dome- or cist-graves and fortifications (Aegean isles, Greek mainland and N.W. Anatolia), but not distinct temples; small shrines, however, and *temenē* (religious enclosures, remains of one of which were probably found at Petsofa near Palaikastro by J. L. Myres in 1904) are represented on intaglios and frescoes. From like sources and from inlay-work we have also representations of palaces and houses.

(2) *Structural Decoration.*—Architectural features, such as columns, friezes and various mouldings; mural decoration, such as fresco-paintings, coloured reliefs and mosaic inlay.

(3) *Furniture.*—(*a*) *Domestic*, such as vessels of all sorts and in many materials, from huge store-jars down to tiny unguent-pots; culinary and other implements; thrones, seats, tables, &c., these all in stone or plastered terra-cotta. (*b*) *Sacred*, such as models or actual examples of ritual objects; of these we have also numerous pictorial representations. (*c*) *Funerary*, *e.g.* coffins in painted terra-cotta.

(4) *Artistic fabrics*, *e.g.* plastic objects, carved in stone or ivory, cast or beaten in metals (gold, silver, copper and bronze), or modelled in clay, faience, paste, &c. Very little trace has yet been found of large free sculpture, but many examples exist of sculptors' smaller work. Vases of all kinds, carved in marble or other stones, cast or beaten in metals or fashioned in clay, the latter in enormous number and variety, richly ornamented with coloured schemes, and sometimes bearing moulded decoration. Examples of painting on stone, opaque and transparent. Engraved objects in great number, *e.g.* ring-bezels and gems; and an immense quantity of clay impressions, taken from these.

(5) *Weapons, tools and implements*, in stone, clay and bronze, and at the last iron, sometimes richly ornamented or inlaid. Numerous representations also of the same. No actual body-armour, except such as was ceremonial and buried with the dead, like the gold breastplates in the circle-graves at Mycenae.

(6) *Articles of personal use*, *e.g.* brooches (*fibulae*), pins, razors, tweezers, &c., often found as dedications to a deity, *e.g.* in the Dictaean Cavern of Crete. No textiles have survived.

(7) *Written documents*, *e.g.* clay tablets and discs (so far in Crete only), but nothing of more perishable nature, such as skin, papyrus, &c.; engraved gems and gem impressions; legends written with pigment on pottery (rare); characters incised on stone or pottery. These show two main systems of script (see CRETE).

(8) *Excavated tombs*, of either the pit or the grotto kind, in which the dead were laid, together with various objects of use and luxury, without cremation, and in either coffins or *loculi* or simple wrappings.

(9) *Public works*, such as paved and stepped roadways, bridges, systems of drainage, &c.

B. There is also a certain amount of *external* evidence to be gathered from—

(1) Monuments and records of other contemporary civilizations, *e.g.* representations of alien peoples in Egyptian frescoes; imitation of Aegean fabrics and style in non-Aegean lands; allusions to Mediterranean peoples in Egyptian, Semitic or Babylonian records.

(2) Literary traditions of subsequent civilizations, especially the Hellenic, such as, *e.g.*, those embodied in the Homeric poems, the legends concerning Crete, Mycenae, &c.; statements as to the origin of gods, cults and so forth, transmitted to us by Hellenic antiquarians such as Strabo, Pausanias, Diodorus Siculus, &c.

(3) Traces of customs, creeds, rituals, &c., in the Aegean area at a later time, discordant with the civilization in which they were practised and indicating survival from earlier systems. There are also possible linguistic and even physical survivals to be considered.

III. *General Features of Aegean Civilization.*—The leading features of Aegean civilization, as deduced from the evidence, must be stated very briefly.

(1) *Political Organization.*—The great Cretan palaces and the fortified citadels of Mycenae, Tiryns and Hissarlik, each

AEGEAN CIVILIZATION

PLATE I.

GRAPHIC ART

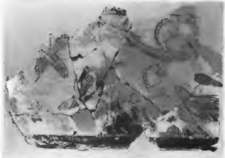


FIG. 1.—FLYING FISH FRESCO, PHYLAKOPI.
Cf. *J.H.S.* Suppl. Papers, iv.

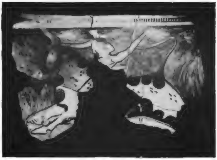


FIG. 2.—BULL, WITH LEAPING BULL-FIGHTER TIRYNS.
Cf. Schliemann, *Tiryns*, Plate XIII.

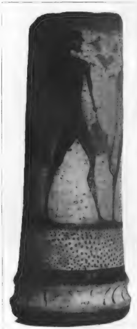


FIG. 3.—LAMP-STAND, PHYLAKOPI.
Cf *J.H.S.* Suppl Papers, iv Plate XXII.

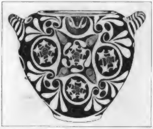


FIG. 4.—MIDDLE MINOAN VASE, CNOSSUS.
B.S.A. ix. 120, Fig. 75.

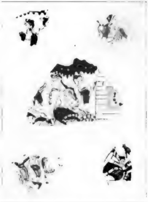


FIG. 5.—MINIATURE FRESCOES, SHOWING SPECTATORS AT ATHLETIC SPORTS, CNOSSUS.
From Photo by Dr. A. J. Evans.

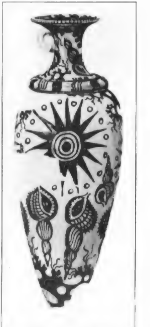


FIG. 6.—FILLER VASE, ZAKRO.
J.H.S. vol xxii. Plate XII

By permission of the Society for the Promotion of Hellenic Studies.

PLATE II.

AEGEAN CIVILIZATION

PLASTIC ART

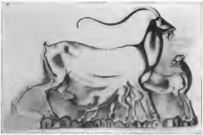


FIG. 1.—FAIENCE PLAGUE, CNOSSUS.
B.S.A. ix. Plate III.

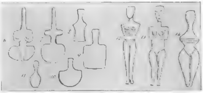


FIG. 2.—MARBLE IDOLS, AMORGOS: 6–11 FIDDLE AND MALLET TYPES, 12–14, DEVELOPED TYPES.
Man 1901, 185, No. 146.
By permission of the Royal Anthropological Institute

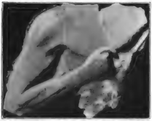


FIG. 3.—COLOURED BAS-RELIEF IN *GESSO DURO*, REPRESENTING MALE FOSSO WITH *FLEUR-DE-LIS* COLLAR.
B.S.A. vii. 17. Fig. 6.

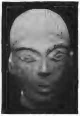


FIG. 4.—MARBLE HEAD FROM AMORGOS (ASHMOLEAN MUSEUM).

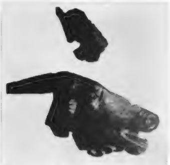
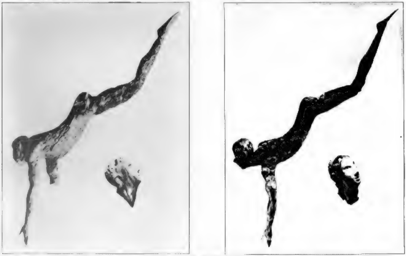
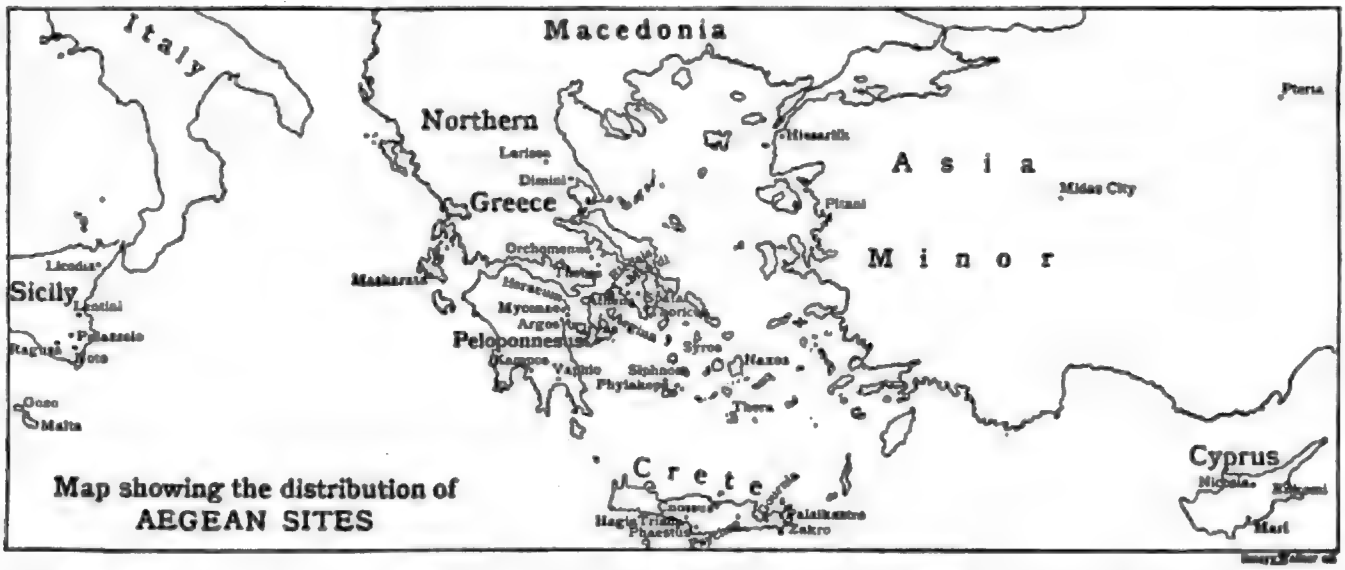


FIG. 5.—BULL IN PAINTED PLASTER, CNOSSUS.
Photo by Dr A. J. Evans.



FIGS. 6, 7.—IVORY FIGURES AND HEADS OF ATHLETES, BULL-FIGHTERS OR ACROBATS, CNOSSUS.
B.S.A. viii. Plates II. and III., and p. 72 sq.
By permission of the Society for the Promotion of Hellenic Studies



Map showing the distribution of AEGEAN SITES

containing little more than one great residence, and dominating lower towns of meaner houses, point to monarchy at all periods. Independent local developments of art before the middle of the 2nd millennium B.C. suggest the early existence of independent units in various parts, of which the strongest was the Cnossian. After that date the evidence goes strongly to show that one political dominion was spread for a brief period, or for two brief periods, over almost all the area (see later). The great number of tribute-tallies found at Cnossus perhaps indicates that the centre of power was always there.

(2) *Religion.*—The fact that shrines have so far been found within palaces and not certainly anywhere else indicates that the kings kept religious power in their own hands; perhaps they were themselves high-priests. Religion in the area seems to have been essentially the same everywhere from the earliest period, viz. the cult of a Divine Principle, resident in dominant features of nature (sun, stars, mountains, trees, &c.) and controling fertility. This cult passed through an aniconic stage, from which fetishes survived to the last, these being rocks or pillars, trees, weapons (*e.g. bipennis*, or double war-axe, shield), &c. When the iconic stage was reached, about 2000 B.C., we find the Divine Spirit represented as a goddess with a subordinate young god, as in many other E. Mediterranean lands. The god was probably son and mate of the goddess, and the divine pair represented the genius of Reproductive Fertility in its relations with humanity. The goddess sometimes appears with doves, as uranic, at others with snakes, as chthonic. In the ritual fetishes, often of miniature form, played a great part: all sorts of plants and animals were sacred: sacrifice (not burnt, and human very doubtful), dedication of all sorts of offerings and *simulacra*, invocation, &c., were practised. The dead, who returned to the Great Mother, were objects of a sort of hero-worship. This early nature-cult explains many anomalous features of Hellenic religion, especially in the cults of Artemis and Aphrodite. (See CRETE.)

(3) *Social Organization.*—There is a possibility that features of a primeval matriarchate long survived; but there is no certain evidence. Of the organization of the people under the monarch we are ignorant. There are so few representations of armed men that it seems doubtful if there can have been any professional military class. Theatral structures found at Cnossus and Phaestus, within the precincts of the palaces, were perhaps used for shows or for sittings of a royal assize, rather than for popular assemblies. The Cnossian remains contain evidence of an elaborate system of registration, account-keeping and other secretarial work, which perhaps indicates a considerable body of law. The life of the ruling class was comfortable and even luxurious from early times. Fine stone palaces, richly decorated, with separate sleeping apartments, large halls, ingenious devices for admitting light and air, sanitary conveniences and marvellously modern arrangements for supply of water and for drainage, attest this fact. Even the smaller houses, after the Neolithic period, seem also to have been of stone, plastered within. After 1600 B.C. the palaces in Crete had more than one story, fine stairways, bath-chambers, windows, folding and sliding doors, &c. In this later period, the distinction of blocks of apartments in some palaces has been held to indicate the seclusion of women in *harems*, at least among the ruling caste. Cnossian frescoes show women grouped apart, and they appear alone on gems. Flesh and fish and many kinds of vegetables were evidently eaten, and wine and beer were drunk. Vessels for culinary, table, and luxurious uses show an infinite variety of form and purpose. Artificers' implements of many kinds were in use, bronze succeeding obsidian and other hard stones as the material. Seats are found carefully shaped to the human person. There was evidently olive- and vine-culture on a large scale in Crete at any rate. Chariots were in use in the later period, as is proved by the pictures of them on Cretan tablets, and therefore, probably, the horse also was known. Indeed a horse appears on a gem impression. Main ways were paved. Sports, probably more or less religious, are often represented, *e.g.* bull-fighting, dancing, boxing, armed combats.

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(4) *Commerce* was practised to some extent in very early times, as is proved by the distribution of Melian obsidian over all the Aegean area and by the Nilotic influence on early Minoan art. We find Cretan vessels exported to Melos, Egypt and the Greek mainland. Melian vases came in their turn to Crete. After 1600 B.C. there is very close intercourse with Egypt, and Aegean things find their way to all coasts of the Mediterranean (see below). No traces of currency have come to light, unless certain axe-heads, too slight for practical use, had that character; but standard weights have been found, and representations of ingots. The Aegean written documents have not yet proved (by being found outside the area) epistolary correspondence with other lands. Representations of ships are not common, but several have been observed on Aegean gems, gem-sealings and vases. They are vessels of low free-board, with masts. Familiarity with the sea is proved by the free use of marine motives in decoration.

(5) *Treatment of the Dead.*—The dead in the earlier period were laid (so far as we know at present) within cists constructed of upright stones. These were sometimes inside caves. After the burial the cist was covered in with earth. A little later, in Crete, bone-pits seem to have come into use, containing the remains of many burials. Possibly the flesh was boiled off the bones at once ("scarification"), or left to rot in separate cists awhile; afterwards the skeletons were collected and the cists

III. 1, 2, with Dynasty XVIII. (*c.* 1600–1400 B.C.). This coincidence has been observed not only at Cnossus, but previously, in connexion with discoveries of scarabs and other Egyptian objects made at Mycenae, Ialysus, Vaphio, &c. In Egypt itself Kefti tributaries, bearing vases of Aegean form, and themselves similar in fashion of dress and arrangement of hair to figures on Cretan frescoes and gems of Period III., are depicted under this and the succeeding Dynasties (*e.g.* Rekhmara tomb at Thebes). Actual vases of late Minoan style have been found with remains of Dynasty XVIII., especially in the town of Amenophis IV. Akhenaton at Tell el-Amarna; while in the Aegean area itself we have abundant evidence of a great wave of Egyptian influence beginning with this same Dynasty. To this wave were owed in all probability the Nilotic scenes depicted on the Mycenae daggers, on frescoes of Hagia Triada and Cnossus, on pottery of Zakro, on the shell-relief of Phaestus, &c.; and also many forms and fabrics, *e.g.* certain Cretan coffins, and the faience industry of Cnossus. These serve to date, beyond all reasonable question, Periods III. 1-2 in Crete, the shaft-graves in the Mycenae circle, the Vaphio tomb, &c., to the 16th and 15th centuries B.C., and Period III. 3 with the lower town at Mycenae, the majority of the sixth stratum at Hissarlik, the Ialysus burials, the upper stratum at Phylakope, &c., to the century immediately succeeding.

The *terminus ad quem* is less certain—iron does not begin to be used for weapons in the Aegean till after Period III. 3, and then not exclusively. If we fix its introduction to about 1000 B.C. and make it coincident with the incursion of northern tribes, remembered by the classical Greeks as the Dorian Invasion, we must allow that this incursion did not altogether stamp out Aegean civilization, at least in the southern part of its area. But it finally destroyed the Cnossian palace and initiated the "Geometric" Age, with which, for convenience at any rate, we may close the history of Aegean civilization proper.

(2) *Annals.*—From these and other data the outlines of primitive history in the Aegean may be sketched thus. A people, agreeing in its prevailing skull-forms with the Mediterranean race of N. Africa, was settled in the Aegean area from a remote Neolithic antiquity, but, except in Crete, where insular security was combined with great natural fertility, remained in a savage and unproductive condition until far into the 4th millennium B.C. In Crete, however, it had long been developing a certain civilization, and at a period more or less contemporary with Dynasties XI. and XII. (2500 B.C.?) the scattered communities of the centre of the island coalesced into a strong monarchical state, whose capital was at Cnossus. There the king, probably also high priest of the prevailing nature-cult, built a great stone palace, and received the tribute of feudatories, of whom, probably, the prince of Phaestus, who commanded the Messará plain, was chief. The Cnossian monarch had maritime relations with Egypt, and presently sent his wares all over the S. Aegean (*e.g.* to Melos in the earlier Second City Period of Phylakope) and to Cyprus, receiving in return such commodities as Melian obsidian knives. A system of pictographic writing came into use early in this Palace period, but only a few documents, made of durable material, have survived. Pictorial art of a purely indigenous character, whether on ceramic material or plaster, made great strides, and from ceramic forms we may legitimately infer also a high skill in metallurgy. The absence of fortifications both at Cnossus and Phaestus suggest that at this time Crete was internally peaceful and externally secure. Small settlements, in very close relation with the capital, were founded in the east of the island to command fertile districts and assist maritime commerce. Gournia and Palaikastro fulfilled both these ends: Zakro must have had mainly a commercial purpose, as the starting-point for the African coast. The acme of this dominion was reached about the end of the 3rd millennium B.C., and thereafter there ensued a certain, though not very serious, decline. Meanwhile, at other favourable spots in the Aegean, but chiefly, it appears, on sites in easy relation to maritime commerce, *e.g.* Tiryns and Hissarlik, other communities of the early race began to arrive at civilization, but were naturally influenced by the more advanced culture of Crete, in proportion to their nearness of vicinity. Early Hissarlik shows less Cretan influence and more external (*i.e.* Asiatic) than early Melos. The inner Greek mainland remained still in a backward state. Five hundred years later—about 1600 B.C.—we observe that certain striking changes have taken place. The Aegean remains have become astonishingly uniform over the whole area; the local ceramic developments have almost ceased and been replaced by ware of one general type both of fabric and decoration. The Cretans have stayed their previous decadence, and are once more possessors of a progressive civilization. They have developed a more convenient and expressive written character by stages of which one is best represented by the tablets of Hagia Triada. The art of all the area gives evidence of one spirit and common models; in religious representations it shows the same anthropomorphic personification and the same ritual furniture. Objects produced in one locality are found in others. The area of Aegean intercourse has widened and become more busy. Commerce with Egypt, for example, has increased in a marked degree, and Aegean objects or imitations of them are found to have begun to penetrate into Syria, inland Asia Minor, and the central and western Mediterranean lands, *e.g.* Sicily, Sardinia and Spain. There can be little doubt that a strong power was now fixed in one Aegean centre, and that all the area had come under its political, social and artistic influence.

How was this brought about, and what was the imperial centre? Some change seems to have come from the north; and there are those who go so far as to say that the centre henceforward was the Argolid, and especially "golden" Mycenae, whose lords imposed a new type of palace and a modification of Aegean art on all other Aegean lands. Others again cite the old-established power and productivity of Crete; the immense advantage it derived from insularity, natural fertility and geographical relation to the wider area of east Mediterranean civilizations; and the absence of evidence elsewhere for the gradual growth of a culture powerful enough to dominate the Aegean. They point to the fact that, even in the new period, the palm for wealth and variety of civilized production still remained with Crete. There alone we have proof that the art of writing was commonly practised, and there tribute-tallies suggest an imperial organization; there the arts of painting and sculpture in stone were most highly developed; there the royal residences, which had never been violently destroyed, though remodelled, continued unfortified; whereas on the Greek mainland they required strong protective works. The golden treasure of the Mycenae graves, these critics urge, is not more splendid than would have been found at Cnossus had royal burials been spared by plunderers, or been happened upon intact by modern explorers. It is not impossible to combine these views, and place the seat of power still in Crete, but ascribe the Renascence there to an influx of new blood from the north, large enough to instil fresh vigour, but too small to change the civilization in its essential character.

If this dominance was Cretan, it was short-lived. The security of the island was apparently violated not long after 1500 B.C., the Cnossian palace was sacked and burned, and Cretan art suffered an irreparable blow. As the comparatively lifeless character which it possesses in the succeeding period (III. 3) is coincident with a similar decadence all over the Aegean area, we can hardly escape from the conclusion that it was due to the invasion of all the Aegean lands (or at least the Greek mainland and isles) by some less civilized conquerors, who remained politically dominant, but, like their forerunners, having no culture of their own, adopted, while they spoiled, that which they found. Who these were we cannot say; but the probability is that they too came from the north, and were precursors of the later "Hellenes." Under their rule peace was re-established, and art production became again abundant among the subject population, though of inferior quality. The Cnossian palace was re-occupied in its northern part by chieftains who have left numerous rich graves; and general commercial intercourse must have been resumed, for the uniformity of the

RELIGION

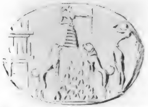

FIG. 1.—LION-GUARDED GODDESS AND SHRINE, ON A CLAY SEALING FROM CNOSSUS.

B.S.A. vii. 29, Fig. 9.

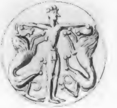

FIG. 2.—MALE DIVINITY BETWEEN LIONS, ON A LENTOID GEM FROM KYDONIA, CRETE.

J.H.S. xxi. 163, Fig. 43.

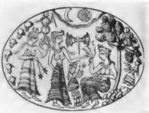

FIG. 3.—GOLD SIGNET FROM ACROPOLIS TREASURE, MYCENAE, SHOWING THE GODDESS BENEATH A SACRED TREE, WITH ADORANTS AND SACRED EMBLEMS.

J.H.S. xxi. 108, Fig. 4.

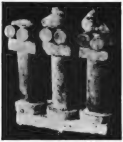

FIG. 4.—BIRDS ON A TRIAD OF PILLARS, CNOSSUS.

B.S.A. viii. 29, Fig. 14.

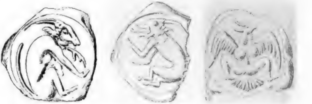

FIG. 5.—CLAY SEALINGS FROM ZAKRO, WITH MINOTAUR TYPES.

B.S.A. vii. 133, Fig. 45.

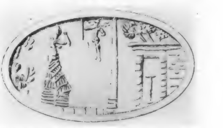

FIG. 6.—DUAL PILLAR WORSHIP, ON A GOLD SIGNET RING, CNOSSUS.

J.H.S. xxi. 170, Fig. 48.

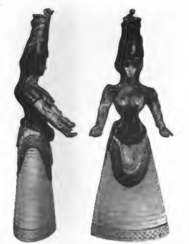

FIG. 7.—FAÏENCE FIGURE OF THE GODDESS, WITH SERPENT ATTRIBUTES, CNOSSUS.

I. 250. *B.S.A.* ix. 75, Fig. 54.

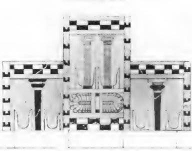

FIG. 8.—FAÇADE OF SMALL TEMPLES, COMPLETED FROM A FRESCO PAINTING, CNOSSUS.

J.H.S. xxi. 193, Fig. 66.

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AEGEAN CIVILIZATION
TYPES AND COSTUMES, ETC.

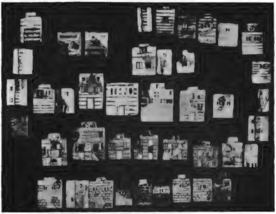


Fig. 1.—TESSERAE OF PORCELAIN MOSAIC IN FORM OF HOUSES AND TOWERS, CNOSSUS. *B.S.A.* viii. 15, Fig. 8.

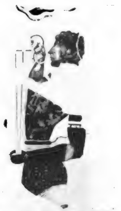
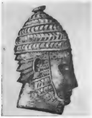


Fig. 2.—CUP-BEARER, CNOSSUS

Photo by Dr A. J. Evans



Figs. 3, 5.—IVORY HEADS FROM SPATA (ATTICA).

Reichel, *Homerische Waffen*, 1901, p. 103.
By permission of A. Hölder, Vienna.

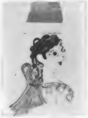


Fig. 4.—FRESCO PAINTING OF GIRL, CNOSSUS.

B.S.A. vii. 57, Fig. 17.

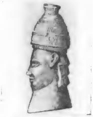


Fig. 5.—See Fig. 3.

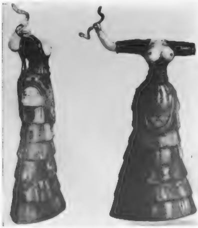


Fig. 6.—FAIENCE FIGURE OF FEMALE VOTARY OF SNAKE-GODDESS, CNOSSUS.

B.S.A. ix. 77, Fig. 56.

Fig. 7.—KEFTIU (CRETAN) BEARING AEGEAN VASE AS TRIBUTE TO PHARAOH.

From H. R. Hall, *Oldest Civilization in Greece* (1901).

By permission of the Society for the Promotion of Hellenic Studies.

decadent Aegean products and their wide distribution become more marked than ever.

About 1000 B.C. there happened a final catastrophe. The palace at Cnossus was once more destroyed, and never rebuilt or re-inhabited. Iron took the place of Bronze, and Aegean art, as a living thing, ceased on the Greek mainland and in the Aegean isles including Crete, together with Aegean writing. In Cyprus, and perhaps on the south-west Anatolian coasts, there is some reason to think that the cataclysm was less complete, and Aegean art continued to languish, cut off from its fountain-head. Such artistic faculty as survived elsewhere issued in the lifeless geometric style which is reminiscent of the later Aegean, but wholly unworthy of it. Cremation took the place of burial of the dead. This great disaster, which cleared the ground for a new growth of local art, was probably due to yet another incursion of northern tribes, more barbarous than their predecessors, but possessed of superior iron weapons—those tribes which later Greek tradition and Homer knew as the Dorians. They crushed a civilization already hard hit; and it took two or three centuries for the artistic spirit, instinct in the Aegean area, and probably preserved in suspended animation by the survival of Aegean racial elements, to blossom anew. On this conquest seems to have ensued a long period of unrest and popular movements, known to Greek tradition as the Ionian Migration and the Aeolic and Dorian "colonizations"; and when once more we see the Aegean area clearly, it is dominated by Hellenes, though it has not lost all memory of its earlier culture.

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AEGEAN SEA, a part of the Mediterranean Sea, being the archipelago between Greece on the west and Asia Minor on the east, bounded N. by European Turkey, and connected by the Dardanelles with the Sea of Marmora, and so with the Black Sea. The name Archipelago (*q.v.*) was formerly applied specifically to this sea. The origin of the name Aegean is uncertain. Various derivations are given by the ancient grammarians—one from the town of Aegae; another from Aegea, a queen of the Amazons who perished in this sea; and a third from Aegeus, the father of Theseus, who, supposing his son dead, drowned himself in it. The following are the chief islands:—Thasos, in the extreme north, off the Macedonian coast; Samothrace, fronting the Gulf of Saros; Imbros and Lemnos, in prolongation of the peninsula of Gallipoli (*Thracian Chersonese*); Euboea, the largest of all, lying close along the east coast of Greece; the Northern Sporades, including Sciathos, Scopelos and Halonesos, running out from the southern extremity of the Thessalian coast, and Scyros, with its satellites, north-east of Euboea; Lesbos and Chios; Samos and Nikaria; Cos, with Calymnos to the north; all off Asia Minor, with the many other islands of the Sporades; and, finally, the great group of the Cyclades, of which the largest are Andros and Tenos, Naxos and Paros. Many of the Aegean islands, or chains of islands, are actually prolongations of promontories of the mainland. Two main chains extend right across the sea—the one through Scyros and Psara (between which shallow banks intervene) to Chios and the hammer-shaped promontory east of it; and the other running from the south-eastern promontory of Euboea and continuing the axis of that island, in a southward curve through Andros, Tenos, Myconos, Nikaria and Samos. A third curve, from the south-easternmost promontory of the Peloponnese through Cerigo, Crete, Carpathos and Rhodes, marks off the outer deeps of the open Mediterranean from the shallow seas of the archipelago, but the Cretan Sea, in which depths occur over 1000 fathoms, intervenes, north of the line, between it and the Aegean proper. The Aegean itself is naturally divided by the island-chains and the ridges from which they rise into a series of basins or troughs, the deepest of which is that in the north, extending from the coast of Thessaly to the Gulf of Saros, and demarcated southward by the Northern Sporades, Lemnos, Imbros and the peninsula of Gallipoli. The greater part of this trough is over 600 fathoms deep. The profusion of islands and their usually bold elevation give beauty and picturesqueness to the sea, but its navigation is difficult and dangerous, notwithstanding the large number of safe and commodious gulfs and bays. Many of the islands are of volcanic formation; and a well-defined volcanic chain bounds the Cretan Sea on the north, including Milo and Kimolos, Santorin (Thera) and Therasia, and extends to Nisyros. Others, such as Paros, are mainly composed of marble, and iron ore occurs in some. The larger islands have some fertile and well-watered valleys and plains. The chief productions are wheat, wine, oil, mastic, figs, raisins, honey, wax, cotton and silk. The people are employed in fishing for coral and sponges, as well as for bream, mullet and other fish. The men are hardy, well built and handsome; and the women are noted for their beauty, the ancient Greek type being well preserved. The Cyclades and Northern Sporades, with Euboea and small islands under the Greek shore, belong to Greece; the other islands to Turkey.

AEGEUS, in Greek legend, son of Pandion and grandson of Cecrops, was king of Athens and the father of Theseus. He was deposed by his nephews, but Theseus defeated them and reinstated his father. When Theseus set out for Crete to deliver Athens from the tribute to the Minotaur he promised Aegeus that, if he were successful, he would change the black sail carried by his ship for a white one. But, on his return, he forgot to hoist the white sail, and his father, supposing that his son had lost his life, threw himself from a high rock on which he was keeping watch into the sea, which was afterwards called the Aegean. The Athenians honoured him with a statue and a shrine, and one of the Attic demes was named after him.

Plutarch, *Theseus*; Pausanias i. 22; Hyginus, *Fab.* 43; Catullus lxiv. 207.

AEGINA (Egina or Engia), an island of Greece in the Saronic Gulf, 20 m. from the Peiraeus. Tradition derives the name from Aegina, the mother of Aeacus, who was born in and ruled the island. In shape Aegina is triangular, 8 m. long from N.W. to S.E., and 6 m. broad, with an area of about 41 sq. m. The western side consists of stony but fertile plains, which are well cultivated and produce luxuriant crops of grain, with some cotton, vines, almonds and figs. The rest of the island is rugged and mountainous. The southern end rises in the conical Mount Oros, and the Panhellenian ridge stretches northward with narrow fertile valleys on either side. From the absence of marshes the climate is the most healthy in Greece. The island forms part of the modern *nomos* of Attica and Boeotia, of which it forms an *eparchy*. The sponge fisheries are of considerable importance. The chief town is Aegina, situated at the north-west end of the island, the summer residence of many Athenian merchants. Capo d'Istria, to whom there is a statue in the principal square, erected there a large building, intended for a barracks, which was subsequently used as a museum, a library and a school. The museum was the first institution of its kind in Greece, but the collection was transferred to Athens in 1834.

Antiquities.—The archaeological interest of Aegina is centred in the well-known temple on the ridge near the northern corner of the island. Excavations were made on its site in 1811 by

Baron Haller von Hallerstein and the English architect C. R. Cockerell, who discovered a considerable amount of sculpture from the pediments, which was bought in 1812 by the crown prince Louis of Bavaria; the groups were set up in the Glyptothek at Munich after the figures had been restored by B. Thorvaldsen. Their restoration was somewhat drastic, the ancient parts being cut away to allow of additions in marble, and the new parts treated in imitation of the ancient weathering. Various conjectures were made as to the arrangement of the figures. That according to which they were set up at Munich was in the main suggested by Cockerell; in the middle of each pediment was a figure of Athena, set well back, and a fallen warrior at her feet; on each side were standing spearmen, kneeling spearmen and bowmen, all facing towards the centre of the composition; the corners were filled with fallen warriors. In 1901 Professor Furtwängler began a more systematic excavation of the site, and the new discoveries he then made, together with a fresh and complete study of the figures and fragments in Munich, have led to a rearrangement of the whole, which, if not certain in all details, may be regarded as approaching finality. According to this the figures of combatants do not all face towards the centre, but are broken up, as in other early compositions, into a series of groups of two or three figures each. A figure of Athena still occupies the centre of each pediment, but is set farther forward than in the old reconstruction. On each side of this, in the western pediment, is a group of two combatants over a fallen warrior; in the eastern pediment, a warrior whose opponent is falling into the arms of a supporting figure; other figures also—the bowmen especially—face towards the angles, and so give more variety to the composition. The western pediment, which is more conservative in type, represents the earlier expedition of Heracles and Telamon against Troy; the eastern, which is bolder and more advanced, probably refers to episodes in the Trojan war. There are also remains of a third pediment, which may have been produced in competition, but never placed on the temple. For the character of the sculptures see GREEK ART. The plan of the temple is chiefly remarkable for the unsymmetrically placed door leading from the back of the cella into the opisthodomus. This opisthodomus was completely fenced in with bronze gratings; and the excavators believe it to have been adapted for use as an *adytum* (shrine).

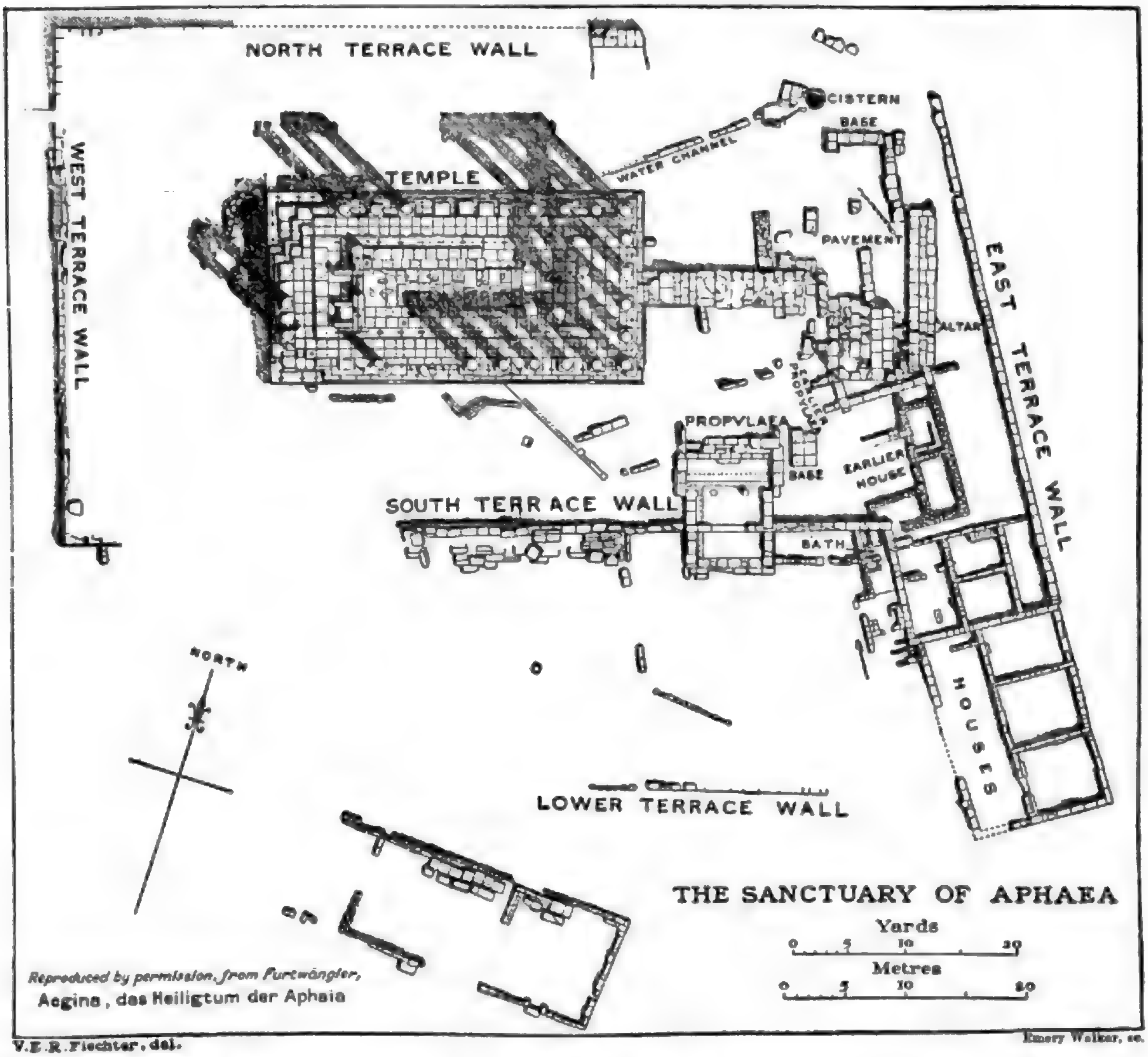
It was disputed in earlier times whether the temple was dedicated to Zeus or Athena. Inscriptions found by the recent excavations seem to prove that it must be identified as the shrine of the local goddess Aphaea, identified by Pausanias with Britomartis and Dictynna.

The excavations have laid bare several other buildings, including an altar, early propylaea, houses for the priests and remains of an earlier temple. The present temple probably dates from the time of the Persian wars. In the town of Aegina itself are the remains of another temple, dedicated to Aphrodite; one column of this still remains standing, and its foundations are fairly preserved.

AUTHORITIES.—*Antiquities of Ionia* (London, 1797), ii. pl. ii.-vii.; C. R. Cockerell, *The Temples of Jupiter Panhellenius at Aegina, &c.* (London, 1860); Ch. Garnier, *Le Temple de Jupiter Panhellénien à Égine* (Paris, 1884); Ad. Furtwängler and others, *Aegina, Heiligtum der Aphaia* (Munich, 1906), where earlier authorities are collected and discussed. (E. GR.)

History.—(1) *Ancient.* Aegina, according to Herodotus (v. 83), was a colony of Epidaurus, to which state it was originally subject. The discovery in the island of a number of gold ornaments belonging to the latest period of Mycenaean art suggests the inference that the Mycenaean culture held its own in Aegina for some generations after the Dorian conquest of Argos and Lacedaemon (see A. J. Evans, in *Journal of Hellenic Studies*, vol. xiii. p. 195). It is probable that the island was not dorized before the 9th century B.C. One of the earliest facts known to us in its history is its membership in the League of Calauria, which included, besides Aegina, Athens, the Minyan (Boeotian) Orchomenos, Troezen, Hermione, Nauplia and Prasiae, and was probably an organization of states which were still Mycenaean, for the suppression of the piracy which had sprung up in the Aegean as a result of the decay of the naval supremacy of the Mycenaean princes. It follows, therefore, that the maritime importance of the island dates back to pre-Dorian times. It is usually stated, on the authority of Ephorus, that Pheidon (*q.v.*) of Argos established a mint in Aegina. Though this statement is probably to be rejected, it may be regarded as certain that Aegina was the first state of European Greece to coin money. Thus it was the Aeginetans who, within thirty or forty years of the invention of coinage by the Lydians (*c.* 700 B.C.), introduced to the western world a system of such incalculable value to trade. The fact that the Aeginetan scale of coins, weights and measures was one of the two scales in general use in the Greek world is sufficient evidence of the early commercial importance of the island. It appears to have belonged to the Eretrian league; hence, perhaps, we may explain the war with Samos, a leading member of the rival Chalcidian league in the reign of King Amphicrates (Herod. iii. 59), *i.e.* not later than the earlier half of the 7th century B.C. In the next century Aegina is one of the three principal states trading at the emporium of Naucratis (*q.v.*), and it is the only state of European Greece that has a share in this factory (Herod. ii. 178). At the beginning of the 5th century it seems to have been an entrepôt of the Pontic grain trade, at a later date an Athenian monopoly (Herod. vii. 147). Unlike the other commercial states of the 7th and 6th centuries B.C., *e.g.* Corinth, Chalcis, Eretria and Miletus, Aegina founded no colonies. The settlements to which Strabo refers (viii. 376) cannot be regarded as any real exceptions to this statement.

The history of Aegina, as it has come down to us, is almost exclusively a history of its relations with the neighbouring state of Athens. The history of these relations, as recorded by Herodotus (v. 79-89; vi. 49-51, 73, 85-94), involve critical problems of some difficulty and interest. He traces back the hostility of the two states to a dispute about the images of the goddesses Damia and Auxesia, which the Aeginetans had carried off from Epidaurus, their parent state. The Epidaurians had been accustomed to make annual offerings to the Athenian deities Athena and Erechtheus in payment for the Athenian olive-wood of which the statues were made. Upon the refusal of the Aeginetans to continue these offerings, the Athenians endeavoured to carry away the images. Their design was miraculously frustrated—according to the Aeginetan version, the statues fell upon their knees,—and only a single survivor returned to Athens, there to fall a victim to the fury of his comrades' widows, who pierced him with their brooch-pins. No date is assigned by Herodotus for this "old feud"; recent writers, *e.g.* J. B. Bury and R. W. Macan, suggest the period between Solon and Peisistratus, *c.* 570 B.C. It may be questioned, however, whether the whole episode is not mythical. A critical analysis of the narrative seems to reveal little else than a series of aetiological traditions, explanatory of cults and customs, *e.g.* of the kneeling posture of the images of Damia and Auxesia, of the use of native ware instead of Athenian in their worship, and of the change in women's dress at Athens from the Dorian to the Ionian style. The account which Herodotus gives of the hostilities between the two states in the early years of the 5th century B.C. is to the following effect. Thebes, after the defeat by Athens about 507 B.C., appealed to Aegina for assistance. The Aeginetans at first contented themselves with sending the images of the Aeacidae, the tutelary heroes of their island. Subsequently, however, they entered into an alliance, and ravaged the sea-board of Attica. The Athenians were preparing to make reprisals, in spite of the advice of the Delphic oracle that they should desist from attacking Aegina for thirty years, and content themselves meanwhile with dedicating a precinct to Aeacus, when their projects were interrupted by the Spartan intrigues for the restoration of Hippias. In 491 B.C. Aegina was one of the states which gave the symbols of submission ("earth and water") to Persia. Athens at once appealed to Sparta to punish this act of medism, and Cleomenes I. (*q.v.*), one of the Spartan kings, crossed over to the island, to arrest those who were responsible for it. His attempt was at first unsuccessful;



THE SANCTUARY OF APHAEA

Reproduced by permission, from Furtwängler, Aegina, das Heiligtum der Aphaia

V.E.R. Fiechter, del. Emery Walker, sc.

but, after the deposition of Demaratus, he visited the island a second time, accompanied by his new colleague Leotychides, seized ten of the leading citizens and deposited them at Athens as hostages. After the death of Cleomenes and the refusal of the Athenians to restore the hostages to Leotychides, the Aeginetans retaliated by seizing a number of Athenians at a festival at Sunium. Thereupon the Athenians concerted a plot with Nicodromus, the leader of the democratic party in the island, for the betrayal of Aegina. He was to seize the old city, and they were to come to his aid on the same day with seventy vessels. The plot failed owing to the late arrival of the Athenian force, when Nicodromus had already fled the island. An engagement followed in which the Aeginetans were defeated. Subsequently, however, they succeeded in winning a victory over the Athenian fleet. All the incidents subsequent to the appeal of Athens to Sparta are expressly referred by Herodotus to the interval between the sending of the heralds in 491 B.C. and the invasion of Datis and Artaphernes in 490 B.C. (cf. Herod. vi. 49 with 94). There are difficulties in this story, of which the following are the principal:—(i.) Herodotus nowhere states or implies that peace was concluded between the two states before 481 B.C., nor does he distinguish between different wars during this period. Hence it would follow that the war lasted from shortly after 507 B.C. down to the congress at the Isthmus of Corinth in 481 B.C. (ii.) It is only for two years (490 and 491) out of the twenty-five that any details are given. It is the more remarkable that no incidents are recorded in the period between Marathon and Salamis, seeing that at the time of the Isthmian Congress the war is described as the most important one then being waged in Greece (Herod. vii. 145). (iii.) It is improbable that Athens would have sent twenty vessels to the aid of the Ionians in 498 B.C. if at the time she was at war with Aegina. (iv.) There is an incidental indication of time, which points to the period after Marathon as the true date for the events which are referred by Herodotus to the year before Marathon, viz. the thirty years that were to elapse between the dedication of the precinct to Aeacus and the final victory of Athens (Herod. v. 89). As the final victory of Athens over Aegina was in 458 B.C., the thirty years of the oracle would carry us back to the year 488 B.C. as the date of the dedication of the precinct and the outbreak of hostilities. This inference is supported by the date of the building of the 200 triremes "for the war against Aegina" on the advice of Themistocles, which is given in the *Constitution of Athens* as 483–482 B.C. (Herod. vii. 144; *Ath. Pol.* 22. 7). It is probable, therefore, that Herodotus is in error both in tracing back the beginning of hostilities to an alliance between Thebes and Aegina (*c.* 507) and in putting the episode of Nicodromus before Marathon. Overtures were unquestionably made by Thebes for an alliance with Aegina *c.* 507 B.C., but they came to nothing. The refusal of Aegina was veiled under the diplomatic form of "sending the Aeacidae." The real occasion of the outbreak of the war was the refusal of Athens to restore the hostages some twenty years later. There was but one war, and it lasted from 488 to 481. That Athens had the worst of it in this war is certain. Herodotus had no Athenian victories to record after the initial success, and the fact that Themistocles was able to carry his proposal to devote the surplus funds of the state to the building of so large a fleet seems to imply that the Athenians were themselves convinced that a supreme effort was necessary. It may be noted, in confirmation of this view, that the naval supremacy of Aegina is assigned by the ancient writers on chronology to precisely this period, *i.e.* the years 490–480 (Eusebius, *Chron. Can.* p. 337).

In the repulse of Xerxes it is possible that the Aeginetans played a larger part than is conceded to them by Herodotus. The Athenian tradition, which he follows in the main, would naturally seek to obscure their services. It was to Aegina rather than Athens that the prize of valour at Salamis was awarded, and the destruction of the Persian fleet appears to have been as much the work of the Aeginetan contingent as of the Athenian (Herod. viii. 91). There are other indications, too, of the importance of the Aeginetan fleet in the Greek scheme of defence. In view of these considerations it becomes difficult to credit the number of the vessels that is assigned to them by Herodotus (30 as against 180 Athenian vessels, cf. GREEK HISTORY, sect. *Authorities*). During the next twenty years the philo-laconian policy of Cimon (*q.v.*) secured Aegina, as a member of the Spartan league, from attack. The change in Athenian foreign policy, which was consequent upon the ostracism of Cimon in 461, led to what is sometimes called the First Peloponnesian War, in which the brunt of the fighting fell upon Corinth and Aegina. The latter state was forced to surrender to Athens after a siege, and to accept the position of a subject-ally (*c.* 456 B.C.). The tribute was fixed at 30 talents. By the terms of the Thirty Years' Truce (445 B.C.) Athens covenanted to restore to Aegina her autonomy, but the clause remained a dead letter. In the first winter of the Peloponnesian War (431 B.C.) Athens expelled the Aeginetans, and established a cleruchy in their island. The exiles were settled by Sparta in Thyreatis, on the frontiers of Laconia and Argolis. Even in their new home they were not safe from Athenian rancour.[1] A force landed under Nicias in 424, and put most of them to the sword. At the end of the Peloponnesian War Lysander restored the scattered remnants of the old inhabitants to the island, which was used by the Spartans as a base for operations against Athens in the Corinthian War. Its greatness, however, was at an end. The part which it plays henceforward is insignificant.

It would be a mistake to attribute the fall of Aegina solely to the development of the Athenian navy. It is probable that the power of Aegina had steadily declined during the twenty years after Salamis, and that it had declined absolutely, as well as relatively, to that of Athens. Commerce was the source of Aegina's greatness, and her trade, which appears to have been principally with the Levant, must have suffered seriously from the war with Persia. Her medism in 491 is to be explained by her commercial relations with the Persian Empire. She was forced into patriotism in spite of herself, and the glory won at Salamis was paid for by the loss of her trade and the decay of her marine. The completeness of the ruin of so powerful a state—we should look in vain for an analogous case in the history of the modern world—finds an explanation in the economic conditions of the island, the prosperity of which rested upon a basis of slave-labour. It is impossible, indeed, to accept Aristotle's (cf. Athenaeus vi. 272) estimate of 470,000 as the number of the slave-population; it is clear, however, that the number must have been out of all proportion to that of the free inhabitants. In this respect the history of Aegina does but anticipate the history of Greece as a whole.

The constitutional history of Aegina is unusually simple. So long as the island retained its independence the government was an oligarchy. There is no trace of the heroic monarchy and no tradition of a *tyrannis*. The story of Nicodromus, while it proves the existence of a democratic party, suggests, at the same time, that it could count upon little support.

(2) *Modern.*—Aegina passed with the rest of Greece under the successive dominations of Macedon, the Aetolians, Attalus of Pergamum and Rome. In 1537 the island, then a prosperous Venetian colony, was overrun and ruined by the pirate Barbarossa (Khair-ed-Din). One of the last Venetian strongholds in the Levant, it was ceded by the treaty of Passarowitz (1718) to the Turks. In 1826–1828 the town became for a time the capital of Greece and the centre of a large commercial population (about 10,000), which has dwindled to about 4300.

BIBLIOGRAPHY.—Herodotus *loc. cit.*; Thucydides i. 105, 108, ii. 27, iv. 56, 57. For the criticism of Herodotus's account of the relations of Athens and Aegina, Wilamowitz, *Aristoteles und Athen*, ii. 280-288, is indispensable. See also Macan, *Herodotus iv.–vi.*, ii. 102-120. (E. M. W.)

AEGINETA, PAULUS, a celebrated surgeon of the island of Aegina, whence he derived his name. According to Le Clerc's calculation, he lived in the 4th century of the Christian era; but Abulfaragius (Barhebraeus) places him with more probability in the 7th. The title of his most important work, as given by Suidas, is Ἐπιτομῆς Ἰατρικῆς Βιβλία Ἑπτά (*Synopsis of Medicine in Seven Books*), the 6th book of which, treating of operative surgery, is of special interest for surgical history. The whole work in the original Greek was published at Venice in 1528, and another edition appeared at Basel in 1538. Several Latin translations have been published, and an excellent English version, with commentary, by Dr F. Adams (1844–1848).

AEGIS (Gr. *Aigis*), in Homer, the shield or buckler of Zeus, fashioned for him by Hephaestus, furnished with tassels and bearing the Gorgon's head in the centre. Originally symbolical of the storm-cloud, it is probably derived from *ἀΐσσω*, signifying rapid, violent motion. When the god shakes it, Mount Ida is wrapped in clouds, the thunder rolls and men are smitten with fear. He sometimes lends it to Athene and (rarely) to Apollo. In the later story (Hyginus, *Poet. Astronom.* ii. 13) Zeus is said to have used the skin of the goat Amaltheia (*αἰγίς* = goat-skin), which suckled him in Crete, as a buckler when he went forth to do battle against the giants. Another legend represents the aegis as a fire-breathing monster like the Chimaera, which was slain by Athene, who afterwards wore its skin as a cuirass (Diodorus Siculus iii. 70). It appears to have been really the goat's skin used as a belt to support the shield. When so used it would generally be fastened on the right shoulder, and would partially envelop the chest as it passed obliquely round in front and behind to be attached to the shield under the left arm. Hence, by transference, it would be employed to denote at times the shield which it supported, and at other times a cuirass, the purpose of which it in part served. In accordance with this double meaning the aegis appears in works of art sometimes as an animal's skin thrown over the shoulders and arms, sometimes as a cuirass, with a border of snakes corresponding to the tassels of Homer, usually with the Gorgon's head in the centre. It is often represented on the statues of Roman emperors, heroes and warriors, and on cameos and vases.

See F. G. Welcker, *Griechische Götterlehre* (1857); L. Preller, *Griechische Mythologie*, i. (1887); articles in Pauly-Wissowa's *Realencyclopädie*, Roscher's *Lexikon der Mythologie*, Daremberg and Saglio's *Dictionnaire des Antiquités*, and Smith's *Dictionary of Greek and Roman Antiquities* (3rd ed., 1890).

AEGISTHUS, in Greek legend, was the son of Thyestes by his own daughter Pelopia. Having been exposed by his mother to conceal her shame, he was found by shepherds and suckled by a goat—whence his name. His uncle Atreus, who had married

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[1] Pericles called Aegina the "eye-sore" (λήμη) of the Peiraeus.

Pelopia, took him to Mycenae, and brought him up as his own son. When he grew up Aegisthus slew Atreus, and ruled jointly with his father over Mycenae, until they were deposed by Agamemnon on his return from exile. After the departure of Agamemnon to the Trojan war, Aegisthus seduced his wife Clytaemnestra (more correctly Clytaemestra) and with her assistance slew him on his return. Eight years later his murder was avenged by his son Orestes.

Homer, *Od.* iii. 263, iv. 517; Hyginus, *Fab.* 87.

AEGOSPOTAMI (*i.e.* " Goat Streams "), a small creek issuing into the Hellespont, N.E. of Sestos, the scene of the decisive battle in 405 B.C. by which Lysander destroyed the last Athenian armament in the Peloponnesian War (*q.v.*). The township of that name, whose existence is attested by coins of the 5th and 4th centuries, must have been quite insignificant.

ÆLFRIC, called the " Grammarian " (*c.* 955–1020?), English abbot and author, was born about 955. He was educated in the Benedictine monastery at Winchester under Æthelwold, who was bishop there from 963 to 984. Æthelwold had carried on the tradition of Dunstan in his government of the abbey of Abingdon, and at Winchester he continued his strenuous efforts. He seems to have actually taken part in the work of teaching. Ælfric no doubt gained some reputation as a scholar at Winchester, for when, in 987, the abbey of Cernel (Cerne Abbas, Dorsetshire) was finished, he was sent by Bishop Ælfheah (Alphege), Æthelwold's successor, at the request of the chief benefactor of the abbey, the ealdorman Æthelmær, to teach the Benedictine monks there. He was then in priest's orders. Æthelmær and his father Æthelweard were both enlightened patrons of learning, and became Ælfric's faithful friends. It was at Cernel, and partly at the desire, it appears, of Æthelweard, that he planned the two series of his English homilies (ed. Benjamin Thorpe, 1844–1846, for the Ælfric Society), compiled from the Christian fathers, and dedicated to Sigeric, archbishop of Canterbury (990–994). The Latin preface to the first series enumerates some of Ælfric's authorities, the chief of whom was Gregory the Great, but the short list there given by no means exhausts the authors whom he consulted. In the preface to the first volume he regrets that except for Alfred's translations Englishmen had no means of learning the true doctrine as expounded by the Latin fathers. Professor Earle (*A.S. Literature*, 1884) thinks he aimed at correcting the apocryphal, and to modern ideas superstitious, teaching of the earlier *Blickling Homilies*. The first series of forty homilies is devoted to plain and direct exposition of the chief events of the Christian year; the second deals more fully with church doctrine and history. Ælfric denied the immaculate birth of the Virgin (*Homilies*, ed. Thorpe, ii. 466), and his teaching on the Eucharist in the *Canons* and in the *Sermo de sacrificio in die pascae* (*ibid.* ii. 262 seq.) was appealed to by the Reformation writers as a proof that the early English church did not hold the Roman doctrine of transubstantiation.[1] His Latin *Grammar* and *Glossary*[2] were written for his pupils after the two books of homilies. A third series of homilies, the *Lives of the Saints*, dates from 996 to 997. Some of the sermons in the second series had been written in a kind of rhythmical, alliterative prose, and in the *Lives of the Saints* (ed. W. W. Skeat, 1881–1900, for the Early English Text Society) the practice is so regular that most of them are arranged as verse by Professor Skeat. By the wish of Æthelweard he also began a paraphrase[3] of parts of the Old Testament, but under protest, for the stories related in it were not, he thought, suitable for simple minds. There is no certain proof that he remained at Cernel. It has been suggested that this part of his life was chiefly spent at Winchester; but his writings for the patrons of Cernel, and the fact that he wrote in 998 his *Canons*[4] as a pastoral letter for Wulfsige, the bishop of Sherborne, the diocese in which the abbey was situated, afford presumption of continued residence there. He became in 1005 the first abbot of Eynsham or Ensham, near Oxford, another foundation of Æthelmær's. After his elevation he wrote an abridgment for his monks of Æthelwold's *De consuetudine monachorum*,[5] adapted to their rudimentary ideas of monastic life; a letter to Wulfgeat of Ylmandun[6]; an introduction to the study of the Old and New Testaments (about 1008, edited by William L'Isle in 1623); a Latin life of his master Æthelwold[7]; a pastoral letter for Wulfstan, archbishop of York and bishop of Worcester, in Latin and English; and an English version of Bede's *De Temporibus*.[8] The *Colloquium*,[9] a Latin dialogue designed to serve his scholars as a manual of Latin conversation, may date from his life at Cernel. It is safe to assume that the original draft of this, afterwards enlarged by his pupil, Ælfric Bata, was by Ælfric, and represents what his own scholar days were like. The last mention of Ælfric Abbot, probably the grammarian, is in a will dating from about 1020.

There have been three suppositions about Ælfric. (1) He was identified with Ælfric (995–1005), archbishop of Canterbury. This view was upheld by John Bale (*Ill. Maj. Brit. Scriptorum* . . . 2nd ed., Basel, 1557–1559; vol. i. p. 149, *s.v.* Alfric); by Humphrey Wanley (*Catalogus librorum septentrionalium, &c.*, Oxford, 1705, forming vol. ii. of George Hickes's *Antiquae literaturae septentrionalis*); by Elizabeth Elstob, *The English-Saxon Homily on the Birthday of St Gregory* (1709; new edition, 1839); and by Edward Rowe Mores, *Ælfrico, Dorobernensi, archiepiscopo, Commentarius* (ed. G. J. Thorkelin, 1789), in which the conclusions of earlier writers on Ælfric are reviewed. Mores made him abbot of St Augustine's at Dover, and finally archbishop of Canterbury. (2) Sir Henry Spelman, in his *Concilia* . . . (1639, vol. i. p. 583), printed the *Canones ad Wulsinum episcopum*, and suggested Ælfric Putta or Putto, archbishop of York, as the author, adding some note of others bearing the name. The identity of Ælfric the grammarian with Ælfric archbishop of York was also discussed by Henry Wharton, in *Anglia Sacra* (1691, vol. i. pp. 125-134), in a dissertation reprinted in J. P. Migne's *Patrologia* (vol. 139, pp. 1459-70, Paris, 1853). (3) William of Malmesbury (*De gestis pontificum anglorum*, ed. N. E. S. A. Hamilton, Rolls Series, 1870, p. 406) suggested that he was abbot of Malmesbury and bishop of Crediton. The main facts of his career were finally elucidated by Eduard Dietrich in a series of articles contributed to C. W. Niedner's *Zeitschrift für historische Theologie* (vols. for 1855 and 1856, Gotha), which have formed the basis of all subsequent writings on the subject.

Sketches of Ælfric's career are in B. Ten Brink's *Early English Literature (to Wiclif)* (trans. H. M. Kennedy, New York, 1883, pp. 105-112), and by J. S. Westlake in *The Cambridge History of English Literature* (vol. i., 1907, pp. 116-129). An excellent bibliography and account of the critical apparatus is given in Dr R. Wülker's *Grundriss zur Geschichte der angelsächsischen Litteratur* (Leipzig, 1885, pp. 452-480). See also the account by Professor Skeat in Pt. iv. pp. 8-61 of his edition of the *Lives of the Saints*, already cited, which gives a full account of the MSS., and a discussion of Ælfric's sources, with further bibliographical references; and *Ælfric, a New Study of his Life and Writings*, by Miss C. L. White (Boston, New York and London, 1898) in the " Yale Studies in English." *Alcuini Interrogationes Sigewulfi Presbyteri in Genesin* (ed. G. E. McLean, Halle, 1883) is attributed to Ælfric by its editor. There are other isolated sermons and treatises by Ælfric, printed in vol. iii. of Grein's *Bibl. v. A.S. Prosa*.

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[1] See *A Testimonie of Antiquitie, shewing the auncient fayth in the Church of England touching the sacrament of the body and bloude of the Lord here publikely preached*, printed by John Day (1567). It was quoted in John Foxe's *Actes and Monuments* (ed. 1610).

[2] Ed. J. Zupitza in *Sammlung englischer Denkmaler* (vol. i., Berlin, 1880).

[3] Edited by Edward Thwaites as *Heptateuchus* (Oxford, 1698); modern edition in Grein's *Bibliothek der A.S. Prosa* (vol. i. Cassel and Göttingen, 1872). See also B. Assmann, *Abt Ælfric's . . . Esther* (Halle, 1885), and *Abt Ælfric's Judith* (in *Anglia*, vol. x.).

[4] Printed by Benjamin Thorpe in *Ancient Laws and Institutes of England* (1840), with the later pastoral for Wulfstan.

[5] See E. Breck, *A Fragment of Ælfric; translation of Æthelwold's De Consuetudine Monachorum and its relation to other MSS.* (Leipzig, 1887.

[6] Ilmington, on the borders of Warwickshire and Gloucestershire.

[7] Included by J. Stevenson in the *Chron. Monast. de Abingdon* (vol. ii. pp. 253-266, Rolls Series, 1858).

[8] See Oswald Cockayne, *Leechdoms, Wortcunning and Starcraft* (vol. iii., 1866, pp. xiv.-xix. and pp. 233 *et seq.*) in the Rolls Series.

[9] See an article by J. Zupitza in the *Zeitschrift für deutsches Altertum* (vol. xix., new series, 1887).

AELIA CAPITOLINA, the city built by the emperor Hadrian, A.D. 131, and occupied by a Roman colony, on the site of Jerusalem (*q.v.*), which was in ruins when he visited his Syrian dominions. *Aelia* is derived from the emperor's family name, and *Capitolina* from that of Jupiter Capitolinus, to whom a temple was built on the site of the Jewish temple.

AELIAN (Aelianus Tacticus), Greek military writer of the 2nd century A.D., resident at Rome. He is sometimes confused with Claudius Aelianus, the Roman writer referred to below. Aelian's military treatise, *Τακτικὴ Θεωρία*, is dedicated to Hadrian, though this is probably a mistake for Trajan, and the date A.D. 106 has been assigned to it. It is a handbook of Greek, *i.e.* Macedonian, drill and tactics as practised by the Hellenistic successors of Alexander the Great. The author claims to have consulted all the best authorities, the chief of which was a lost treatise on the subject by Polybius. Perhaps the chief value of Aelian's work lies in his critical account of preceding works on the art of war, and in the fulness of his technical details in matters of drill. Critics of the 18th century—Guichard Folard and the prince de Ligne—were unanimous in thinking Aelian greatly inferior to Arrian, but both on his immediate successors, the Byzantines, and on the Arabs, who translated the text for their own use, Aelian exercised a great influence. The emperor Leo VI. incorporated much of Aelian's text in his own work on the military art. The Arabic version of Aelian was made about 1350. In spite of its academic nature, the copious details to be found in the treatise rendered it of the highest value to the army organizers of the 16th century, who were engaged in fashioning a regular military system out of the semi-feudal systems of previous generations. The Macedonian phalanx of Aelian had many points of resemblance to the solid masses of pikemen and the "squadrons" of cavalry of the Spanish and Dutch systems, and the translations made in the 16th century formed the groundwork of numerous books on drill and tactics. Moreover, his works, with those of Xenophon, Polybius, Aeneas and Arrian, were minutely studied by every soldier of the 16th and 17th centuries who wished to be master of his profession. It has been suggested that Aelian was the real author of most of Arrian's *Tactica*, and that the *Τακτικὴ Θεωρία* is a later revision of this original, but the theory is not generally accepted.

The first edition of the Greek text is that of Robortelli (Venice, 1552); the Elzevir text (Leiden, 1613) has notes. The text in W. Rüstow and H. Köchly's *Griechische Kriegsschriftsteller* (1855) is accompanied by a translation, notes and reproductions of the original illustrations. A Latin translation by Theodore Gaza of Thessalonica was included in the famous collection *Veteres de re militari scriptores* (Rome and Venice, 1487, Cologne, 1528, &c.). The French translation of Machault, included in his *Milices des Grecs et Romains* (Paris, 1615) and entitled *De la Sergenterie des Grecs*, a German translation from Theodore Gaza (Cologne, 1524), and the English version of Jo. B(ingham), which includes a drill manual of the English troops in the Dutch service, *Tacticks of Aelian* (London, 1616), are of importance in the military literature of the period. A later French translation by Bouchard de Bussy, *La Milice des Grecs ou Tactique d'Élien* (Paris, 1737 and 1757); Baumgärtner's German translation in his incomplete *Sammlung aller Kriegsschriftsteller der Griechen* (Mannheim and Frankenthal, 1779), reproduced in 1786 as *Von Schlachtordnungen*, and Viscount Dillon's English version (London, 1814) may also be mentioned. See also R. Förster, *Studien zu den griechischen Taktikern* (*Hermes*, xii., 1877, pp. 444-449); F. Wüstenfeld, *Das Heerwesen der Muhammedaner und die arabische Uebersetzung der Taktik des Aelianus* (Göttingen, 1880); M. Jähns, *Gesch. der Kriegswissenschaften*, i. 95-97 (Munich, 1889); Rüstow and Köchly, *Gesch. des griechischen Kriegswesens* (1852); A. de Lort-Sérignan, *La Phalange* (1880); P. Serre, *Études sur l'histoire militaire et maritime des Grecs et des Romains* (1887); K. K. Müller, in Pauly-Wissowa, *Realencyclopädie* (Stuttgart, 1894).

AELIAN (Claudius Aelianus), Roman author and teacher of rhetoric, born at Praeneste, flourished under Septimius Severus and probably outlived Elagabalus (d. 222). He spoke Greek so perfectly that he was called "honey-tongued" (μελίγλωσσος); although a Roman he preferred Greek authors, and wrote in Greek himself. His chief works are: *On the Nature of Animals*, curious and interesting stories of animal life, frequently used to convey moral lessons (ed. Schneider, 1784; Jacobs, 1832); *Various History*—for the most part preserved only in an abridged form—consisting mainly of anecdotes of men and customs (ed. Lünemann, 1811). Both works are valuable for the numerous excerpts from older writers. Considerable fragments of two other works *On Providence* and *Divine Manifestations* are preserved in Suidas; twenty *Peasants' Letters*, after the manner of Alciphron but inferior, are also attributed to him.

Editio princeps of complete works by Gesner, 1556; Hercher, 1864-1866. English translation of the *Various History* only by Fleming, 1576, and Stanley, 1665; of the *Letters* by Quillard (French), 1895.

ÆLRED, Ailred, Ethelred (1109-1166), English theologian, historical writer and abbot of Rievaulx, was born at Hexham about the year 1109. In his youth he was at the court of Scotland as an attendant of Henry, son of David I. He was in high favour with that sovereign, but renounced the prospect of a bishopric to enter the Cistercian house of Rievaulx in Yorkshire, which was founded in 1131 by Walter Espec. Here Ælred remained for some time as master of the novices, but between the years 1142 and 1146 was elected abbot of Revesby in Lincolnshire and migrated thither. In 1146 he became abbot of Rievaulx. He led a life of the severest asceticism, and was credited with the power of working miracles; owing to his reputation the numbers of Rievaulx were greatly increased. In 1164 he went as a missionary to the Picts of Galloway. He found their religion at a low ebb, the regular clergy apathetic and sensual, the bishop little obeyed, the laity divided by the family feuds of their rulers, unchaste and ignorant. He induced a Galwegian chief to take the habit of religion, and restored the peace of the country. Two years later he died of a decline, at Rievaulx, in the fifty-seventh year of his age. In the year 1191 he was canonized. His writings are voluminous and have never been completely published. Amongst them are homilies "on the burden of Babylon in Isaiah"; three books "on spiritual friendship"; a life of Edward the Confessor; an account of miracles wrought at Hexham, and the tract called *Relatio de Standardo*. This last is an account of the Battle of the Standard (1138), better known than the similar account by Richard of Hexham, but less trustworthy, and in places obscured by a peculiarly turgid rhetoric.

See the *Vita Alredi* in John of Tynemouth's *Nova Legenda Anglie* (ed. C. Horstmann, 1901, vol. i. p. 41), whence it was taken by Capgrave. From Capgrave the work passed into the Bollandist *Acta Sanctorum* (Jan. ii. p. 30). This life is anonymous, but of an early date. The most complete printed collection of Ælred's works is in Migne's *Patrologia Latina*, vol. cxcv.; but this does not include the *Miracula Hagulstaldensis Ecclesiae* which are printed in J. Raine's *Priory of Hexham*, vol. i. (Surtees Society, 1864). A complete list of works attributed to Ælred is given in T. Tanner's *Bibliotheca Britannico-Hibernica* (1748), pp. 247-248. The *Relatio de Standardo* has been critically edited by R. Howlett in *Chronicles, &c., of Stephen, Henry II. and Richard I.*, vol. iii. (Rolls Series, 1886). (H. W. C. D.)

AEMILIA VIA, or Aemilian Way. (1) A highroad of Italy, constructed in 187 B.C. by the consul M. Aemilius Lepidus, from whom it takes its name; it ran from Ariminum to Placentia, a distance of 176 m. almost straight N.W., with the plain of the Po (Padus) and its tributaries on the right, and the Apennines on the left. The 79th milestone from Ariminum found in the bed of the Rhenus at Bononia records the restoration of the road by Augustus from Ariminum to the river Trebia in 2 B.C. (*Notiz. Scav.*, 1902, 539). The bridge by which it crossed the Sillaro was restored by Trajan in A.D. 100 (*Notizie degli Scavi*, 1888, 621). The modern highroad follows the ancient line, and some of the original bridges still exist. After Augustus, the road gave its name to the district which formed the eighth region of Italy (previously known as Gallia or Provincia Ariminum), at first in popular usage (as in Martial), but in official language as early as the 2nd century; it is still in use (see Emilia). The district was bounded on the N. by the Padus, E. by the Adriatic, S. by the river Crustumium (mod. Conca), and W. by the Apennines and the Ira (mod. Staffora) at Iria (mod. Voghera), and corresponds approximately with the modern district.

(2) A road constructed in 109 B.C. by the censor M. Aemilius Scaurus from Vada Volaterrana and Luna to Vada Sabatia and thence over the Apennines to Dertona (Tortona), where it joined

the Via Postumia from Genua to Cremona. We must, however (as Mommsen points out in *C.I.L.* v. p. 885), suppose that the portion of the coast road from Vada Volaterrana to Genua at least must have existed before the construction of the Via Postumia in 148 B.C. Indeed Polybius (iii. 39. 8) tells us (and this must refer to the time of the Gracchi if not earlier) that the Romans had in his time built the coast road from the Rhone to Carthago Nova; and it is incredible that the coast road in Italy itself should not have been constructed previously. It is, however, a very different thing to open a road for traffic, and so to construct it that it takes its name from that construction in perpetuity. (T. As.)

AEMILIUS, PAULUS (PAOLO EMILIO) (d. 1529), Italian historian, was born at Verona. He obtained such reputation in his own country that he was invited to France in the reign of Charles VIII., in order to write in Latin the history of the kings of France, and was presented to a canonry in Notre Dame. He enjoyed the patronage and support of Louis XII. He died at Paris on the 5th of May 1529. His *De Rebus gestis Francorum* was translated into French in 1581, and has also been translated into Italian and German.

AENEAS, the famous Trojan hero, son of Anchises and Aphrodite, one of the most important figures in Greek and Roman legendary history. In Homer, he is represented as the chief bulwark of the Trojans next to Hector, and the favourite of the gods, who frequently interpose to save him from danger (*Iliad*, v. 311). The legend that he remained in the country after the fall of Troy, and founded a new kingdom (*Iliad*, xx. 308; *Hymn to Aphrodite*, 196) is now generally considered to be of comparatively late origin. The story of his emigration is post-Homeric, and set forth in its fullest development by Virgil in the *Aeneid*. Carrying his aged father and household gods on his back and leading his little son Ascanius by the hand, he makes his way to the coast, his wife Creusa being lost during the confusion of the flight. After a perilous voyage to Thrace, Delos, Crete and Sicily (where his father dies), he is cast up by a storm, sent by Juno, on the African coast. Refusing to remain with Dido, queen of Carthage, who in despair puts an end to her life, he sets sail from Africa, and after seven years' wandering lands at the mouth of the Tiber. He is hospitably received by Latinus, king of Latium, is betrothed to his daughter Lavinia, and founds a city called after her, Lavinium. Turnus, king of Rutuli, a rejected suitor, takes up arms against him and Latinus, but is defeated and slain by Aeneas on the river Numicius. The story of the *Aeneid* ends with the death of Turnus. According to Livy (i. 1. 2), Aeneas, after reigning a few years over Latium, is slain by the Rutuli; after the battle, his body cannot be found, and he is supposed to have been carried up to heaven. He receives divine honours, and is worshipped under the name of Jupiter Indiges (Dionysius Halic. i. 64).

See J. A. Hild, *La Légende d'Énée avant Vergile* (1883); F. Cauer, *De Fabulis Graecis ad Romam conditam pertinentibus* (1884) and *Die Römische Aeneassage, von Naevius bis Vergilius* (1886); G. Boissier, "La Légende d'Énée" in *Revue des Deux Mondes*, Sept. 1883; A. Förstemann, *Zur Geschichte des Aeneasmythus* (1894); articles in Pauly-Wissowa's *Realencyclopädie* (new ed., 1894; Roscher's *Lexicon der Mythologie*; Daremberg and Saglio's *Dictionnaire des antiquités*; Preller's *Griechische und römische Mythologie*; and especially Schwegler, *Römische Geschichte* (1867).

Romances.—The story of Aeneas, as a sequel to the legend of Troy, formed the subject of several epic romances in the middle ages. The *Roman d'Énéas* (*c.* 1160, or later), of uncertain authorship (attributed by some to Benoît de Sainte-More), the first French poem directly imitated from the *Aeneid*, is a fairly close adaptation of the original. The trouvère, however, omits the greater part of the wanderings of Aeneas, and adorns his narrative with gorgeous descriptions, with accounts of the marvellous properties of beasts and stones, and of single combats among the knights who figure in the story. He also elaborates the episodes most attractive to his audience, notably those of Dido and Aeneas and Lavinia, the last of whom plays a far more important part than in the *Aeneid*. Where possible, he substitutes human for divine intervention, and ignores the idea of the glorification of Rome and Augustus, which dominates the Virgilian epic. On this work were founded the *Eneide* or *Eneit* (between 1180 and 1190) of Heinrich von Veldeke, written in Flemish and now only extant in a version in the Thuringian dialect, and the *Eneydos*, written by William Caxton in 1490.

See *Énéas*, ed. J. Salverda de Grave (Halle, 1891); see also A. Peij, *Essai sur li romans d' Énéas* (Paris, 1856); A. Duval in *Hist. littéraire de la France*, xix.; Veldeke's *Eneide*, ed. Ettmüller (Leipzig, 1852) and O. Behaghel (Heilbronn, 1882); *Eneydos*, ed. F. J. Furnivall (1890). For Italian versions see E. G. Parodi in *Studi di filologia romanza* (v. 1887).

AENEAS TACTICUS (4th century B.C.), one of the earliest Greek writers on the art of war. According to Aelianus Tacticus and Polybius, he wrote a number of treatises (Ὑπομνήματα) on the subject; the only one extant deals with the best methods of defending a fortified city. An epitome of the whole was made by Cineas, minister of Pyrrhus, king of Epirus. The work is chiefly valuable as containing a large number of historical illustrations. Aeneas was considered by Casaubon to have been a contemporary of Xenophon and identical with the Arcadian general Aeneas of Stymphalus, whom Xenophon (*Hellenica*, vii. 3) mentions as fighting at the battle of Mantinea (362 B.C.).

Editions in I. Casaubon's (1619), Gronovius' (1670) and Ernesti's (1763) editions of Polybius; also separately, with notes, by J. C. Orelli (Leipzig, 1818). Other texts are those of W. Rüstow and H. Köchly (*Griechische Kriegsschriftsteller*, vol. i. Leipzig, 1853) and A. Hug, *Prolegomena Critica ad Aeneae . . . editionem* (Zürich University, 1874). See also Count Beausobre, *Commentaires sur la défense des places d'Aeneas* (Amsterdam, 1757); A. Hug, *Aeneas von Stymphalos* (Zürich, 1877); C. C. Lange, *De Aeneae commentario poliorcetico* (Berlin, 1879); M. H. Meyer, *Observationes in Aeneam Tacticum* (Halle, 1835); Haase, in *Jahns Jahrbuch*, 1835, xiv. 1; Max Jähns, *Gesch. der Kriegswissenschaften*, i. pp. 26-28 (Munich, 1889); Ad. Bauer, in *Zeitschrift für allg. Geschichte, &c.*, 1886, i.; T. H. Williams in *American Journal of Philology*, xxv. 4; E. Schwartz in Pauly-Wissowa, *Realencyclopädie* (Stuttgart, 1894).

AENESIDEMUS, Greek philosopher, was born at Cnossus in Crete and taught at Alexandria, probably during the first century B.C. He was the leader of what is sometimes known as the third sceptical school and revived to a great extent the doctrine of Pyrrho and Timon. His chief work was the *Pyrrhonian Principles* addressed to Lucius Tubero. His philosophy consisted of four main parts, the reasons for scepticism and doubt, the attack on causality and truth, a physical theory and a theory of morality. Of these the two former are important. The reasons for doubt are given in the form of the ten "tropes": (1) different animals manifest different modes of perception; (2) similar differences are seen among individual men; (3) even for the same man, sense-given data are self-contradictory, (4) vary from time to time with physical changes, and (5) according to local relations; (6) and (7) objects are known only indirectly through the medium of air, moisture, &c., and are in a condition of perpetual change in colour, temperature, size and motion; (8) all perceptions are relative and interact one upon another; (9) our impressions become less deep by repetition and custom; and (10) all men are brought up with different beliefs, under different laws and social conditions. Truth varies infinitely under circumstances whose relative weight cannot be accurately gauged. There is, therefore, no absolute knowledge, for every man has different perceptions, and, further, arranges and groups his data in methods peculiar to himself; so that the sum total is a quantity with a purely subjective validity. The second part of his work consists in the attack upon the theory of causality, in which he adduces almost entirely those considerations which are the basis of modern scepticism. Cause has no existence apart from the mind which perceives; its validity is ideal, or, as Kant would have said, subjective. The relation between cause and effect is unthinkable. If the two things are different, they are either simultaneous or in succession. If simultaneous, cause is effect and effect cause. If not, since effect cannot precede cause, cause must precede effect, and there must be an instant when cause is not effective, that is, is not itself. By these and similar arguments he arrives at the fundamental principle of Scepticism, the radical and universal opposition of causes; παντὶ λόγῳ λόγος ἀντίκειται. Having reached this conclusion, he was able to assimilate the physical theory of Heraclitus, as is explained in the *Hypotyposes* of Sextus Empiricus. For admitting that contraries co-exist for the perceiving subject, he was able to assert the co-existence of contrary qualities in the same object. Having thus disposed of the ideas of truth and causality, he proceeds to undermine the ethical criterion, and denies that any man can aim at Good, Pleasure or Happiness as an absolute, concrete ideal. All actions are product of pleasure and pain, good and evil. The end of ethical endeavour is the conclusion that all endeavour is vain and illogical. The main tendency of this destructive scepticism is essentially the same from its first crystallization by Aenesidemus down to the most advanced sceptics of to-day (see SCEPTICISM). For the immediate successors of Aenesidemus see AGRIPPA, SEXTUS EMPIRICUS. See also CARNEADES and ARCESILAUS. Of the Πυρρώνειοι λόγοι nothing remains; we have, however, an analysis in the *Myriobiblion* of Photius.

See Zeller's *History of Greek Philosophy*; E. Saisset, *Ænésidème, Pascal, Kant*; Ritter and Preller, §§ 364-370.

AEOLIAN HARP (Fr. *harpe éolienne*; Ger. *Äolsharfe*, *Windharfe*; Ital. *arpa d' Eolo*), a stringed musical instrument, whose name is derived from Aeolus, god of the wind. The aeolian harp consists of a sound-box about 3 ft. long, 5 in. wide, and 3 in. deep, made of thin deal, or preferably of pine, and having beech ends to hold the tuning-pins and hitch-pins. A dozen or less catgut strings of different thickness, but tuned in exact unison, and left rather slack, are attached to the pins, and stretched over two narrow bridges of hard wood, one at each end of the sound-board, which is generally provided with two rose sound-holes. To ensure a proper passage for the wind, another pine board is placed over the strings, resting on pegs at the ends of the sound-board, or on a continuation of the ends raised from 1 to 3 in. above the strings. Kaufmann of Dresden and Heinrich Christoph Koch, who improved the aeolian harp, introduced this contrivance, which was called by them *Windfang* and *Windflügel*; the upper board was prolonged beyond the sound-box in the shape of a funnel, in order to direct the current of air on to the strings. The aeolian harp is placed across a window so that the wind blows obliquely across the strings, causing them to vibrate in aliquot parts, *i.e.* (the fundamental note not being heard) the half or octave, the third or interval of the twelfth, the second octave, and the third above it, in fact the upper partials of the strings in regular succession. With the increased pressure of the wind, the dissonances of the 11th and 13th overtones are heard in shrill discords, only to give place to beautiful harmonies as the force of the wind abates. The principle of the natural vibration of strings by the pressure of the wind was recognized in ancient times; King David, we hear from the Rabbinic records, used to hang his *kinnor* (*kithara*) over his bed at night, when it sounded in the midnight breeze. The same is related of St Dunstan of Canterbury, who was in consequence charged with sorcery. The Chinese at the present day fly kites of various sizes, having strings stretched across apertures in the paper, which produces the effect of an aerial chorus.

See Athanasius Kircher, *Musurgia Universalis*, where the aeolian harp is first described (1602–1608), p. 148; Mathew Young, Bishop of Clonfert, *Enquiry into the Principal Phenomena of Sounds and Musical Strings*, pp. 170-182 (London, 1784); Göttingen Pocket Calendar (1792); Mendel's *Musikalisches Conversations-Lexikon*, article "Aeolsharfe." An illustration is given in Rees' *Encyclopedia*, plates, vol. ii. Misc. pl. xxv. (K. S.)

AEOLIS (AEOLIA), an ancient district of Asia Minor, colonized at a very early date by Aeolian Greeks. The name was applied to the coast from the river Hermus to the promontory of Lectum, *i.e.* between Ionia to S. and Troas to N. The Aeolians founded twelve cities on the mainland, including Cyme, and numerous towns in Mytilene: they were said also to have settled in the Troad and even within the Hellespont.

AEOLUS, in Greek mythology, according to Homer the son of Hippotes, god and father of the winds, and ruler of the island of Aeolia. In the *Odyssey* (x. 1) he entertains Odysseus, gives him a favourable wind to help him on his journey, and a bag in which the unfavourable winds have been confined. Out of curiosity, or with the idea that it contains valuable treasures, Odysseus' companions open the bag; the winds escape and drive them back to the island, whence Aeolus dismisses them with bitter reproaches. According to Virgil, Aeolus dwells on one of the Aeolian islands to the north of Sicily, Lipara or Strongyle (Stromboli), where he keeps the winds imprisoned in a vast cavern (Virgil, *Aen.* i. 52). Another genealogy makes him the son of Poseidon and Arne, granddaughter of Hippotes, and a descendant of Aeolus, king of Magnesia in Thessaly, the mythical ancestor of the tribe of the Aeolians (Diodorus iv. 67).

AEON, a term often used in Greek (*αἰών*) to denote an indefinite or infinite duration of time; and hence, by metonymy, a being that exists for ever. In the latter sense it was chiefly used by the Gnostic sects to denote those eternal beings or manifestations which emanated from the one incomprehensible and ineffable God. (See GNOSTICISM.)

AEPINUS, FRANZ ULRICH THEODOR (1724–1802), German natural philosopher, was born at Rostock in Saxony on the 13th of December 1724. He was descended from John Aepinus (1499–1553), the first to adopt the Greek form (*αἰπεινός*) of the family name Hugk or Huck, and a leading theologian and controversialist at the time of the Reformation. After studying medicine for a time, Franz Aepinus devoted himself to the physical and mathematical sciences, in which he soon gained such distinction that he was admitted a member of the Berlin academy of sciences. In 1757 he settled in St Petersburg as member of the imperial academy of sciences and professor of physics, and remained there till his retirement in 1798. The rest of his life was spent at Dorpat, where he died on the 10th of August 1802. He enjoyed the special favour of the empress Catherine II., who appointed him tutor to her son Paul, and endeavoured, without success, to establish normal schools throughout the empire under his direction. Aepinus is best known by his researches, theoretical and experimental, in electricity and magnetism, and his principal work, *Tentamen Theoriae Electricitatis et Magnetismi*, published at St Petersburg in 1759, was the first systematic and successful attempt to apply mathematical reasoning to these subjects. He also published a treatise, in 1761, *De distributione caloris per tellurem*, and he was the author of memoirs on different subjects in astronomy, mechanics, optics and pure mathematics, contained in the journals of the learned societies of St Petersburg and Berlin. His discussion of the effects of parallax in the transit of a planet over the sun's disc excited great interest, having appeared (in 1764) between the dates of the two transits of Venus that took place in the 18th century.

AEQUI, an ancient people of Italy, whose name occurs constantly in Livy's first decade as hostile to Rome in the first three centuries of the city's existence. They occupied the upper reaches of the valleys of the Anio, Tolenus and Himella; the last two being mountain streams running northward to join the Nar. Their chief centre is said to have been taken by the Romans about 484 B.C. (Diodorus xi. 40) and again about ninety years later (*id.* xiv. 106), but they were not finally subdued till the end of the second Samnite war (Livy ix. 45, x. 1; Diod. xx. 101), when they seem to have received a limited form of franchise (Cic. *Off.* i. 11, 35). All we know of their subsequent political condition is that after the Social war the folk of Cliternia and Nersae appear united in a *res publica Aequiculorum*, which was a *municipium* of the ordinary type (*C.I.L.* ix. p. 388). The Latin colonies of Alba Fucens (304 B.C.) and Carsioli (298 B.C.) must have spread the use of Latin (or what passed as such) all over the district; through it lay the chief (and for some time the only) route (Via Valeria) to Luceria and the south.

Of the language spoken by the Aequi before the Roman conquest we have no record; but since the Marsi (*q.v.*), who lived farther east, spoke in the 3rd century B.C. a dialect closely akin to Latin, and since the Hernici (*q.v.*), their neighbours to the south-west, did the same, we have no ground for separating any of these tribes from the Latian group (see LATINI). If we could be certain of the origin of the *q* in their name and of the relation between its shorter and its longer form (note that the *i* in *Aequiculus* is long—Virgil, *Aen.* vii. 744—which seems to connect it with the locative of *aequum* "a plain," so that it would mean "dwellers in the plain"; but in the historical period they certainly lived mainly in the hills), we should know whether they were to be grouped with the *q* or the *p* dialects, that is to say, with Latin on the one hand, which preserved an original *q*, or with the dialect of Velitrae, commonly called Volscian (and the Volsci were the constant allies of the Aequi), on the other hand, in which, as in the Iguvine and Samnite dialects, an original *q* is changed into *p*. There is no decisive evidence to show whether the *q* in Latin *aequus* represents an Indo-European *q* as in Latin *quis*, Umbro-Volsc. *pis*, or an Indo-European *k* + *u* as in *equus*, Umb. *ekvo-*. The derivative adjective *Aequicus* might be taken to range them with the Volsci rather than the Sabini, but it is not clear that this adjective was ever used as a real ethnicon; the name of the tribe is always *Aequi*, or *Aequicoli*.

At the end of the Republican period the Aequi appear, under the name Aequiculi or Aequicoli, organized as a *municipium*, the territory of which seems to have comprised the upper part of the valley of the Salto, still known as Cicolano. It is probable, however, that they continued to live in their villages as before. Of these Nersae (mod. Nesce) was the most considerable. The polygonal terrace walls, which exist in considerable numbers in the district, are shortly described in *Römische Mitteilungen* (1903), 147 *seq.*, but require further study.

See further the articles MARSI, VOLSCI, LATINI, and the references there given; the place-names and other scanty records of the dialect are collected by R. S. Conway, *The Italic Dialects*, pp. 300 ff. (R. S. C.)

AERARII (from Lat. *aes*, in its subsidiary sense of "poll-tax"), originally a class of Roman citizens not included in the thirty tribes of Servius Tullius, and subject to a poll-tax arbitrarily fixed by the censor. They were (1) the inhabitants of conquered towns which had been deprived of local self-government, who possessed the *jus conubii* and *jus commercii*, but no political rights; Caere is said to have been the first example of this (353 B.C.); hence the expression "in tabulas Caeritum referre" came to mean "to degrade to the status of an *aerarius*": (2) full citizens subjected to civil degradation (*infamia*) as the result of following certain professions (*e.g.* acting), of dishonourable acts in private life (*e.g.* bigamy) or of conviction for certain crimes; (3) persons branded by the censor. Those who were thus excluded from the tribes and centuries had no vote, were incapable of filling Roman magistracies and could not serve in the army. According to Mommsen, the *aerarii* were originally the non-*assidui* (non-holders of land), excluded from the tribes, the comitia and the army. By a reform of the censor Appius Claudius in 312 B.C. these non-*assidui* were admitted into the tribes, and the *aerarii* as such disappeared. But in 304, Fabius Rullianus limited them to the four city tribes, and from that time the term meant a man degraded from a higher (country) to a lower (city) tribe, but not deprived of the right of voting or of serving in the army. The expressions "tribu movere" and "aerarium facere," regarded by Mommsen as identical in meaning ("to degrade from a higher tribe to a lower"), are explained by A. H. J. Greenidge—the first as relegation from a higher to a lower tribe or total exclusion from the tribes, the second as exclusion from the centuries. Other views of the original *aerarii* are that they were:—artisans and freedmen (Niebuhr); inhabitants of towns united with Rome by a *hospitium publicum*, who had become domiciled on Roman territory (Lange); only a class of degraded citizens, including neither the *cives sine suffragio* nor the artisans (Madvig); identical with the *capite censi* of the Servian constitution (Belot, Greenidge).

See A. H. J. Greenidge, *Infamia in Roman Law* (1894), where Mommsen's theory is criticized; E. Belot, *Histoire des chevaliers romains*, i. p. 200 (Paris, 1866); L. Pardon, *De Aerariis* (Berlin, 1853); P. Willems, *Le Droit public romain* (1883); A. S. Wilkins in Smith's *Dict. of Greek and Roman Antiquities* (3rd ed., 1891); and the usual handbooks of antiquities.

AERARIUM (from Lat. *aes*, in its derived sense of "money"), the name (in full, *aerarium stabulum*, treasure-house) given in ancient Rome to the public treasury, and in a secondary sense to the public finances. The treasury contained the moneys and accounts of the state, and also the standards of the legions; the public laws engraved on brass, the decrees of the senate and other papers and registers of importance. These public treasures were deposited in the temple of Saturn, on the eastern slope of the Capitoline hill, and, during the republic, were in charge of the urban quaestors (see QUAESTOR), under the superintendence and control of the senate. This arrangement continued (except for the year 45 B.C., when no quaestors were chosen) until 28 B.C., when Augustus transferred the *aerarium* to two *praefecti aerarii*, chosen annually by the senate from ex-praetors; in 23 these were replaced by two praetors (*praetores aerarii* or *ad aerarium*), selected by lot during their term of office; Claudius in A.D. 44 restored the quaestors, but nominated by the emperor for three years, for whom Nero in 56 substituted two ex-praetors, under the same conditions. In addition to the common treasury, supported by the general taxes and charged with the ordinary expenditure, there was a special reserve fund, also in the temple of Saturn, the *aerarium sanctum* (or *sanctius*), probably originally consisting of the spoils of war, afterwards maintained chiefly by a 5% tax on the value of all manumitted slaves, this source of revenue being established by a lex Manlia in 357. This fund was not to be touched except in cases of extreme necessity (Livy vii. 16, xxvii. 10). Under the emperors the senate continued to have at least the nominal management of the *aerarium*, while the emperor had a separate exchequer, called *fiscus*. But after a time, as the power of the emperors increased and their jurisdiction extended till the senate existed only in form and name, this distinction virtually ceased. Besides creating the *fiscus*, Augustus also established in A.D. 6 a military treasury (*aerarium militare*), containing all moneys raised for and appropriated to the maintenance of the army, including a pension fund for disabled soldiers. It was largely endowed by the emperor himself (see *Monumentum Ancyranum*, iii. 35) and supported by the proceeds of the tax on public sales and the succession duty. Its administration was in the hands of three *praefecti aerarii militaris*, at first appointed by lot, but afterwards by the emperor, from senators of praetorian rank, for three years. The later emperors had a separate *aerarium privatum*, containing the moneys allotted for their own use, distinct from the *fiscus*, which they administered in the interests of the empire.

The *tribuni aerarii* have been the subject of much discussion. They are supposed by some to be identical with the *curatores tribuum*, and to have been the officials who, under the Servian organization, levied the war-tax (*tributum*) in the tribes and the poll-tax on the *aerarii* (*q.v.*). They also acted as paymasters of the equites and of the soldiers on service in each tribe. By the *lex Aurelia* (70 B.C.) the list of judices was composed, in addition to senators and equites, of *tribuni aerarii*. Whether these were the successors of the above, or a new order closely connected with the equites, or even the same as the latter, is uncertain. According to Mommsen, they were persons who possessed the equestrian census, but no public horse. They were removed from the list of judices by Caesar, but replaced by Augustus. According to Madvig, the original *tribuni aerarii* were not officials at all, but private individuals of considerable means, quite distinct from the *curatores tribuum*, who undertook certain financial work connected with their own tribes. Then, as in the case of the equites, the term was subsequently extended to include all those who possessed the property qualification that would have entitled them to serve as *tribuni aerarii*.

See Tacitus, *Annals*, xiii. 29, with Furneaux's notes; O. Hirschfeld, "Das Aerarium militare in der römischen Kaiserzeit," in Fleckeisen's *Jahrbuch*, vol. xcvii. (1868); S. Herrlich, *De Aerario et Fisco Romanorum* (Berlin, 1872); and the usual handbooks and dictionaries of antiquities. On the *tribuni aerarii* see E. Belot, *Hist. des chevaliers romains*, ii. p. 276; J. N. Madvig, *Opuscula Academica*, ii. p. 242; J. B. Mispoulet, *Les Institutions politiques des Romains* (1883), ii. p. 208; Mommsen, *Römisches Staatsrecht*, iii. p. 189; A. S. Wilkins in Smith's *Dictionary of Greek and Roman Antiquities* (3rd ed., 1890).

AERATED WATERS. Waters charged with a larger proportion of carbon dioxide than they will dissolve at ordinary atmospheric pressure occur in springs in various parts of the world (see Mineral Waters). Such waters, which also generally hold in solution a considerable percentage of saline constituents, early acquired a reputation as medicinal agents, and when carbon dioxide ("fixed air") became familiar to chemists the possibility was recognized, as by Joseph Priestley (*Directions for impregnating water with fixed air . . . to communicate the peculiar Spirit and Virtues of Pyrmont water*, 1772), of imitating them artificially. Many of the ordinary aerated waters of commerce, however, do not pretend to reproduce any known natural water; they are merely beverages owing their popularity to their effervescing properties and the flavour imparted by a small quantity of some salt such as sodium bicarbonate or a little fruit syrup. Their manufacture on a considerable scale was begun at Geneva so far back as 1790 by Nicholas Paul, and the excellence of the soda water prepared in London by J. Schweppe, who had been a partner of Paul's, is referred to by Tiberius Cavallo in his *Essay on the Medicinal Properties of Factitious Airs*, published in 1798. Many forms of apparatus are employed for charging the water with the gas. A simple machine for domestic use, called a gasogene or seltzogene, consists of two strong glass globes connected one above the other by a wide glass tube which rises nearly to the top of the upper and smaller globe. Surmounting the small globe there is a spring valve, fitted to a narrow tube that passes through the wide tube to the bottom of the large globe. To use the machine, the lower vessel is filled with water, and in the upper one, round the base of the wide tube, is placed a mixture, commonly of sodium bicarbonate and tartaric acid, which with water yields carbon dioxide. The valve head is then fastened on, and by tilting the apparatus some water is made to flow through the wide tube from the lower to the upper vessel. The water in the lower globe takes up the gas thus produced, and when required for use is withdrawn by the valve, being forced up the narrow tube by the pressure of the gas. In another arrangement the gas is supplied compressed in little steel capsules, and is liberated into a bottle containing the water which has to be aerated. On a large scale, use is made of continuously acting machinery which is essentially of the type devised by Joseph Bramah. The gas is prepared in a separate generator by the action of sulphuric acid on sodium bicarbonate or whiting, and after being washed is collected in a gas-holder, whence it is forced with water under pressure into a receiver or saturator in which an agitator is kept moving. Some manufacturers buy their gas compressed in steel cylinders. The water thus aerated or *carbonated* passes from the receiver, in which the pressure may be 100–200 ℔ on the square inch, to bottling machines which fill and close the bottles; if beverages like lemonade are being made the requisite quantity of fruit syrup is also injected into the bottles, though sometimes the fruit syrup mixture is aerated in bulk. For soda water sodium bicarbonate should be added to the water before aeration, in varying proportions up to about 15 grains per pint, but the simple carbonated water often does duty instead. Potash water, lithia water and many others are similarly prepared, the various salts being used in such amounts as are dictated by the experience and taste of the manufacturer. Aerated waters are sent out from the factories either in siphons (*q.v.*) or in bottles; the latter may be closed by corks, or by screw-stoppers or by internal stoppers consisting of a valve, such as a glass ball, held up against an indiarubber ring in the neck by the pressure of the gas. For use in "soda-fountains" the waters are sent out in large cylinders.

See W. Kirkby, *Evolution of Artificial Mineral Waters* (Manchester, 1902).

AERONAUTICS, the art of "navigating" the "air." It is divisible into two main branches—*aerostation*, dealing properly with machines which like balloons are lighter than the air, and *aviation*, dealing with the problem of artificial flight by means of flying machines which, like birds, are heavier than the air, and also with attempts to fly made by human beings by the aid of artificial wings fitted to their limbs.

Historically, *aviation* is the older of the two, and in the legends or myths of men or animals which are supposed to have travelled through the air, such as Pegasus, Medea's dragons and Daedalus, as well as in Egyptian bas-reliefs, wings appear as the means by which aerial locomotion is effected. In later times there are many stories of men who have attempted to fly in the same way. John Wilkins (1614–1672), one of the founders of the Royal Society and bishop of Chester, who in 1640 discussed the possibility of reaching the moon by volitation, says in his *Mathematical Magick* (1648) that it was related that "a certain English monk called Elmerus, about the Confessor's time," flew from a town in Spain for a distance of more than a furlong; and that other persons had flown from St Mark's, Venice, and at Nuremberg. Giovanni Battista Dante, of Perugia, is said to have flown several times across Lake Trasimene. At the beginning of the 16th century an Italian alchemist who was collated to the abbacy of Tungland, in Galloway, Scotland, by James IV., undertook to fly from the walls of Stirling Castle through the air to France. He actually attempted the feat, but soon came to the ground and broke his thigh-bone in the fall—an accident which he explained by asserting that the wings he employed contained some fowls' feathers, which had an "affinity" for the dung-hill, whereas if they had been composed solely of eagles' feathers they would have been attracted to the air. This anecdote furnished Dunbar, the Scottish poet, with the subject of one of his rude satires. Leonardo da Vinci about the same time approached the problem in a more scientific spirit, and his notebooks contain several sketches of wings to be fitted to the arms and legs. In the following century a lecture on flying delivered in 1617 by Fleyder, rector of the grammar school at Tübingen, and published eleven years later, incited a poor monk to attempt to put the theory into practice, but his machinery broke down and he was killed.

In Francis Bacon's *Natural History* there are two passages which refer to flying, though they scarcely bear out the assertion made by some writers that he first published the true principles of aeronautics.

The first is styled *Experiment Solitary, touching Flying in the Air:*—"Certainly many birds of good wing (as kites and the like) would bear up a good weight as they fly; and spreading feathers thin and close, and in great breadth, will likewise bear up a great weight, being even laid, without tilting up on the sides. *The farther extension of this experiment might be thought upon.*" The second passage is more diffuse, but less intelligible; it is styled *Experiment Solitary, touching the Flying of unequal Bodies in the Air:*—"Let there be a body of unequal weight (as of wool and lead or bone and lead); if you throw it from you with the light end forward, it will turn, and the weightier end will recover to be forwards, unless the body be over long. The cause is, for that the more dense body hath a more violent pressure of the parts from the first impulsion, which is the cause (though heretofore not found out, as hath been often said) of all violent motions; and when the hinder part moveth swifter (for that it less endureth pressure of parts) than the forward part can make way for it, it must needs be that the body turn over; for (turned) it can more easily draw forward the lighter part." The fact here alluded to is the resistance that bodies experience in moving through the air, which, depending on the quantity of surface merely, must exert a proportionally greater effect on rare substances. The passage itself, however, after making every allowance for the period in which it was written, must be deemed confused, obscure and unphilosophical.

In his posthumous work, *De Motu Animalium*, published at Rome in 1680–1681, G. A. Borelli gave calculations of the enormous strength of the pectoral muscles in birds; and his proposition cciv. (vol. i. pp. 322-326), entitled *Est impossibile ut homines propriis viribus artificiose volare possint*, points out the impossibility of man being able by his muscular strength to give motion to wings of sufficient extent to keep him suspended in the air. But during his lifetime two Frenchmen, Allard in 1660 and Besnier about 1678, are said to have succeeded in making short flights. An account of some of the modern attempts to construct flying machines will be found in the article Flight and Flying; here we append a brief consideration of the mechanical aspects of the problem.

The very first essential for success is safety, which will probably only be attained with automatic stability. The underlying principle is that the centre of gravity shall at all times be on the same vertical line as the centre of pressure. The latter varies with the angle of incidence. For square planes it moves approximately as expressed by Joessel's formula, $C + (0{\cdot}2 + 0{\cdot}3 \sin \alpha) L$, in which C is the distance from the front edge, L the length fore and aft, and α the angle of incidence. The movement is different on concave surfaces. The term *aeroplane* is understood to apply to flat sustaining surfaces, but experiment indicates that arched surfaces are more efficient. S. P. Langleyproposed the word *aerodrome*, which seems the preferable term for apparatus with wing-like surfaces. This is the type to which results point as the proper one for further experiments. With this it seems probable that, with well-designed apparatus, 40 to 50 lb can be sustained per indicated h.p., or about twice that quantity per resistance or "thrust" h.p., and that some 30 or 40% of the weight can be devoted to the machinery, thus requiring motors, with their propellers, shafting, supplies, &c., weighing less than 20 lb per h.p. It is evident that the apparatus must be designed to be as light as possible, and also to reduce to a minimum all resistances to propulsion. This being kept in view, the strength and consequent section required for each member may be calculated by the methods employed in proportioning bridges, with the difference that the support (from air pressure) will be considered as uniformly distributed, and the load as concentrated at one or more points. Smaller factors of safety may also have to be used. Knowing the sections required and unit weights of the materials to be employed, the weight of each part can be computed. If a model has been made to absolutely exact scale, the weight of the full-sized apparatus may approximately be ascertained by the formula

$$W' = W \sqrt{\left(\frac{S'}{S}\right)^3},$$

in which W is the weight of the model, S its surface, and W' and S' the weight and surface of the intended apparatus. Thus if the model has been made one-quarter size in its homologous dimensions, the supporting surfaces will be sixteen times, and the total weight sixty-four times those of the model. The weight and the surface being determined, the three most important things to know are the angle of incidence, the "lift," and the required speed. The fundamental formula for rectangular air pressure is well known: $P = KV^2S$, in which P is the rectangular normal pressure, in pounds or kilograms, K a coefficient (0·0049 for British, and 0·11 for metric measures), V the velocity in miles per hour or in metres per second, and S the surface in square feet or in square metres. The normal on oblique surfaces, at various angles of incidence, is given by the formula $P = KV^2S\eta$, which latter factor is given both for planes and for arched surfaces in the subjoined table:—

Percentages of Air Pressure at Various Angles of Incidence

Planes (Duchemin Formula, verified by Langley). $N = P\frac{2\sin\alpha}{1+\sin^2\alpha}$.				Wings (Lilienthal). Concavity 1 in 12.			
Angle. α.	Normal. η.	Lift. $\eta\cos\alpha$.	Drift. $\eta\sin\alpha$.	Normal. η.	Lift. $\eta\cos\alpha$.	Drift. $\eta\sin\alpha$.	Tangential force. α.
−9°				0·0	0·0	0·0	+0·070
−8°				0·040	0·0396	−0·0055	+0·067
−7°				0·080	0·0741	−0·0097	+0·064
−6°				0·120	0·1193	−0·0125	+0·060
−5°				0·160	0·1594	−0·0139	+0·055
−4°				0·200	0·1995	−0·0139	+0·049
−3°				0·242	0·2416	−0·0126	+0·043
−2°				0·286	0·2858	−0·0100	+0·037
−1°				0·332	0·3318	−0·0058	+0·031
0°	0·0	0·0	0·0	0·381	0·3810	−0·0	+0·024
+1°	0·035	0·035	0·000611	0·434	0·434	+0·0075	+0·016
+2°	0·070	0·070	0·00244	0·489	0·489	+0·0170	+0·008
+3°	0·104	0·104	0·00543	0·546	0·545	+0·0285	0·0
+4°	0·139	0·139	0·0097	0·600	0·597	+0·0418	−0·007
+5°	0·174	0·173	0·0152	0·650	0·647	+0·0566	−0·014
+6°	0·207	0·206	0·0217	0·696	0·692	+0·0727	−0·021
+7°	0·240	0·238	0·0293	0·737	0·731	+0·0898	−0·028
+8°	0·273	0·270	0·0381	0·771	0·763	+0·1072	−0·035
+9°	0·305	0·300	0·0477	0·800	0·790	+0·1251	−0·042
10°	0·337	0·332	0·0585	0·825	0·812	+0·1432	−0·050
11°	0·369	0·362	0·0702	0·846	0·830	+0·1614	−0·058
12°	0·398	0·390	0·0828	0·864	0·845	+0·1803	−0·064
13°	0·431	0·419	0·0971	0·879	0·856	+0·1976	−0·070
14°	0·457	0·443	0·1155	0·891	0·864	+0·2156	−0·074
15°	0·486	0·468	0·1240	0·901	0·870	+0·2332	−0·076

The sustaining power, or "lift," which in horizontal flight must be equal to the weight, can be calculated by the formula $L = KV^2S\eta\cos\alpha$, or the factor may be taken direct from the table, in which the "lift" and the "drift" have been obtained by multiplying the normal η by the cosine and sine of the angle. The last column shows the tangential pressure on concave surfaces which O. Lilienthal found to possess a propelling component between 3° and 32°, and therefore to be negative to the relative wind. Former modes of computation indicated angles of 10° to 15° as necessary for support with planes. These were prohibitory in consequence of the great "drift"; but the present data indicate that, with concave surfaces, angles of 2° to 5° will produce adequate "lift." To compute the latter the angle at which the wings are to be set must first be assumed, and that of +3° will generally be found preferable. Then the required velocity is next to be computed by the formula

$$V = \sqrt{\frac{L}{KS\eta\cos\alpha}};$$

or for concave wings at +3°:

$$V = \sqrt{\frac{W}{0{\cdot}545KS}}.$$

Having thus determined the weight, the surface, the angle of incidence and the required speed for horizontal support, the next step is to calculate the power required. This is best accomplished by first obtaining the total resistances, which consist of the "drift" and of the head resistances due to the hull and framing. The latter are arrived at preferably by making a tabular statement showing all the spars and parts offering head resistance, and applying to each the coefficient appropriate to its "master section," as ascertained by experiment. Thus is obtained an "equivalent area" of resistance, which is to be multiplied by the wind pressure due to the speed. Care must be taken to resolve all the resistances at their proper angle of application, and to subtract or add the tangential force, which consists in the surface S, multiplied by the wind pressure, and by the factor in the table, which is, however, 0 for 3° and 32°, but positive or negative at other angles. When the aggregate resistances are known, the "thrust h.p." required is obtained by multiplying the resistance by the speed, and then allowing for mechanical losses in the motor and propeller, which losses will generally be 50% of indicated h.p. Close approximations are obtained by the above method when applied to full-sized apparatus. The following example will make the process clearer. The weight to be carried by an apparatus was 189 lb on concave wings of 143·5 sq. ft. area, set at a positive angle of 3°. There were in addition rear wings of 29·5 sq. ft., set at a negative angle of 3°; hence, $L = 189 = 0{\cdot}005 \times V^2 \times 143{\cdot}5 \times 0{\cdot}545$.

$$\text{Whence } V = \sqrt{\frac{189}{0{\cdot}005 \times 143{\cdot}5 \times 0{\cdot}545}} = 22 \text{ miles per hour,}$$

at which the air pressure would be 2·42 lb per sq. ft. The area of spars and man was 17·86 sq. ft., reduced by various coefficients to an "equivalent surface" of 11·70 sq. ft., so that the resistances were:—

Drift front wings, 143·5 × 0·0285 × 2·42	= 9·90 lb
" rear wings, 29·5 × (0·043 − 0·242 × 0·0523) × 2·42	= 2·17 "
Tangential force at 3°	= 0·00 "
Head resistance, 11·70 × 2·42	= 28·31 "
Total resistance	= 40·38 lb

Speed 22 miles per hour. Power $= \frac{40{\cdot}38 \times 22}{375} = 2{\cdot}36$ h.p. for the "thrust" or 4·72 h.p. for the motor. The weight being 189 lb, and the resistance 40·38 lb, the gliding angle of descent was $\frac{40{\cdot}38}{189} =$ tangent of 12°, which was verified by many experiments.

The following expressions will be found useful in computing such projects, with the aid of the table above given:—

1. Wind force, $F = KV^2$.
2. Pressure, $P = KV^2S$.
3. Velocity, $V = \sqrt{\frac{W}{KS\eta\cos\alpha}}$.
4. Surface S varies as $\frac{1}{V^2}$.
5. Normal, $N = KSV^2\eta$.
6. Lift, $L = KSV^2\eta\cos\alpha$.
7. Weight, $W = L = N\cos\alpha$.
8. Drift, $D = KSV^2\eta\sin\alpha$.
9. Head area E, get an equivalent.
10. Head resistance, $H = EF$.
11. Tangential force, $T = P\alpha$.
12. Resistance, $R = D + H \pm T$.
13. Ft. lb, $M = RV$.
14. Thrust, h.p., $= \frac{RV}{\text{factor}}$.

Aerostation.—Possibly the flying dove of Archytas of Tarentum is the earliest suggestion of true aerostation. According to Aulus Gellius (*Noctes Atticae*) it was a "model of a dove or pigeon formed in wood and so contrived as by a certain mechanical art and power to fly: so nicely was it balanced by weights and put in motion by hidden and enclosed air." This "hidden and enclosed air" may conceivably represent an anticipation of the hot-air balloon, but it is at least as probable that the apparent flight of the dove was a mere mechanical trick depending on the use of fine wires or strings invisible to the spectators.

In the middle ages vague ideas appear of some ethereal substance so light that vessels containing it would remain suspended in the air. Roger Bacon (1214–1294) conceived of a large hollow globe made of very thin metal and filled with ethereal air or liquid fire, which would float on the atmosphere like a ship on water. Albert of Saxony, who was bishop of Halberstadt from 1366 to 1390, had a similar notion, and considered that a small portion of the principle of fire enclosed in a light sphere would raise it and keep it suspended. The same speculation was advanced by Francis Mendoza, a Portuguese Jesuit, who died in 1626 at the age of forty-six, and by Gaspar Schott (1608–1666), also a Jesuit and professor of mathematics at Würzburg, though for fire he substituted the thin ethereal fluid which he believed to float above the atmosphere. So late as 1755 Joseph Galien (1699–1782), a Dominican friar and professor of philosophy and theology in the papal university of Avignon, proposed to collect the diffuse air of the upper regions and to enclose it in a huge vessel extending more than a mile every way, and intended to carry fifty-four times as much weight as did Noah's ark! A somewhat different but equally fantastic method of making heavy bodies rise is quoted by Schott from Lauretus Laurus, according to whom swans' eggs or leather balls filled with nitre, sulphur or mercury ascend when exposed to the sun. Laurus also stated that hens' eggs filled with dew will ascend in the same circumstances, because dew is shed by the stars and drawn up again to heaven by the sun's heat during the day. The same notion is utilized by Cyrano de Bergerac (1619–1655) in his romances describing journeys to the moon and sun, for his French traveller fastens round his body a multitude of very thin flasks filled with the morning's dew, whereby through the attractive power of the sun's heat on the dew he is raised to the middle regions of the atmosphere, to sink again, however, on the breaking of some of the flasks.

A distinct advance on Schott is marked by the scheme for aerial navigation proposed by the Jesuit, Francis Lana (1631–1687), in his book, published at Brescia in 1670, *Prodromo ovvero Saggio di alcune invenzioni nuove promesso all' Arte Maestra.* His idea, though useless and unpractical in so far that it could never be carried out, is yet deserving of notice, as the principles involved are sound; and this can be said of no earlier attempt. His project was to procure four copper balls of very large dimensions (fig. 1), yet so extremely thin that after the air was exhausted from them they would be lighter than the air they displaced and so would rise; and to those four balls he proposed to attach a boat, with sails, &c., which would carry up a man. He submitted the whole matter to calculation, and proposed that the globes should be about 25 ft. in diameter and $\frac{1}{225}$th of an inch in thickness; this would give from all four balls a total ascensional force of about 1200 lb, which would be quite enough to raise the boat, sails, passengers, &c. But the obvious objection to the whole scheme is, that it would be quite impossible to construct a globe of so large a size and of such small thickness which would even support its own weight without collapsing if placed on the ground, much less bear the external atmospheric pressure when the internal air was removed. Lana himself noticed this objection, but he thought that the spherical form of the copper shell would, notwithstanding its extreme thinness, enable it, after the exhaustion was effected, to sustain the enormous pressure, which, acting equally on every point of the surface, would tend to consolidate rather than to break the metal. His proposal to exhaust the air from the globes by attaching to each a tube 36 ft. long, fitted with a stopcock, and so producing a Torricellian vacuum, suggests that he was ignorant of the invention of the air-pump by Otto von Guericke about 1650.

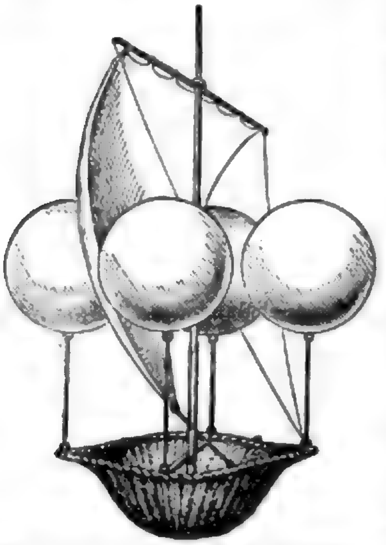

FIG. 1.—Lana's Aeronautical Machine.

Invention of the balloon.

We now come to the invention of the balloon, which was due to Joseph Michel Montgolfier (1740–1810) and Jacques Étienne Montgolfier (1745–1799), sons of Pierre Montgolfier, a large and celebrated papermaker at Annonay, a town about 40 m. from Lyons. The brothers had observed the suspension of clouds in the atmosphere, and it occurred to them that if they could enclose any vapour of the nature of a cloud in a large and very light bag, it might rise and carry the bag with it into the air. Towards the end of 1782 they inflated bags with smoke from a fire placed underneath, and found that either the smoke or some vapour emitted from the fire did ascend and carry the bag with it. Being thus assured of the correctness of their views, they determined to have a public ascent of a balloon on a large scale. They accordingly invited the States of Vivarais, then assembled at Annonay, to witness their aerostatic experiment; and on the 5th of June 1783, in the presence of a considerable concourse of spectators, a linen globe of 105 ft. in circumference was inflated over a fire fed with small bundles of chopped straw. When released it rapidly rose to a great height, and descended, at the expiration of ten minutes, at the distance of about 1½m. This was the discovery of the balloon. The brothers Montgolfier imagined that the bag rose because of the levity of the smoke or other vapour given forth by the burning straw; and it was not till some time later that it was recognized that the ascending power was due merely to the lightness of heated air compared to an equal volume of air at a lower temperature. In this balloon, no source of heat was taken up, so that the air inside rapidly cooled, and the balloon soon descended.

The news of the experiment at Annonay attracted so much attention at Paris that Barthélemi Faujas de Saint-Fond (1741–1819), afterwards professor of geology at the Musée d'Histoire Naturelle, set on foot a subscription for paying the expense of repeating the experiment. The balloon was constructed by two brothers of the name of Robert, under the superintendence of the physicist, J. A. C. Charles. The first suggestion was to copy the process of Montgolfier, but Charles proposed the application of hydrogen gas, which was adopted. The filling of the balloon, which was made of thin silk varnished with a solution of elastic gum, and was about 13 ft. in diameter, was begun on the 23rd of August 1783, in the Place des Victoires. The hydrogen gas was obtained by the action of dilute sulphuric acid upon iron filings, and was introduced through leaden pipes; but as the gas was not passed through cold water, great difficulty was experienced in filling the balloon completely; and altogether about 500 lb of sulphuric acid and twice that amount of iron filings were used (fig. 2). Bulletins were issued daily of the progress of the inflation; and the crowd was so great that on the 26th the balloon was moved secretly by night to the Champ de Mars, a distance of 2 m. On the next day an immense concourse of people covered the Champ de Mars, and every spot from which a view could be obtained was crowded. About five o'clock a cannon was discharged as the signal for the ascent, and the balloon when liberated rose to the height of about 3000 ft. with great rapidity. A shower of rain which began to fall directly after it had left the earth in no way checked its progress; and the excitement was so great, that thousands of well-dressed spectators, many of them ladies, stood exposed, watching it intently the whole time it was in sight, and

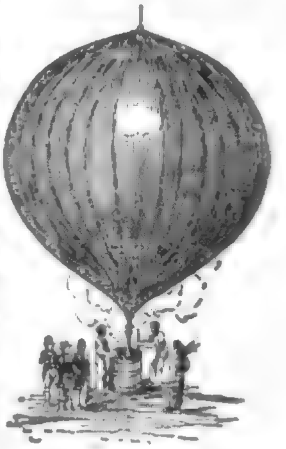

FIG. 2.—Charles' and Robert's Balloon.

were drenched to the skin. The balloon, after remaining in the air for about three-quarters of an hour, fell in a field near Gonesse, about 15 m. off, and terrified the peasantry so much that it was torn into shreds by them. Hydrogen gas was at this time known by the name of inflammable air; and balloons inflated with gas have ever since been called by the people air-balloons, the kind invented by the Montgolfiers being designated fire-balloons. French writers have also very frequently styled them after their inventors, *Charlières* and *Montgolfières*.

On the 19th of September 1783 Joseph Montgolfier repeated the Annonay experiment at Versailles, in the presence of the king, the queen, the court and an immense number of spectators. The inflation was begun at one o'clock, and completed in eleven minutes, when the balloon rose to the height of about 1500 ft., and descended after eight minutes, at a distance of about 2 m., in the wood of Vaucresson. Suspended below the balloon, in a cage, had been placed a sheep, a cock and a duck, which were thus the first aerial travellers. They were quite uninjured, except the cock, which had its right wing hurt in consequence of a kick it had received from the sheep; but this took place before the ascent. The balloon, which was painted with ornaments in oil colours, had a very showy appearance (fig. 3).

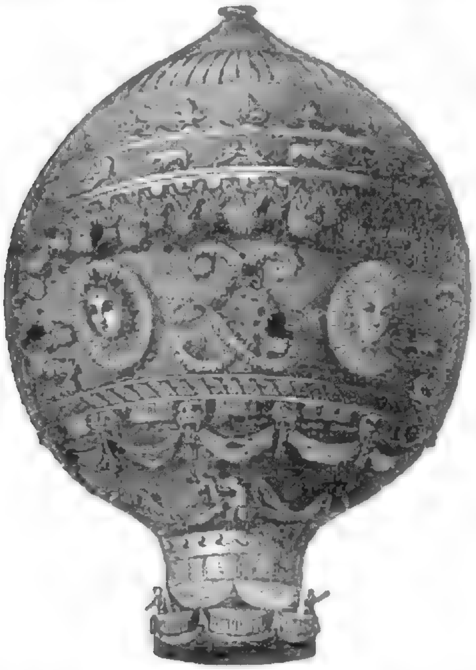

FIG. 3.—Montgolfier's Balloon.

The first human being who ascended in a balloon was Jean François Pilâtre de Rozier (1756–1785), a native of Metz, who was appointed superintendent of the natural history collections of Louis XVIII. On the 15th of October 1783, and following days, he made several ascents (generally alone, but once with a companion, Girond de Villette) in a captive balloon (*i.e.* one attached by ropes to the ground), and demonstrated that there was no difficulty in taking up fuel and feeding the fire, which was kindled in a brazier suspended under the balloon, when in the air. The way being thus prepared for aerial navigation, on the 21st of November 1783, Pilâtre de Rozier and the marquis d'Arlandes first trusted themselves to a free fire-balloon. The experiment was made from the Jardin du Château de la Muette, in the Bois de Boulogne. A large fire-balloon was inflated at about two o'clock, rose to a height of about 500 ft., and passing over the Invalides and the École Militaire, descended beyond the Boulevards, about 9000 yds. from the place of ascent, having been between twenty and twenty-five minutes in the air.

Only ten days later, viz. on the 1st of December 1783, Charles ascended from Paris in a balloon inflated with hydrogen gas. The balloon, as in the case of the small one of the same kind previously launched from the Champ de Mars, was constructed by the brothers Robert, one of whom took part in the ascent. It was 27 ft. in diameter, and the car was suspended from a hoop surrounding the middle of the balloon, and fastened to a net, which covered the upper hemisphere. The balloon ascended very gently from the Tuileries at a quarter to two o'clock, and after remaining for some time at an elevation of about 2000 ft., it descended in about two hours at Nesle, a small town about 27 m. from Paris, when Robert left the car, and Charles made a second ascent by himself. He had intended to have replaced the weight of his companion by a nearly equivalent quantity of ballast; but not having any suitable means of obtaining such at the place of descent, and it being just upon sunset, he gave the word to let go, and the balloon being thus so greatly lightened, ascended very rapidly to a height of about 2 m. After staying in the air about half an hour, he descended 3 m. from the place of ascent, although he believed the distance traversed, owing to different currents, to have been about 9 m. In this second journey he experienced a violent pain in his right ear and jaw, no doubt produced by the rapidity of the ascent. He also witnessed the phenomenon of a double sunset on the same day; for when he ascended, the sun had set in the valleys, and as he mounted he saw it rise again, and set a second time as he descended.

All the features of the modern balloon as now used are more or less due to Charles, who invented the valve at the top, suspended the car from a hoop, which was itself attached to the balloon by netting, &c. With regard to his use of hydrogen gas, there are anticipations that must be noticed. As early as 1766 Henry Cavendish showed that this gas was at least seven times lighter than ordinary air, and it immediately occurred to Dr. Joseph Black, of Edinburgh, that a thin bag filled with hydrogen gas would rise to the ceiling of a room. He provided, accordingly, the allantois of a calf, with the view of showing at a public lecture such a curious experiment; but for some reason it seems to have failed, and Black did not repeat it, thus allowing a great discovery, almost within his reach, to escape him. Several years afterwards a similar idea occurred to Tiberius Cavallo, who found that bladders, even when carefully scraped, are too heavy, and that China paper is permeable to the gas. But in 1782, the year before the invention of the Montgolfiers, he succeeded in elevating soap-bubbles by inflating them with hydrogen gas.

Researches on the use of gas for inflating balloons seem to have been carried on at Philadelphia nearly simultaneously with the experiments of the Montgolfiers; and when the news of the latter reached America, D. Rittenhouse and F. Hopkinson, members of the Philosophical Society at Philadelphia, constructed a machine consisting of forty-seven small hydrogen gas-balloons attached to a car or cage. After several preliminary experiments, in which animals were let up to a certain height by a rope, a carpenter, one James Wilcox, was induced to enter the car for a small sum of money; the ropes were cut, and he remained in the air about ten minutes, and only then effected his descent by making incisions in a number of the balloons, through fear of falling into the river, which he was approaching.

First ascents in Great Britain.

Although the news of the Annonay and subsequent experiments in France rapidly spread all over Europe, and formed a topic of general discussion, still it was not till five months after the Montgolfiers had first publicly sent a balloon into the air that any aerostatic experiment was made in England. In November 1783 Count Francesco Zambeccari (1756–1812), an Italian who happened to be in London, made a balloon of oil-silk, 10 ft. in diameter, and weighing 11 lb. It was publicly shown for several days, and on the 25th it was three-quarters filled with hydrogen gas and launched from the Artillery ground at one o'clock. It descended after two hours and a half near Petworth, in Sussex, 48 m. from London. This was the first balloon that ascended from English ground. On the 22nd of February 1784 a hydrogen gas balloon, 5 ft. in diameter, was let up from Sandwich, in Kent, and descended at Warneton, in French Flanders, 75 m. distant. This was the first balloon that crossed the Channel. The first person who rose into the air from British ground appears to have been J. Tytler,[1] who ascended from the Comely Gardens, Edinburgh, on the 27th of August 1784, in a fire-balloon of his own construction. He descended on the road to Restalrig, about half a mile from the place where he rose.

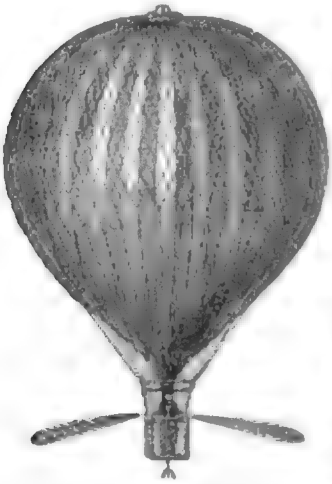

FIG. 4.—Lunardi's Balloon.

But it was Vincent Lunardi who practically introduced aerostation into Great Britain. Although Tytler had the precedence by a few days still his attempts and partial success were all but unknown; whereas Lunardi's experiments excited an enormous amount of enthusiasm in London. He was secretary to Prince Caramanico, the Neapolitan ambassador, and his published letters to his guardian, the chevalier Compagni, written while he was carrying out his project, and detailing all the difficulties, &c., he met with as they occurred, give an interesting and vivid account of the whole matter. His balloon was 33 ft. in circumference (fig. 4), and was exposed to the public view at the Lyceum in the Strand, where it was visited by upwards of 20,000 people. He originally intended to ascend from Chelsea Hospital, but the conduct of a crowd at a garden at Chelsea, which destroyed the fire-balloon of a Frenchman named de Moret, who announced an ascent on the 11th of August, but was unable to keep his word, led to the withdrawal of the leave that had been granted. Ultimately he was permitted to ascend from the Artillery ground, and on the 15th of September 1784 the inflation with hydrogen gas took place. It was intended that an English gentleman named Biggin should accompany Lunardi; but the crowd becoming impatient, the latter judged it prudent to ascend with the balloon only partially full rather than risk a longer delay, and accordingly Mr Biggin was obliged to leave the car. Lunardi therefore ascended alone, in presence of the prince of Wales and an enormous crowd of spectators. He took up with him a pigeon, a dog and a cat, and the balloon was provided with oars, by means of which he hoped to raise or lower it at pleasure. Shortly after starting the pigeon escaped, and one of the oars became broken and fell to the ground. In about an hour and a half he descended at South Mimms, in Hertfordshire, and landed the cat, which had suffered from the cold: he then ascended again, and descended, after the lapse of about three-quarters of an hour, at Standon, near Ware, where he had great difficulty in inducing the peasants to come to his assistance; but at length a young woman, taking hold of one of the cords, urged the men to follow her example, which they then did. The excitement caused by this ascent was immense, and Lunardi at once became the star of the hour. He was presented to the king, and was courted and flattered on all sides. To show the enthusiasm displayed by the people during his ascent, he tells himself, in his sixth letter, how a lady, mistaking the oar which fell for himself, was so affected by his supposed destruction that she died in a few days; but, on the other hand, he says he was told by the judges "that he had certainly saved the life of a young man who might possibly be reformed, and be to the public a compensation for the death of the lady"; for the jury were deliberating on the fate of a criminal, whom they must ultimately have condemned, when the balloon appeared, and to save time they gave a verdict of acquittal, and the whole court came out to view the balloon. The king also was in conference with his ministers; but on hearing that the balloon was passing, he broke up the discussion, and with them watched the balloon through telescopes. The balloon was afterwards exhibited in the Pantheon. In the latter part of the following year (1785) Lunardi made several successful ascents from Kelso, Edinburgh and Glasgow (in one of which he traversed a distance of 110 m.); these he described in a second series of letters.

The first ascent from Ireland was made on the 19th of January 1785 by a Mr Crosbie, who on the following 19th of July attempted to cross St George's Channel to England but fell into the sea. The second person who ascended from Ireland was Richard Maguire. Mr Crosbie had inflated his balloon on the 12th of May 1785, but it was unable to take him up. Maguire in these circumstances offered himself as a substitute, and his offer being accepted he made the ascent. For this he was knighted by the Lord-Lieutenant. Another attempt to cross St George's Channel was made by James Sadler on the 1st of October 1812, and he had nearly succeeded when in consequence of a change of wind he was forced to descend into the sea off Liverpool, whence he was rescued by a fishing-boat. But on the 22nd of July 1817 his second son, Windham Sadler, succeeded in crossing from Dublin to Holyhead.

Voyages across English Channel.

The first balloon voyage across the English Channel was accomplished by Jean Pierre Blanchard (1753–1809) and Dr. J. Jeffries, an American physician, on the 7th of January 1785. In the preceding year, on the 2nd of March, Blanchard, who was one of the most celebrated of the earlier aeronauts, made his first voyage from Paris in a balloon 27 ft. in diameter (fig. 5), and descended at Billancourt near Sèvres. Just as the balloon was about to start, a young man jumped into the car and drawing his sword declared his determination to ascend with Blanchard. He was ultimately removed by force. It has sometimes been incorrectly stated that he was Napoleon Bonaparte; his name in reality was Dupont de Chambon. In their Channel crossing Blanchard and his companion, who started from Dover, when about one-third across found themselves descending, and threw out every available thing from the boat or car. When about three-quarters across they were descending again, and had to throw out not only the anchor and cords, but also to strip and throw away part of their clothing, after which they found they were rising, and their last resource, viz. to cut away the car, was rendered unnecessary. As they approached the shore the balloon rose, describing a magnificent arch high over the land. They descended in the forest of Guinnes.

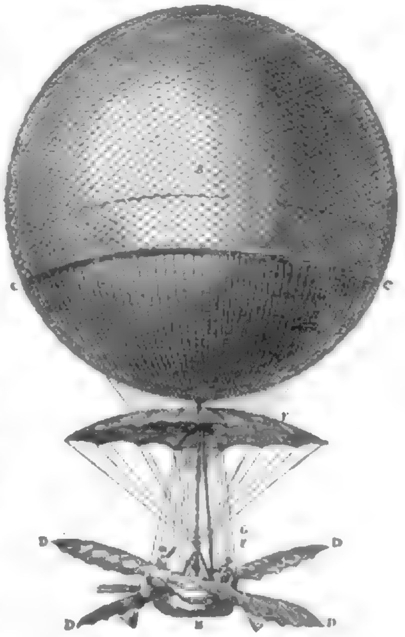

FIG. 5.—Blanchard's Balloon.

A, Balloon of taffeta, 26 ft. in diameter, covered with a net.
B, Car suspended by cords from hoop C.
D, D, D, D, Wings worked by rack-work E.
F, Parachute to break the force of descent should the balloon burst.
G, Tube communicating with inside of balloon.

On the 15th of June 1785, Pilâtre de Rozier made an attempt to repeat the exploit of Blanchard and Jeffries in the reverse direction, and cross from Boulogne to England. For this purpose he contrived a double balloon, which he expected would combine the advantages of both kinds—a fire-balloon, 10 ft. in diameter, being placed underneath a gas-balloon of 37 ft. in diameter, so that by increasing or diminishing the fire in the former it might be possible to ascend or descend without waste of gas. Rozier was accompanied by P. A. Romain, and for rather less than half an hour after the aerostat ascended all seemed to be going on well, when suddenly the whole apparatus was seen in flames, and the unfortunate adventurers came to the ground from the supposed height of more than 3000 ft. Rozier was killed on the spot, and Romain only survived about ten minutes. A monument was erected on the place where they fell, which was near the sea-shore, about 4 m. from the starting-point.

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[1] Mr Tytler contributed largely to, and, indeed, appears to have been virtually editor of, the second edition (1778–1783) of the *Encyclopaedia Britannica*.

Early large balloons.

The largest balloon on record (if the contemporary accounts are correct) ascended from Lyons on the 19th of January 1784. It was more than 100 ft. in diameter, about 130 ft. in height, and when distended had a capacity, it is said, of over half a million cubic feet. It was called the "Flesselles" (from the name of its proprietor, we believe), and after having been inflated from a straw fire in seventeen minutes, it rose with seven persons in the car to the height of about 3000 ft., but descended again after the lapse of about a quarter of an hour from the time of starting, in consequence of a rent in the upper part.

Another large fire-balloon, 68 ft. in diameter, was constructed by the chevalier Paul Andreani of Milan, and on the 25th of February he ascended in it from Milan, remaining in the air for about twenty minutes. This is usually regarded as the first ascent in Italy (but see Monck Mason's *Aeronautica*, p. 247).

On the 7th of November 1836, at half-past one o'clock, a large balloon containing about 85,000 cub. ft. of gas ascended from Vauxhall Gardens, London, carrying Robert Hollond, M.P., Monck Mason and Charles Green, and descended about two leagues from Weilburg, in the duchy of Nassau, at half-past seven the next morning, having thus traversed a distance of about 500 m. in 18 hours; Liége was passed in the course of the night, and Coblentz in the early morning. In consequence of this journey the balloon became famous as the "Nassau Balloon" (fig. 6). Charles Green (1785–1870), who constructed it and subsequently became its owner, was the most celebrated of English aeronauts, and made an extraordinary number of ascents. His first, made from the Green Park, London, on the 19th of July 1821 at the coronation of George IV., was distinguished for the fact that for the first time coal-gas was used instead of hydrogen for inflating the balloon. In 1828 he made an equestrian ascent from the Eagle Tavern, City Road, London, seated on his favourite pony. Such ascents have since been repeated; in 1852 Madame Poitevin made one from Cremorne Gardens, but was prevented from giving a second performance by police interference, the exhibition outraging public opinion. It was in descending from the "Nassau Balloon" in a parachute that Robert Cocking was killed in 1837 (see PARACHUTE). Green was the inventor of the guide-rope, which consists of a long rope trailing below the car. Its function is to reduce the waste of gas and ballast required to keep the balloon at a proper altitude. When a balloon sinks so low that a good deal of the guide-rope rests on the ground, it is relieved of so much weight and therefore tends to rise; if on the other hand it rises so that most of the rope is lifted off the ground, it has to bear a greater weight and tends to sink.

In 1863 A. Nadar, a Paris photographer, construtced "Le Géant," which was the largest gas-balloon made up to that time and contained over 200,000 cub. ft. of gas. Underneath it was placed a smaller balloon, called a compensator, the object of which was to prevent loss of gas during the voyage. The car had two stories, and was, in fact, a model of a cottage in wicker-work, 8 ft. in height by 13 ft. in length, containing a small printing-office, a photographic department, a refreshment-room, a lavatory, &c. The first ascent took place at five o'clock on Sunday the 4th of October 1863, from the Champ de Mars. There were thirteen persons in the car, including one lady, the princess de la Tour d'Auvergne, and the two aeronauts Louis and Jules Godard. In spite of the elaborate preparations that had been made and the stores of provisions that were taken up, the balloon descended at nine o'clock, at Meaux, the early descent being rendered necessary, it was said, by an accident to the valve-line. At a second ascent, made a fortnight later, there were nine passengers, including Madame Nadar. The balloon descended at the expiration of seventeen hours, near Nienburg in Hanover, a distance of about 400 m. A strong wind was blowing, and it was dragged over the ground for 7 or 8 m. All the passengers were bruised, and some seriously hurt. The balloon and car were then brought to England, and exhibited at the Crystal Palace at the end of 1863 and beginning of 1864. The two ascents of Nadar's balloon excited an extraordinary amount of enthusiasm and interest, vastly out of proportion to what they were entitled to. Nadar's idea was to obtain sufficient money, by the exhibition of his balloon, to carry out a plan of aerial locomotion he had conceived possible by means of the principle of the screw; in fact, he spoke of "Le Géant" as "the last balloon." He also started *L'Aeronaute*, a newspaper devoted to aerostation, and published a small book, which was translated into English under the title *The Right to Fly*.

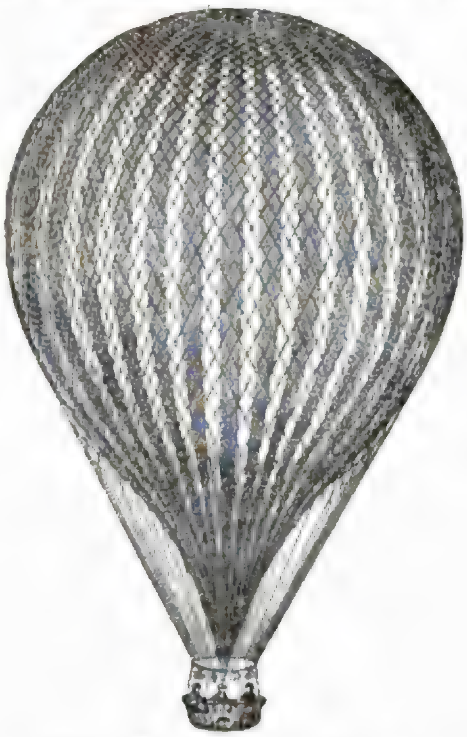


FIG. 6.—The Great Nassau Balloon.

Directly after Nadar's two ascents, Eugene Godard constructed a fire-balloon of nearly half a million cubic feet capacity—more than double that of Nadar's and only slightly less than that attributed to the "Flesselles" of 1783. The air was heated by an 18-ft. stove, weighing, with the chimney, 980 lb. This furnace was fed by straw; and the "car" consisted of a gallery surrounding it. Two ascents of this balloon, the first fire-balloon seen in London, were made from Cremorne Gardens in July 1864. After the first journey the balloon descended at Greenwich, and after the second at Walthamstow, where it was injured by being blown against a tree. Notwithstanding its enormous size, Godard asserted that it could be inflated in half an hour, and the inflation at Cremorne did not occupy more than an hour. In spite of the rapidity with which the inflation was effected, few who saw the ascent could fail to receive an impression unfavourable to the fire-balloon in the matter of safety, as a rough descent, with a heated furnace as it were in the car, could not be other than most dangerous.

Long balloon voyages.

In the summer of 1873 the proprietors of the New York *Daily Graphic*, reviving a project discussed by Green in 1840, determined to construct a very large balloon, and enable the American aeronaut, John Wise, to realize his favourite scheme of crossing the Atlantic Ocean to Europe, by taking advantage of the current from west to east which was believed by many to exist constantly at heights above 10,000 ft. The project came to nothing owing to the quality of the material of which the balloon was made. When it was being inflated in September 1873 a rent was observed after 325,000 cub. ft. of gas had been put in, and the whole rapidly collapsed. The size was said to be such as to contain 400,000 cub. ft., so that it would lift a weight of 14,000 lb. No balloon voyage has yet been made of a length comparable to the breadth of the Atlantic. In fact only two voyages exceeding 1000 m. are on record—that of John Wise from St Louis to Henderson, N.Y., 1120 m., in 1859, and that of Count Henry de la Vaulx from Paris to Korosticheff in Russia, 1193 m., in 1900. On the 11th of July 1897 Salomon Andrée, with two companions, Strendberg and Fränkel, ascended from Spitzbergen in a daring attempt to reach the North Pole, about 600 m. distant. One carrier pigeon, apparently liberated 48 hours after the start, was shot, and two floating buoys with messages were found, but nothing more was heard of the explorers.

Scientific ascents.

At an early date the balloon was applied to scientific purposes. So far back as 1784, Dr Jeffries made an ascent from London in which he carried out barometric, thermometric and hygrometric observations, also collecting samples of the air at different heights. In 1803 the St Petersburg Academy of Sciences, entertaining the opinion that the experiments made on mountain-sides by J. A. Deluc, H. B. de Saussure, A. von Humboldt and others must give results different from those made in free air at the same heights, resolved to arrange a balloon ascent. Accordingly, on the 30th of January 1804, Sacharof, a member of the academy, ascended in a gas-balloon, in company with a French aeronaut, É. G. Robertson, who at one time gave conjuring entertainments in Paris. The ascent was made at a quarter past seven, and the descent effected at a quarter to eleven. The height reached was less than 1½ m. The experiments were not very systematically made, and the chief results were the filling and bringing down of several flasks of air collected at different elevations, and the supposed observation that the magnetic dip was altered. A telescope fixed in the bottom of the car and pointing vertically downwards enabled the travellers to ascertain exactly the spot over which they were floating at any moment. Sacharof found that, on shouting downwards through his speaking-trumpet, the echo from the earth was quite distinct, and at his height was audible after an interval of about ten seconds (*Phil. Mag.*, 1805, 21, p. 193).

Some of the results reported by Robertson appearing doubtful, Laplace proposed to the members of the French Academy of Sciences that the funds placed by the government at their disposal for the prosecution of useful experiments should be utilized in sending up balloons to test their accuracy. The proposition was supported by J. A. C. Chaptal, the chemist, who was then minister of the interior, and accordingly the necessary arrangements were speedily effected, the charge of the experiments being given to L. J. Gay-Lussac and J. B. Biot. The principal object of this ascent was to determine whether the magnetic force experienced any appreciable diminution at heights above the earth's surface. On the 24th of August 1804, Gay-Lussac and Biot ascended from the Conservatoire des Arts at ten o'clock in the morning. Their magnetic experiments were incommoded by the rotation of the balloon, but they found that, up to the height of 13,000 ft., the time of vibration of a magnet was appreciably the same as on the earth's surface. They found also that the air became drier as they ascended. The height reached was about 13,000 ft., and the temperature declined from 63° to 51° F. The descent was effected about half-past one, at Meriville, 18 leagues from Paris.

In a second experiment, which was made on the 16th of September 1804, Gay-Lussac ascended alone. The balloon left the Conservatoire des Arts at 9.40 A.M., and descended at 3.45 P.M. between Rouen and Dieppe. The chief result obtained was that the magnetic force, like gravitation, did not experience any sensible variation at heights from the earth's surface which we can attain to. Gay-Lussac also brought down air collected at the height of nearly 23,000 ft., and on analysis it appeared that its composition was the same as that of air collected at the earth's surface. At the time of leaving the earth the thermometer stood at 82° F., and at the highest point reached (23,000 ft.) it was 14·9° F. Gay-Lussac remarked that at his highest point there were still clouds above him.

From 1804 to 1850 there is no record of any scientific ascents in balloons having been undertaken. In the latter year J. A. Bixio (1808–1865) and J. A. Barral (1819–1884) made two ascents of this kind. In the first they ascended from the Paris observatory on the 29th of June 1850, at 10.27 A.M., the balloon being inflated with hydrogen gas. The day was a rough one, and the ascent took place without any previous attempt having been made to test the ascensional force of the balloon. When liberated, it rose with great rapidity, and becoming fully inflated it pressed upon the network, bulging out at the top and bottom. The ropes by which the car was suspended being too short, the balloon soon covered the travellers like an immense hood. In endeavouring to secure the valve-rope, they made a rent in the balloon, and the gas escaped so close to their faces as almost to suffocate them. Finding that they were descending then too rapidly, they threw overboard everything available, including their coats and only excepting the instruments. The ground was reached at 10h. 45m., near Lagny. Of course no observations were made. Their second ascent was made on the 27th of July, and was remarkable on account of the extreme cold met with. At about 20,000 ft. the temperature was 15° F., the balloon being enveloped in cloud; but on emerging from the cloud, at 23,000 ft., the temperature sank to −38° F., no less than 53° F. below that experienced by Gay-Lussac at the same elevation. The existence of these very cold clouds served to explain certain meteorological phenomena that were observed on the earth both the day before and the day after the ascent. Some pigeons were taken up in this, as in most other high ascents; when liberated, they showed a reluctance to leave the car, and then fell heavily downwards.

In July 1852 the committee of the Kew Observatory resolved to institute a series of balloon ascents, with the view of investigating such meteorological and physical phenomena as require the presence of an observer at a great height in the atmosphere. John Welsh (1824–1859) of the Kew Observatory was the observer, and the great "Nassau Balloon" was employed, with Green himself as the aeronaut. Four ascents were made in 1852, viz. on the 17th and 26th of August, the 31st of October and the 10th of November. The heights attained were 19,510, 19,100, 12,640 and 22,930 ft., and the lowest temperatures met with in the four ascents were 8·7° F. (19,380 ft.), 12·4° F. (18,370 ft.), 16·4° F. (12,640 ft.) and 10·5° F. (22,370 ft.). The decline of temperature was very regular. A siphon barometer, dry and wet bulb thermometers, aspirated and free, and a Regnault hygrometer were taken up. Some air collected at a considerable height was found on analysis not to differ appreciably in its composition from air collected near the ground. For the original observations see *Phil. Trans.*, 1853, pp. 311-346.

Glaisher's ascents.

At the meeting of the British Association for the Advancement of Science held at Aberdeen in 1859, a committee was appointed for the purpose of making observations in the higher strata of the atmosphere by means of the balloon. For two years nothing was effected, owing to the want both of an observer and of a suitable balloon. After its re-appointment at the Manchester meeting of 1861, the committee communicated with Henry Tracey Coxwell (1819–1900), an aeronaut who had made a good many ascents, and he agreed to construct a new balloon, of 90,000 cub. ft. capacity, on the condition that the committee would undertake to use it, and pay £25 for each high ascent made especially on its behalf, defraying also the cost of gas, &c., so that the expense of each high ascent amounted to nearly £50. An observer being still wanted, James Glaisher, a member of the committee, offered himself to take the observations, and accordingly the first ascent was made on the 17th of July 1862, from the gas-works at Wolverhampton, this town being chosen on account of its central position in the country. Altogether, Glaisher made twenty-eight ascents, the last being on the 26th of May 1866. Of these only seven were specially high ascents, although six others were undertaken for the objects of the committee alone. On the other occasions he availed himself of public ascents from the Crystal Palace and other places of entertainment, merely taking his place like the other passengers. In the last six ascents another aeronaut and a smaller balloon were employed. The dates, places of ascent and greatest heights (in feet) attained in the twenty-eight ascents were—1862: July 17, Wolverhampton, 26,177; July 30, Crystal Palace, 6937; August 18, Wolverhampton, 23,377; August 20, Crystal Palace, 5900; August 21, Hendon, 14,355; September 1, Crystal Palace, 4190; September 5, Wolverhampton, 37,000; September 8, Crystal Palace, 5428. 1863: March 31, Crystal Palace, 22,884; April 18, Crystal Palace, 24,163; June 26, Wolverton, 23,200; July 11, Crystal Palace, 6623; July 21, Crystal Palace, 3298; August 31, Newcastle-upon-Tyne, 8033; September 29, Wolverhampton, 16,590; October 9, Crystal Palace, 7310. 1864: January 12, Woolwich, 11,897; April 6, Woolwich, 11,075; June 13, Crystal Palace, 3543; June 20, Derby, 4280; June 27, Crystal Palace, 4898; August 29, Crystal Palace, 14,581; December 1, Woolwich, 5431; December 30, Woolwich, 3735. 1865: February 27, Woolwich, 4865; October 2, Woolwich, 1949; December 2, Woolwich, 4628. 1866: May 26, Windsor, 6325.

The primary object of the ascents was to determine the temperature of the air, and its hygrometrical state at different elevations to as great a height as could be reached; and the secondary objects were—(1) to determine the temperature of the dew-point by Daniell's and Regnault's hygrometers, as well as by the dry and wet bulb thermometers, and to compare the results; (2) to compare the readings of an aneroid barometer with those of a mercurial barometer up to the height of 5 m.; (3) to determine the electrical state of the air, (4) the oxygenic condition of the atmosphere, and (5) the time of vibration of a magnet; (6) to collect air at different elevations; (7) to note the height and kind of clouds, their density and thickness; (8) to determine the rate and direction of different currents in the atmosphere; and (9) to make observations on sound. The instruments used were mercurial and aneroid barometers, dry and wet bulb thermometers, Daniell's dew-point hygrometer, Regnault's condensing hygrometer, maximum and minimum thermometers, a magnet for horizontal vibration, hermetically sealed glass tubes exhausted of air, and an electrometer. In one or two of the ascents a camera was taken up.

The complete observations, both as made and after reduction, are printed in the *British Association Reports*, 1862–1866; here only a general account of the results can be given. It appeared that the rate of the decline of temperature with elevation near the earth was very different according as the sky was clear or cloudy; and the equality of temperature at sunset and increase with height after sunset were very remarkable facts which were not anticipated. Even at the height of 5 m., cirrus clouds were seen high in the air, apparently as far above as they seem when viewed from the earth. The results of the observations differed very much, and no doubt the atmospheric conditions depended not only on the time of day, but also on the season of the year, and were such that a vast number of ascents would be requisite to determine the true laws with anything approaching to certainty and completeness. It was also clear that England is a most unfit country for the pursuit of such investigations, as, from whatever place the balloon started, it was never safe to be more than an hour above the clouds for fear of reaching the sea. It appeared from the observations that an aneroid barometer could be trusted to read as accurately as a mercurial barometer to the heights reached. The time of vibration of a horizontal magnet was taken in very many of the ascents, and the results of ten different sets of observations indicated that the time of vibration was longer than on the earth. In almost all the ascents the balloon was under the influence of currents of air in different directions which varied greatly in thickness. The direction of the wind on the earth was sometimes that of the whole mass of air up to 20,000 ft., whilst at other times the direction changed within 500 ft. of the earth. Sometimes directly opposite currents were met with at different heights in the same ascent, and three or four streams of air were encountered moving in different directions. The direct distances between the places of ascent and descent, apart from the movements of the balloon under the influence of these various currents, were always very much greater than the horizontal movement of the air as measured by anemometers. For example, on the 12th of January 1862, the balloon left Woolwich at 2h. 8m. P.M., and descended at Lakenheath, 70 m. distant from the place of ascent, at 4h. 19m. P.M. At the Greenwich Observatory, by a Robinson anemometer, during this time the motion of the air was 6 m. only. With regard to physiological observations, Glaisher found that the frequency of his pulse increased with elevation, as also did the number of inspirations. The number of his pulsations was generally 76 per minute before starting, about 90 at 10,000 ft., 100 at 20,000 ft., and 110 at higher elevations. But a good deal depended on the temperament of the individual. This was also the case in respect to colour; at 10,000 ft. the faces of some would be a glowing purple, whilst others would be scarcely affected; at 4 m. high Glaisher found the pulsations of his heart distinctly audible, and his breathing was very much affected, so that panting was produced by the slightest exertion; at 29,000 ft. he became insensible. In reference to the propagation of sound, it was at all times found that sounds from the earth were more or less audible according to the amount of moisture in the air. When in clouds at 4 m. high, a railway train was heard; but when clouds were far below, no sound ever reached the ear at this elevation. The discharge of a gun was heard at 10,000 ft. The barking of a dog was heard at the height of 2 m., while the shouting of a multitude of people was not audible at heights exceeding 4000 ft. In his ascent of the 5th of September 1862, Glaisher considered that he reached a height of 37,000 ft. But that figure was based, not on actual record, but on the circumstances that at 29,000 ft., when he became insensible, the balloon was rising 1000 ft. a minute, and that when he recovered consciousness thirteen minutes later it was falling 2000 ft. a minute, and the accuracy of his conclusions has been questioned. Few scientific men have imitated Glaisher in making high ascents for meteorological observations. In 1867 and 1868 Camille Flammarion made eight or nine ascents from Paris for scientific purposes. The heights attained were not great, but the general result was to confirm the observations of Glaisher; for an account see *Voyages aériens*, Paris, 1870, or *Travels in the Air*, London, 1871, in which also some ascents by W. de Fonvielle are noticed. On the 15th of April 1875, H. T. Sivel, J. E. Crocé-Spinelli and Gaston Tissandier ascended from Paris in the balloon "Zenith," and reached a height of 27,950 ft.; but only Tissandier came down alive, his two companions being asphyxiated. This put an end to such attempts for a time. But Dr A. Berson and Lieut. Gross attained 25,840 ft. on the 11th of May 1894; Berson, ascending alone from Strassfurt on the 4th of December 1894, attained about 31,500 ft. and recorded a temperature of −54° F.; and Berson and Stanley Spencer are stated by the latter to have attained 27,500 ft. on the 15th of September 1898 when they ascended in a hydrogen balloon from the Crystal Palace, the thermometer registering −29° F. On the 31st of July 1901, Berson and R. J. Süring, ascending at Berlin, actually noted a barometric reading corresponding to a height of 34,500 ft., and possibly rose 1000 or 1500 ft. higher, though in spite of oxygen inhalations they were unconscious during the highest portion of the ascent.

The personal danger attending high ascents led Gustave Hermite and Besançon in November 1892 to inaugurate the sending up of unmanned balloons (*ballons sondes*) equipped with automatic recording instruments, and kites (*q.v.*) have also been employed for similar meteorological purposes. (See also METEOROLOGY.)

Military balloons.

The balloon had not been discovered very long before it received a military status, and soon after the beginning of the French revolutionary war an aeronautic school was founded at Meudon, in charge of Guyton de Morveau, the chemist, and Colonel J. M. J. Coutelle (1748–1835). Four balloons were constructed for the armies of the north, of the Sambre and Meuse, of the Rhine and Moselle, and of Egypt. In June 1794 Coutelle ascended with the adjutant and general to reconnoitre the hostile army just before the battle of Fleurus, and two reconnaissances were made, each occupying four hours. It is generally stated that it was to the information so gained that the French victory was due. The balloon corps was in constant requisition during the campaign, but it does not appear that, with the exception of the reconnaissances just mentioned, any great advantages resulted, except in a moral point of view. But even this was of importance, as the enemy were much disconcerted at having their movements so completely watched, while the French were correspondingly elated at the superior information it was believed they were gaining. An attempt was made to revive the use of balloons in the African campaign of 1830, but no opportunity occurred in which they could be employed. It is said that in 1849 a reconnoitring balloon was sent up from before Venice, as also were small balloons loaded with bombs to be exploded by time-fuses. In the French campaign against Italy in 1859 the French had recourse to the use of balloons, but this time there was not any aerostatic corps, and their management was entrusted to the brothers Godard. Several reconnaissances were made, and one of especial interest the day before the battle of Solferino. No information of much importance seems, however, to have been gained thereby.

In the American Civil War (1861) balloons were a good deal used by the Federals. There was a regular balloon staff attached to McClellan's army, with a captain, an assistant-captain and about 50 non-commissioned officers and privates. The apparatus consisted of two generators, drawn by four horses each; two balloons, drawn by four horses each, and an acid-cart, drawn by two horses. The two balloons used contained about 13,000 and 26,000 ft. of gas, and the inflation usually occupied about three hours. (See *Royal Engineers' Papers*, vol. xii.) By their aid useful information was gained about the enemy round Richmond and in other places, but eventually difficulties of transport and the topography of the theatre of war made ballooning impracticable; and little was heard of it after the first two years of the war.

The balloon proved itself very valuable during the siege of Paris (1870–71). It was by it alone that communication was kept up between the besieged city and the external world, as the balloons carried away from Paris the pigeons which afterwards brought back to it the news of the provinces. The total number of balloons that ascended from Paris during the siege, conveying persons and despatches, was sixty-four—the first having started on the 23rd of September 1870, and the last on the 28th of January 1871. Gambetta effected his escape from Paris, on the 7th of October, in the balloon "Armand-Barbès," an event which doubtless led to the prolongation of the war. Of the sixty-four balloons only two were never heard of; they were blown out to sea. One of the most remarkable voyages was that of the "Ville d'Orléans," which, leaving Paris at eleven o'clock on the 21st of November, descended fifteen hours afterwards near Christiania, having crossed the North Sea. Several of the balloons on their descent were taken by the Prussians, and a good many were fired at while in the air. The average size of the balloons was from 2000 to 2050 metres, or from 70,000 to 72,000 cub. ft. The above facts are extracted from *Les Ballons du siège de Paris*, a sheet published by Bulla and Sons, Paris, and compiled by the brothers Tissandier, well-known French aeronauts, which gives the name, size and times of ascent and descent of every balloon that left Paris, with the names of the aeronaut and generally also of the passengers, the weight of despatches, the number of pigeons, &c. Only those balloons, however, are noticed in which some person ascended. The balloons were manufactured and despatched (generally from the platforms of the Orleans or the Northern railway) under the direction of the Post Office. The aeronauts employed were mostly sailors, who did their work very well. No use whatever was made in the war of balloons for purposes of reconnaissance.

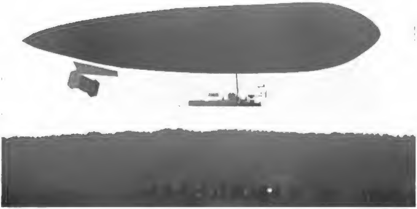
Ballooning, however, as a recognized military science, only dates back to about the year 1883 or 1884, when most of the powers organized regular balloon establishments. In 1884–85 the French found balloons very useful during their campaign in Tongking; and the British government also despatched balloons with the Bechuanaland expedition, and also with that to Suakin in those years. During the latter campaign several ascents were made in the presence of the enemy, on whom it was said that a great moral effect was produced. The employment of balloons has been common in nearly all modern wars.

We may briefly describe the apparatus used in military operations. The French in the campaigns of the 19th century used varnished silk balloons of about 10,000 cub. ft. capacity. The Americans in the Civil War used much larger ones, those of 26,000 cub. ft. being found the most suitable. These were also of varnished silk. In the present day most nations use balloons of about 20,000 cub. ft., made of varnished cambric; but the British war balloons, made of goldbeater skin, are usually of comparatively small size, the normal capacity being 10,000 cub. ft., though others of 7000 and 4500 cub. ft. have also been used, as at Suakin. The usual shape is spherical; but since 1896 the Germans, and now other nations, have adopted a long cylindrical-shaped balloon, so affixed to its cable as to present an inclined surface to the wind and thus act partly on the principle of a kite. Though coal-gas and even hot air may occasionally be used for inflation, hydrogen gas is on account of its lightness far preferable. In the early days of ballooning this had to be manufactured in the field, but nowadays it is almost universally carried compressed in steel tubes. About 100 such tubes, each weighing 75 lb, are required to fill a 10,000-ft. balloon. Tubes of greater capacity have also been tried.

The balloon is almost always used *captive*. If allowed to go free it will usually be rapidly carried away by the wind and the results of the observations cannot easily be transmitted back. Occasions may occur when such ascents will be of value, but the usual method is to send up a captive balloon to a height of somewhere about 1000 ft. With the standard British balloon two officers are sent up, one of whom has now particularly to attend to the management of the balloon, while the other makes the observations.

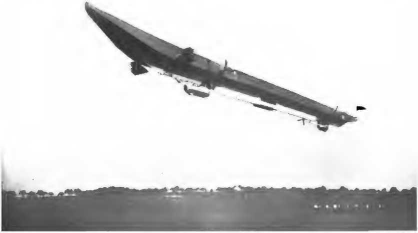
With regard to observations from captive balloons much depends on circumstances. In a thickly wooded country, such as that in which the balloons were used in the American Civil War, and in the war in Cuba (in which the balloon merely served to expose the troops to severe fire), no very valuable information is, as a rule, to be obtained; but in fairly open country all important movements of troops should be discernible by an experienced observer at any point within about four or five miles of the balloon. The circumstances, it may be mentioned, are such as would usually preclude one unaccustomed to ballooning from affording valuable reports. Not only is he liable to be disturbed by the novel and apparently hazardous situation, but troops and features of the ground often have so peculiar an appearance from that point of view, that a novice will often have a difficulty in deciding whether an object be a column of troops or a ploughed field. Then again, much will depend on atmospheric conditions. Thus, in misty weather a balloon is well-nigh useless; and in strong winds, with a velocity of anything over 20 m. an hour, efficient observation becomes a matter of difficulty. When some special point has to be reported on, such as whether there is any large body of troops behind a certain hill or wood, a rapid ascent may still be made in winds up to 30 m. an hour, but the balloon would then be so unsteady that no careful scouting could be made. It is usually estimated that a successful captive ascent can only be made in England on half the days of the year. As a general rule balloon ascents would be made for one of the following objects:—to examine the country for an enemy; to reconnoitre the enemy's position; to ascertain the strength of his force, number of guns and exact situation of the various arms; also to note the plan of his earthworks or fortifications. During an action the aerial observer would be on the look-out for any movements of the enemy and give warning of flank attacks or surprises. Such an observer could also keep the general informed as to the progress of various detached parties of his own force, as to the advance of reinforcements, or to the conduct of any fighting going on at a distance. Balloon observations are also of especial aid to artillery in correcting their aim.

The vulnerability of a captive balloon to the enemy's fire has been tested by many experiments with variable results. One established



Photo, Topical Press.

FIG. 1.—CLÉMENT-BAYARD DIRIGIBLE.



Photo, Topical Press.

FIG. 2.—ZEPPELIN VII. (DEUTSCHLAND), WRECKED JUNE 28, 1910.

AERONAUTICS

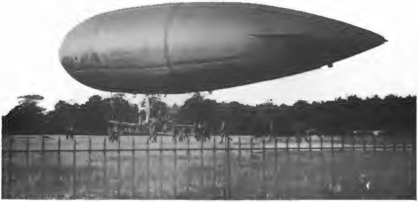


Fig. 3.—BRITISH ARMY DIRIGIBLE, BETA.

Photo, Topical Press.

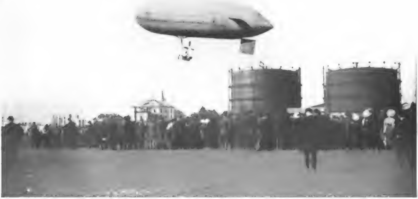


Fig. 4.—PARSEVAL DIRIGIBLE.

Photo, Topical Press.

fact is that the range of a balloon in mid-air is extremely difficult to judge, and, as its altitude can be very rapidly altered, it becomes a very difficult mark for artillery to hit. A few bullet-holes in the fabric of a balloon make but little difference, since the size of the perforation is very minute as compared with the great surface of material, but on the other hand, a shrapnel bursting just in front of it may cause a rapid fall. It is therefore considered prudent to keep the balloon well away from an enemy, and two miles are laid down as the nearest approach it should make habitually.

Besides being of use on land for war purposes, balloons have also been tried in connexion with the naval service. In France especially regular trials have been made of inflating balloons on board ships, and sending them aloft as a look-out; but it is now generally contended that the difficulties of storing the gas and of manœuvring the balloon are so great on board ship as to be hardly worth the results to be gained.

A very important development of military ballooning is that of the navigable balloon. If only a balloon could be sent up and driven in any required direction, and brought back to its starting-point, it is obvious that it would be of the very greatest use in war.

Dirigible balloons.

From the very first invention of balloons the problem has been how to navigate them by propulsion. General J. B. M. C. Meusnier (1754–1793) proposed an elongated balloon in 1784. It was experimented on by the brothers Robert, who made two ascensions and claimed to have obtained a deviation of 22° from the direction of a light wind by means of aerial oars worked by hand. The relative speed was probably about 3 m. an hour, and it was so evident that a very much more energetic light motor than any then known was required to stem ordinary winds that nothing more was attempted till 1852, when Henri Giffard (1825–1882) ascended with a steam-engine of then unprecedented lightness. The subjoined table exhibits some of the results subsequently obtained :—

EXPERIMENTS WITH DIRIGIBLE BALLOONS

Year.	Inventor.	Length.	Diameter.	Contents.	Lifting Capacity.	Weight of Balloon.	Weight of Motor.	H.P.	Speed per hour.
		Ft.	Ft.	Cub. ft.	lb.	lb.	lb.		Miles.
1852	Giffard	144	39	88,300	3,978	2,794	462	3·0	6·71
1872	Dupuy de Lôme	118	49	120,088	8,358	4,728	2000	0·8	6·26
1884	Tissandier	92	30	37,439	2,728	933	616	1·5	7·82
1885	Renard and Krebs	165	27	65,836	4,402	2,449	1174	9·0	14·00
1897	Schwarz	157	46 39	130,500	8,133	6,800	800 ?	16·0	17·00
1900	Zeppelin I.	420	39	400,000	25,000	19,000	1500	32·0	18·00
1901	Santos Dumont VI.	108	20	22,200	..	..	..	16·20	19·00
1908	"République"	195	35	130,000	3,100	..	..	80	30
1908	Zeppelin IV.	446	42½	450,000	..	..	..	220	..

Giffard, the future inventor of the injector, devised a steam-engine weighing, with fuel and water for one hour, 154 lb per horse-power, and was bold enough to employ it in proximity to a balloon inflated with coal gas. He was not able to stem a medium wind, but attained some deviation. He repeated the experiment in 1855 with a more elongated spindle, which proved unstable and dangerous. During the siege of Paris the French government decided to build a navigable balloon, and entrusted the work to the chief naval constructor, Dupuy de Lôme. He went into the subject very carefully, made estimates of all the strains, resistances and speeds, and tested the balloon in 1872. Deviations of 12° were obtained from the course of a wind blowing 27 to 37 m. per hour. The screw propeller was driven by eight labourers, a steam-engine being deemed too dangerous; but it was estimated that had one been used, weighing as much as the men, the speed would have been doubled. Tissandier and his brother applied an electric motor, lighter than any previously built, to a spindle-shaped balloon, and went up twice in 1883 and 1884. On the latter occasion he stemmed a wind of 7 m. per hour. The brothers abandoned these experiments, which had been carried on at their own expense, when the French War Department took up the problem. Renard and Krebs, the officers in charge of the War Aeronautical Department at Meudon, built and experimented with in 1884 and 1885 the fusiform balloon "La France," in which the "master" or maximum section was about one-quarter of the distance from the stem. The propelling screw was at the front of the car and driven by an electric motor of unprecedented lightness. Seven ascents were made on very calm days, a maximum speed of 14 m. an hour was obtained, and the balloon returned to its starting-point on five of the seven occasions. Subsequently another balloon was constructed, said to be capable of a speed of 22 to 28 m. per hour, with a different motor. After many years of experiment Dr Wölfert built and experimented with in Berlin, in 1897, a cigar-shaped balloon driven by a gasoline motor. An explosion took place in the air, the balloon fell and Dr Wölfert and his assistant were killed. It was also in 1897 that an aluminium balloon was built from the designs of D. Schwarz and tested in Berlin. It was driven by a Daimler benzine motor, and attained a greater speed than "La France"; but a driving belt slipped, and in coming down the balloon was injured beyond repair.

From 1897 onwards Count Ferdinand von Zeppelin, of the German army, was engaged in constructing an immense balloon, truly an airship, of most careful and most intelligent design, to carry five men. It consisted of an aluminium framework containing sixteen gas bags with a total capacity of nearly 400,000 cub. ft., and it had two cars, each containing a 16 h.p. motor. It was first tested in June 1900, when it attained a speed of 18 m. an hour and travelled a distance of 3½ m. before an accident to the steering gear necessitated the discontinuance of the experiment. In 1905 Zeppelin built a second airship which had a slightly smaller capacity but much greater power, its two motors each developing 85 h.p. This, after making some successful trips, was wrecked in a violent gale, and was succeeded by a third airship, which, at its trial in October 1906, travelled round Lake Constance and showed itself able to execute numerous curves and traverses. At a second series of trials in September 1907, after some alterations had been effected, it attained a speed of 36 m. an hour, remaining in the air for many hours and carrying nine or eleven passengers. A fourth vessel of similar design, but with more powerful motors, was tried in 1908, and succeeded in travelling 250 m. in 11 hours, but owing to a storm it was wrecked when on land and burnt at Echterdingen on the 5th of August. Subscriptions, headed by the emperor, were at once raised to enable Zeppelin to build another.

Meanwhile in 1901 Alberto Santos Dumont had begun experiments with dirigible balloons in Paris, and on the 19th of October won the Deutsch prize by steering a balloon from St Cloud round the Eiffel tower and back in half an hour, encountering on his return journey a wind of nearly 5 metres a second. An airship constructed by Pierre and Paul Lebaudy in 1904 also made a number of successful trials in the vicinity of Paris; with a motor of 40 h.p., its speed was about 25 m. an hour, and it regularly carried three passengers. In October 1907 the "Nulli Secundus," an airship constructed for the British War Office, sailed from Farnborough round St Paul's Cathedral, London, to the Crystal Palace, Sydenham, a distance of about 50 m., in 3 hours 35 minutes. The weight carried, including two occupants, was 3400 lb, and the maximum speed was 24 m. an hour, with a following wind of 8 m. an hour.

Thus the principles which govern the design of the dirigible balloon may be said to have been evolved. As the lifting power grows as the cube of the dimensions, and the resistance approximately as the square, the advantage lies with the larger sizes of balloons, as of ocean steamers, up to the limits within which they may be found practicable. Count Zeppelin gained an advantage by attaching his propellers to the balloon, instead of to the car as heretofore; but this requires a rigid framework and a great increase of weight. Le Compagnon endeavoured, in 1892, to substitute flapping wings for rotary propellers, as the former can be suspended near the centre of resistance. C. Danilewsky followed him in 1898 and 1899, but without remarkable results. Dupuy de Lôme was the first to estimate in detail the resistances to balloon propulsion, but experiment showed that in the aggregate they were greater than he calculated. Renard and Krebs also found that their computed resistances were largely exceeded, and after revising the results they gave the formula $R=0·01685\ D^2V^2$, R being the resistance in kilograms, D the diameter in metres and V the velocity in metres per second. Reduced to British measures, in pounds, feet and miles per hour, $R=0·0006876\ D^2V^2$, which is somewhat in excess of the formula computed by Dr William Pole from Dupuy de Lôme's experiments. The above coefficient applies only to the shape and rigging of the balloon "La France," and combines all resistances into one equivalent, which is equal to that of a flat plane 18% of the "master section." This coefficient may perhaps hereafter be reduced by one-half through a better form of hull and car, more like a fish than a spindle, by diminished sections of suspension lines and net, and by placing the propeller at the centre of resistance. To compute the results to be expected from new projects, it will be preferable to estimate the resistances in detail. The following table shows how this was done by Dupuy de Lôme, and the probable corrections which should have been made by him:—

RESISTANCES—DUPUY DE LÔME'S BALLOON

Computed by Dupuy de Lôme. V = 2·22 m. per sec.					More Probable Values. V = 2·82 m. per sec.		
Part.	Area, Sq. Metres.	Co-efficient.	Air Pressure.	Resistance, Kg.	Co-efficient.	Air Pressure.	Resistance, Kg.
Hull, without net. .	172·96	1/30	0·665	3·830	1/15	0·875	10·091
Car . . .	3·25	1/5	,,	0·432	1/5	,,	0·569
Men's bodies	3·00	1/5	,,	0·400	1/2	,,	1·312
Gas tubes .	6·40	1/5	,,	0·850	1/2	,,	2·750
Small cords	10·00	1/2	,,	3·325	1/2	,,	4·375
Large cords	9·90	1/3	,,	2·194	1/3	,,	2·887
				11·031			21·984

When the resistances have been reduced to the lowest possible minimum by careful design, the attainable speed must depend upon the efficiency of the propeller and the relative lightness of the motor. The commercial uses of dirigible balloons, however, will be small, as they must remain housed when the wind aloft is brisk. The sizes will be great and costly, the loads small, and the craft frail and short-lived, yet dirigible balloons constitute the obvious type for governments to evolve, until they are superseded by efficient flying machines. (See further, as to the latter, the article FLIGHT AND FLYING.)

Practice of aerostation.

The chief danger attending ballooning lies in the descent; for if a strong wind be blowing, the grapnel will sometimes trail for miles over the ground at the rate of ten or twenty miles an hour, catching now and then in hedges, ditches, roots of trees, &c.; and, after giving the balloon a terrible jerk, breaking loose again, till at length some obstruction, such as the wooded bank of a stream, affords a firm hold. This danger, however, has been much reduced by the use of the "ripping-cord," which enables a panel to be ripped open and the balloon to be completely deflated in a few seconds, just as it is reaching the earth. But even a very rough descent is usually not productive of any very serious consequences; as, although the occupants of the car generally receive many bruises and are perhaps cut by the ropes, it rarely happens that anything worse occurs. On a day when the wind is light (supposing that there is no want of ballast) nothing can be easier than the descent, and the aeronaut can decide several miles off on the field in which he will alight. It is very important to have a good supply of ballast, so as to be able to check the rapidity of the descent, as in passing downwards through a wet cloud the weight of the balloon is enormously increased by the water deposited on it; and if there is no ballast to throw out in compensation, the velocity is sometimes very great. It is also convenient, if the district upon which the balloon is descending appear unsuitable for landing, to be able to rise again. The ballast consists of fine baked sand, which becomes so scattered as to be inappreciable before it has fallen far below the balloon. It is taken up in bags containing about ½ cwt. each. The balloon at starting is liberated by a spring catch which the aeronaut releases, and the ballast should be so adjusted that there is nearly equilibrium before leaving, else the rapidity of ascent is too great, and has to be checked by parting with gas. It is almost impossible to liberate the balloon in such a way as to avoid giving it a rotary motion about a vertical axis, which continues during the whole time it is in the air. This rotation makes it difficult for those in the car to discover in what direction they are moving; and it is only by looking down along the rope to which the grapnel is suspended that the motion of the balloon over the country below can be traced. The upward and downward motion at any instant is at once known by merely dropping over the side of the car a small piece of paper: if the paper ascends or remains on the same level or stationary, the balloon is descending; while, if it descends, the balloon is ascending. This test is exceedingly delicate.

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AEROTHERAPEUTICS, the treatment of disease by atmospheric air: a term which of late has come to be used somewhat more loosely to include also pneumotherapeutics, or the treatment of disease by artificially prepared atmospheres. The physical and chemical properties of atmospheric air, under ordinary pressure or under modified pressure, may be therapeutically utilized either on the external surface of the body, on the respiratory surface, or on both surfaces together. Also modifications may be induced in the ventilation of the lungs by general gymnastics or respiratory gymnastics.

The beneficial effects of air under ordinary pressure are now utilized in the open-air treatment of phthisical patients, and the main indications of benefit resulting therefrom are reduction of the fever, improvement of appetite and the induction of sleep.

The air, however, may be modified in composition or in temperature. Inhalation is the most common and successful method of applying it—when modified in composition—to the human body. The methods in use are as follows: (1) Inhalation of gases, as oxygen and nitrous oxide. The dyspnoea and cyanosis of pneumonia, capillary bronchitis, heart failure, &c., are much relieved by the inhalation of oxygen; and nitrous oxide is largely used as an anaesthetic in minor operations. (2) Certain liquids are used as anaesthetics, which volatilize at low temperatures, as chloroform and ether. (3) Mercury and sulphur, both of which require heat for volatilization, are very largely used. In a mercurial or sulphur bath, the patient, enveloped in a sheet, sits on a chair beneath which a spirit lamp is placed to vaporize the drug, the best results being obtained when the atmosphere is surcharged with steam at the same time. The vapour envelops the patient and is absorbed by the skin. This method is extensively used in the treatment of syphilis, and also for scabies and other parasitic affections of the skin. (4) Moist inhalations are rather losing repute in the light of modern investigations, which tend to show that nothing lower than the larger bronchial tubes is affected. Complicated apparatus has been devised for the application, although a wide-mouthed jug filled with boiling water, into which the drug is thrown, is almost equally efficacious.

Artificial atmospheres may be made for invalids by respirators which cover the mouth and nose, the air being drawn through tow or sponge, on which is sprinkled the disinfectant to be used. This is most valuable in the intensely offensive breath of some cases of bronchiectasis.

The air may be modified as to temperature. Cold air at 32–33° F. has been used in chronic catarrhal conditions of the lungs, with the result that cough diminishes, the pulse becomes fuller and slower and the general condition improves. The more recent observations of Pasquale di Tullio go far to show that this may be immensely valuable in the treatment of haemoptysis. The inspiration of superheated dry air has been the subject of much investigation, but with very doubtful results.

Hot air applied to the skin is more noteworthy in its therapeutic effects. If a current of hot air is directed upon healthy skin, the latter becomes pale and contracts in consequence of vaso-constriction. But if it is directed on a patch of diseased skin, as in lupus, an inflammatory reaction is set up and the diseased part begins to undergo necrosis. This fact has been used with good results in lupus, otorrhoea, rhinitis and other nasal and laryngeal troubles.

Lastly the air may be either compressed or rarefied. The physiological effects of compressed air were first studied in diving-bells, and more recently in caissons. Caisson workers at first enjoy increased strength, vigour and appetite; later, however, the opposite effect is produced and intense debility supervenes. In addition, caisson workers suffer from a series of troubles which are known as accidents of decompression. (See Caisson Disease.) But, therapeutically, compressed air has been utilized by means of pneumatic chambers large enough to hold one or more adults at the time, in which the pressure of the atmosphere can be exactly regulated. This form of treatment has been found of much value in the treatment of emphysema, early pulmonary tuberculosis (not in the presence of persistent high temperature, haemorrhage, softening or suppuration), delayed absorption of pleural effusions, heart disease, anaemia and chlorosis. But compressed air is contra-indicated in advanced tubercle, fever, and in diseases of kidneys, liver or intestines.

Rarefied air was used as long ago as 1835, by V. T. Junod, who utilized it for local application by inventing the Junod Boot. By means of this the blood could be drawn into any part to which it was applied, the vessels of which became gorged with blood at the expense of internal organs. More recently this method of treatment has undergone far-reaching developments and is known as the passive hyperaemic treatment.

There are also various forms of apparatus by means of which air at greater or lesser pressures may be drawn into the lungs, and for the performance of lung gymnastics of various kinds. Mr Ketchum of the United States has invented one which is much used. A committee of the Brompton Hospital, London, investigating its capabilities, decided that its use brought about (1) an increase of chest circumference, and (2) in cases of consolidation of the lung a diminution in the area of dulness.

AERTSZEN (or Aartsen), **PIETER** (1507–1573), called "Long Peter" on account of his height, Dutch historical painter, was born and died at Amsterdam. When a youth he distinguished himself by painting homely scenes, in which he reproduced articles of furniture, cooking utensils, &c., with marvellous fidelity, but he afterwards cultivated historical painting. Several of his best works—altar-pieces in various churches—were destroyed in the religious wars of the Netherlands. An excellent specimen of his style on a small scale, a picture of the crucifixion, may be seen in the Antwerp Museum. Aertszen was a member of the Academy of St Luke, in whose books he is entered as *Langhe Peter, schilder*. Three of his sons attained to some note as painters.

AESCHINES (389–314 B.C.), Greek statesman and orator, was born at Athens. The statements as to his parentage and early life are conflicting; but it seems probable that his parents, though poor, were respectable. After assisting his father in his school, he tried his hand at acting with indifferent success, served with distinction in the army, and held several clerkships, amongst them the office of clerk to the Boulē. The fall of Olynthus (348) brought Aeschines into the political arena, and he was sent on an embassy to rouse the Peloponnesus against Philip. In 347 he was a member of the peace embassy to Philip of Macedon, who seems to have won him over entirely to his side. His dilatoriness during the second embassy (346) sent to ratify the terms of peace led to his accusation by Demosthenes and Timarchus on a charge of high treason, but he was acquitted as the result of a powerful speech, in which he showed that his accuser Timarchus had, by his immoral conduct, forfeited the right to speak before the people. In 343 the attack was renewed by Demosthenes in his speech *On the False Embassy*; Aeschines replied in a speech with the same title and was again acquitted. In 339, as one of the Athenian deputies (*pylagorae*) in the Amphictyonic Council, he made a speech which brought about the Sacred War. By way of revenge, Aeschines endeavoured to fix the blame for these disasters upon Demosthenes. In 336, when Ctesiphon proposed that his friend Demosthenes should be rewarded with a golden crown for his distinguished services to the state, he was accused by Aeschines of having violated the law in bringing forward the motion. The matter remained in abeyance till 330, when the two rivals delivered their speeches *Against Ctesiphon* and *On the Crown*. The result was a complete victory for Demosthenes. Aeschines went into voluntary exile at Rhodes, where he opened a school of rhetoric. He afterwards removed to Samos, where he died in the seventy-fifth year of his age. His three speeches, called by the ancients "the Three Graces," rank next to those of Demosthenes. Photius knew of nine letters by him which he called the Nine Muses; the twelve published under his name (Hercher, *Epistolographi Graeci*) are not genuine.

Ancient Authorities.—Demosthenes, *De Corona* and *De Falsa Legatione*; Aeschines, *De Falsa Legatione* and *In Ctesiphontem*; Lives by Plutarch, Philostratus and Libanius; the *Exegesis* of Apollonius. Editions.—Benseler (1855–1860) (trans. and notes), Weidner (1872), Blass (1896); *Against Ctesiphon*, Weidner (1872), (1878), G.A. and W.H. Simcox (1866), Drake (1872), Richardson (1889), Gwatkin and Shuckburgh (1890). English Translations.—Leland (1771), Biddle (1881), and others. See also Stechow, *Aeschinis Oratoris vita* (1841); Marchand, *Charakteristik des Redners Äschines* (1876); Castets, *Eschine, l'Orateur* (1875); for the political problems see histories of Greece, esp. A. Holm, vol. iii. (Eng. trans., 1896); A. Schäfer, *Demosth. und seine Zeit* (Leipzig, 1856–1858); also Demosthenes.

AESCHINES (5th century B.C.), an Athenian philosopher. According to some accounts he was the son of a sausage-maker, but others say that his father was Lysanias (Diog. Laert. ii. 60; Suidas, *s.v.*). He was an intimate friend of Socrates, who is reported to have said that the sausage-maker's son alone knew how to honour him. Diogenes Laertius preserves a tradition that it was he, not Crito, who offered to help Socrates to escape from prison. He was always a poor man, and Socrates advised him "to borrow from himself, by diminishing his expenditure." He started a perfumery shop in Athens on borrowed capital, became bankrupt and retired to the Syracusan court, where he was well received by Aristippus. According to Diog. Laert. (ii. 61), Plato, then at Syracuse, pointedly ignored Aeschines, but this does not agree with Plutarch, *De adulatore et amico* (c. 26). On the expulsion of the younger Dionysius, he returned to Athens, and, finding it impossible to profess philosophy publicly owing to the contempt of Plato and Aristotle, was compelled to teach privately. He wrote also forensic speeches; Phrynichus, in Photius, ranks him amongst the best orators, and mentions his orations as the standard of the pure Attic style. Hermogenes also spoke highly of him (Περὶ ἰδεῶν). He wrote several philosophical dialogues: (1) *Concerning virtue, whether it can be* *taught*; (2) *Eryxias, or Erasistratus; concerning riches, whether they are good*; (3) *Axiochus: concerning death, whether it is to be feared*,—but those extant on the several subjects are not genuine remains. J. le Clerc has given a Latin translation of them, with notes and several dissertations, entitled *Silvae Philologicae*, and they have been edited by S. N. Fischer (Leipzig, 1786), and K. F. Hermann, *De Aeschin. Socrat. relig.* (Gött. 1850). The genuine dialogues appear to have been marked by the Socratic irony; an amusing passage is quoted by Cicero in the *De inventione* (i. 31).

See Hirzel, *Der Dialog.* i. 129-140; T. Gomperz, *Greek Thinkers*, vol. iii. p. 342 (Eng. trans. G. G. Berry, London, 1905).

AESCHYLUS (525-456 B.C.), Greek poet, the first of the only three Attic Tragedians of whose work entire plays survive, and in a very real sense (as we shall see) the founder of the Greek drama, was born at Eleusis in the year 525 B.C. His father, Euphorion, belonged to the "Eupatridae" or old nobility of Athens, as we know on the authority of the short *Life* of the poet given in the Medicean Manuscript (see note on "authorities" at the end). According to the same tradition he took part as a soldier in the great struggle of Greece against Persia; and was present at the battles of Marathon, Artemisium, Salamis and Plataea, in the years 490-479. At least one of his brothers, Cynaegirus, fought with him at Marathon, and was killed in attempting a conspicuous act of bravery; and the brothers' portraits found a place in the national picture of the battle which the Athenians set up as a memorial in the Stoa Poecile (or "Pictured Porch") at Athens.

Life.

The vigour and loftiness of tone which mark Aeschylus' poetic work was not only due, we may be sure, to his native genius and gifts, powerful as they were, but were partly inspired by the personal share he took in the great actions of a heroic national uprising. In the same way, the poet's brooding thoughtfulness on deep questions—the power of the gods, their dealings with man, the dark mysteries of fate, the future life in Hades—though largely due to his turn of mind and temperament, was doubtless connected with the place where his childhood was passed. Eleusis was the centre of the most famous worship of Demeter, with its processions, its ceremonies, its mysteries, its impressive spectacles and nocturnal rites; and these were intimately connected with the Greek beliefs about the human soul, and the underworld.

His dramatic career began early, and was continued for more than forty years. In 499, his 26th year, he first exhibited at Athens; and his last work, acted during his lifetime at Athens, was the trilogy of the *Oresteia*, exhibited in 458. The total number of his plays is stated by Suidas to have been ninety; and the seven extant plays, with the dramas named or nameable which survive only in fragments, amount to over eighty, so that Suidas' figure is probably based on reliable tradition. It is well known that in the 5th century each exhibitor at the tragic contests produced four plays; and Aeschylus must therefore have competed (between 499 and 458) more than twenty times, or once in two years. His first victory is recorded in 484, fifteen years after his earliest appearance on the stage; but in the remaining twenty-six years of his dramatic activity at Athens he was successful at least twelve times. This clearly shows that he was the most commanding figure among the tragedians of 500-458; and for more than half that time was usually the victor in the contests. Perhaps the most striking evidence of his exceptional position among his contemporaries is the well-known decree passed shortly after his death that whosoever desired to exhibit a play of Aeschylus should "receive a chorus," *i.e.* be officially allowed to produce the drama at the Dionysia. The existence of this decree, mentioned in the *Life*, is strongly confirmed by two passages in Aristophanes: first in the prologue of the *Acharnians* (which was acted in 425, thirty-one years after the poet's death), where the citizen, grumbling about his griefs and troubles, relates his great disappointment, when he took his seat in the theatre "expecting Aeschylus," to find that when the play came on it was Theognis; and secondly in a scene of the *Frogs* (acted 405 B.C.), where the throne of poetry is contested in Hades between Aeschylus and Euripides, the former complains (*Fr.* 866) that "the battle is not fair, because my own poetry has not died with me, while Euripides' has died, and therefore *he will have it with him to recite*"—a clear reference, as the scholiast points out, to the continued production at Athens of Aeschylus' plays after his death.

Apart from fables, guesses and blunders, of which a word is said below, the only other incidents recorded of the poet's life that deserve mention are connected with his Sicilian visits, and the charge preferred against him of revealing the "secrets of Demeter." This tale is briefly mentioned by Aristotle (*Eth.* iii. 2), and a late commentator (Eustratius, 12th century) quotes from one Heraclides Ponticus the version which may be briefly given as follows:—

The poet was acting a part in one of his own plays, where there was a reference to Demeter. The audience suspected him of revealing the inviolable secrets, and rose in fury; the poet fled to the altar of Dionysus in the orchestra and so saved his life for the moment; for even an angry Athenian crowd respected the inviolable sanctuary. He was afterwards charged with the crime before the Areopagus; and his plea "that he did not know that what he said was secret" was accepted by the court and secured his acquittal. The commentator adds that the prowess of the poet (and his brother) at Marathon was the real cause of the leniency of his judges. The story was afterwards developed, and embellished by additions; but in the above shape it dates back to the 4th century; and as the main fact seems accepted by Aristotle, it is probably authentic.

As to his foreign travel, the suggestion has been made that certain descriptions in the *Persae*, and the known facts that he wrote a trilogy on the story of the Thracian king Lycurgus, persecutor of Dionysus, seem to point to his having a special knowledge of Thrace, which makes it likely that he had visited it. This, however, remains at best a conjecture. For his repeated visits to Sicily, on the other hand, there is conclusive ancient evidence. Hiero the First, tyrant of Syracuse, who reigned about twelve years (478-467), and amongst other efforts after magnificence invited to his court famous poets and men of letters, had founded a new town, Aetna, on the site of Catana which he captured, expelling the inhabitants. Among his guests were Aeschylus, Pindar, Bacchylides and Simonides. About 476 Aeschylus was entertained by him, and at his request wrote and exhibited a play called *The Women of Aetna* in honour of the new town. He paid a second visit about 472, the year in which he had produced the *Persae* at Athens; and the play is said to have been repeated at Syracuse at his patron's request. Hiero died in 467, the year of the *Seven against Thebes*; but after 458, when the *Oresteia* was exhibited at Athens, we find the poet again in Sicily for the last time. In 456 he died, and was buried at Gela; and on his tomb was placed an epitaph in two elegiac couplets saying: "Beneath this stone lies Aeschylus, son of Euphorion, the Athenian, who perished in the wheat-bearing land of Gela; of his noble prowess the grove of Marathon can speak, or the long-haired Persian who knows it well." The authorship of this epitaph is uncertain, as the *Life* says it was inscribed on his grave by the people of Gela, while Athenaeus and Pausanias attribute it to Aeschylus. Probably most people would agree that only the poet himself could have praised the soldier and kept silence about the poetry.

Of the marvellous traditions which gathered round his name little need be said. Pausanias' tale, how Dionysus appeared to the poet when a boy, asleep in his father's vineyard, and bade him write a tragedy—or the account in the *Life*, how he was killed by an eagle letting fall on his head a tortoise whose shell the bird was unable to crack—clearly belong to the same class of legends as the story that Plato was son of Apollo, and that a swarm of bees settled upon his infant lips as he lay in his mother's arms. Less supernatural, but hardly more historical, is the statement in the *Life* that the poet left Athens for Sicily in consequence of his defeat in the dramatic contest of 468 by Sophocles; or the alternative story of the same authority that the cause of his chagrin was that Simonides' elegy on the heroes slain at Marathon was preferred to his own. Apart from the inherent improbability of such pettiness in such a man, neither story fits the facts; for in 467, the next year after Sophocles' success, we know that Aeschylus won the prize of tragedy with the *Septem*; and the Marathon elegy must have been written in 490, fourteen years before his first visit to Sicily.

Work.

In passing from Aeschylus' life to his work, we have obviously far more trustworthy data, in the seven extant plays (with the fragments of more than seventy others), and particularly in the invaluable help of Aristotle's *Poetics*. The real importance of our poet in the development of the drama (see DRAMA: *Greek*) as compared with any of his three or four known predecessors—who are at best hardly more than names to us—is shown by the fact that Aristotle, in his brief review of the rise of tragedy (*Poet*. iv. 13), names no one before Aeschylus. He recognizes, it is true, a long process of growth, with several stages, from the dithyramb to the drama; and it is not difficult to see what these stages were. The first step was the addition to the old choric song of an interlude spoken, and in early days *improvised*, by the leader of the chorus (*Poet*. iv. 12). The next was the introduction of an actor (ὑποκριτής or "answerer"), to reply to the leader; and thus we get dialogue added to recitation. The "answerer" was at first the poet himself (Ar. *Rhet*. iii. 1). This change is traditionally attributed to Thespis (536 B.C.), who is, however, not mentioned by Aristotle. The mask, to enable the actor to assume different parts, by whomsoever invented, was in regular use before Aeschylus' day. The third change was the enlarged range of subjects. The lyric dithyramb-tales were necessarily about Dionysus, and the interludes had, of course, to follow suit. Nothing in the world so tenaciously resists innovation as religious ceremony; and it is interesting to learn that the Athenian populace (then, as ever, eager for "some new thing") nevertheless opposed at first the introduction of other tales. But the innovators won; or otherwise there would have been no Attic drama.

In this way, then, to the original lyric song and dances in honour of Dionysus was added a spoken (but still metrical) interlude by the chorus-leader, and later a dialogue with one actor (at first the poet), whom the mask enabled to appear in more than one part.

But everything points to the fact that in the development of the drama Aeschylus was the decisive innovator. The two things that were important, when the 5th century began, if tragedy was to realize its possibilities, were (1) the disentanglement of the dialogue from its position as an interlude in an artistic and religious pageant that was primarily lyric; and (2) its general elevation of tone. Aeschylus, as we know on the express authority of Aristotle (*Poet*. iv. 13), achieved the first by the introduction of the second actor; and though he did not begin the second, he gave it the decisive impulse and consummation by the overwhelming effect of his serious thought, the stately splendour of his style, his high dramatic purpose, and the artistic grandeur and impressiveness of the construction and presentment of his tragedies.

As to the importance of the second actor no argument is needed. The essence of a play is dialogue; and a colloquy between the coryphaeus and a messenger (or, by aid of the mask, a series of messengers), as must have been the case when Aeschylus began, is in reality not dialogue in the dramatic sense at all, but rather narrative. The discussion, the persuasion, the instruction, the pleading, the contention—in short, the interacting personal influences of different characters on each other—are indispensable to anything that can be called a play, as we understand the word; and, without two "personae dramatis" at the least, the drama in the strict sense is clearly impossible. The number of actors was afterwards increased; but to Aeschylus are due the perception and the adoption of the essential step; and therefore, as was said above, he deserves in a very real sense to be called the founder of Athenian tragedy.

Of the seven extant plays, *Supplices*, *Persae*, *Septem contra Thebas*, *Prometheus*, *Agamemnon*, *Choephoroe* and *Eumenides*, five can fortunately be dated with certainty, as the archon's name is preserved in the Arguments; and the other two approximately. The dates rest, in the last resort, on the διδασκαλίαι, or the official records of the contests, of which we know that Aristotle (and others) compiled catalogues; and some actual fragments have been recovered. The order of the plays is probably that given above; and certainly the *Persae* was acted in 472, *Septem* in 467, and the last three, the trilogy, in 458. The *Supplices* is generally, though not unanimously, regarded as the oldest; and the best authorities tend to place it not far from 490. The early date is strongly confirmed by three things: the extreme simplicity of the plot, the choric (instead of dramatic) opening, and the fact that the percentage of lyric passages is 54, or the highest of all the seven plays. The chief doubt is in regard to *Prometheus*, which is variously placed by good authorities; but the very low percentage of lyrics (only 27, or roughly a quarter of the whole), and still more the strong characterization, a marked advance on anything in the first three plays, point to its being later than any except the trilogy, and suggest a date somewhere about 460, or perhaps a little earlier. A few comments on the extant plays will help to indicate the main points of Aeschylus' work.

Supplices.—The exceptional interest of the *Supplices* is due to its date. Being nearly twenty years earlier than any other extant play, it furnishes evidence of a stage in the evolution of Attic drama which would otherwise have been unrepresented. Genius, as Patin says, is a "puissance libre," and none more so than that of Aeschylus; but with all allowance for the "uncontrolled power" of this poet, we may feel confident that we have in the *Supplices* something resembling in general structure the lost works of Choerilus, Phrynichus, Pratinas and the 6th-century pioneers of drama.

The plot is briefly as follows: the fifty daughters of Danaus (who are the chorus), betrothed by the fiat of Aegyptus (their father's brother) to his fifty sons, flee with Danaus to Argos, to escape the marriage which they abhor. They claim the protection of the Argive king, Pelasgus, who is kind but timid; and he (by a pleasing anachronism) refers the matter to the people, who agree to protect the fugitives. The pursuing fleet of suitors is seen approaching; the herald arrives (with a company of followers), blusters, threatens, orders off the cowering Danaids to the ships and finally attempts to drag them away. Pelasgus interposes with a force, drives off the Egyptians and saves the suppliants. Danaus urges them to prayer, thanksgiving and maidenly modesty, and the grateful chorus pass away to the shelter offered by their protectors.

It is clear that we have here the drama in its nascent stage, just developing out of the lyric pageant from which it sprang. The interest still centres round the chorus, who are in fact the "protagonists" of the play. Character and plot—the two essentials of drama, in the view of all critics from Aristotle downwards—are both here rudimentary. There are some fluctuations of hope and fear; but the play is a single situation. The stages are: the appeal; the hesitation of the king, the resolve of the people; the defeat of insolent violence; and the rescue. It should not be forgotten, indeed, that the play is one of a trilogy—an act, therefore, rather than a complete drama. But we have only to compare it with those later plays of which the same is true, to see the difference. Even in a trilogy, each play is a complete whole in itself, though also a portion of a larger whole.

Persae.—The next play that has survived is the *Persae*, which has again a special interest, viz. that it is the only extant Greek historical drama. We know that Aeschylus' predecessor, Phrynichus, had already twice tried this experiment, with the *Capture of Miletus* and the *Phoenician Women*; that the latter play dealt with the same subject as the *Persae*, and the handling of its opening scene was imitated by the younger poet. The plot of the *Persae* is still severely simple, though more developed than that of the *Suppliants*. The opening is still lyric, and the first quarter of the play brings out, by song and speech, the anxiety of the people and queen as to the fate of Xerxes' huge army. Then comes the messenger with the news of Salamis, including a description of the sea-fight itself which can only be called magnificent. We realize what it must have been for the vast audience—30,000, according to Plato (*Symp.* 175 E)—to hear, eight years only after the event, from the supreme poet of Athens, who was himself a distinguished actor in the war, this thrilling narrative of the great battle. But this reflexion at once suggests another; it is not a tragedy in the true Greek sense, according to the practice of the 5th-century poets. It may be called in one point of view a tragedy, since the scene is laid in Persia, and the drama forcibly depicts the downfall of the Persian pride. But its real aim is not the "pity and terror" of the developed drama; it is the triumphant glorification of Athens, the exultation of the whole nation gathered in one place, over the ruin of their foe. This is best shown by the praise of Aeschylus' great admirer and defender Aristophanes, who (*Frogs*, 1026-1027) puts into the poet's mouth the boast that in the *Persae* he had "glorified a noble exploit, and taught men to be eager to conquer their foe."

Thus, both as an historic drama and in its real effect, the *Persae* was an experiment; and, as far as we know, the experiment was not repeated either by the author or his successors. One further point may be noted. Aeschylus always has a taste for the unseen and the supernatural; and one effective incident here is the raising of Darius's ghost, and his prophecy of the disastrous battle of Plataea. But in the ghost's revelations there is a mixture of audacity and naïveté, characteristic at once of the poet and the early youth of the drama. The dead Darius prophesies Plataea, but has not heard of Salamis; he gives a brief (and inaccurate) list of the Persian kings, which the queen and chorus, whom he addresses, presumably know; and his only practical suggestion, that the Persians should not again invade Greece, seems attainable without the aid of superhuman foresight.

Septem contra Thebas.—Five years later came the Theban Tragedy. It is not only, as Aristophanes says (*Frogs*, 1024), "a play full of the martial spirit," but is (like the *Supplices*) one of a connected series, dealing with the evil fate of the Theban House. But instead of being three acts of a single story like the *Supplices*, these three plays trace the fate through three generations, Laius, Oedipus and the two sons who die by each other's hands in the fight for the Theban sovereignty. This family fate, where one evil deed leads to another after many years, is a larger conception, strikingly suited to Aeschylus' genius, and constitutes a notable stage in the development of the Aeschylean drama. And just as here we have the tragedy of the Theban house, so in the last extant work, the *Oresteia*, the poet traces the tragedy of the Pelopid family, from Agamemnon's first sin to Orestes' vengeance and purification. And the names of several lost plays point to similar handling of the tragic trilogy.

The *Seven against Thebes* is the last play of its series; and again the plot is severely simple, not only in outline, but in detail. Father and grandfather have both perished miserably; and the two princes have quarrelled, both claiming the kingdom. Eteocles has driven out Polynices, who fled to Argos, gathered a host under seven leaders (himself being one), and when the play opens has begun the siege of his own city. The king appears, warns the people, chides the clamour of women, appoints seven Thebans, including himself, to defend the seven gates, departs to his post, meets his brother in battle and both are killed. The other six chieftains are all slain, and the enemy beaten off. The two dead princes are buried by their two sisters, who alone are left of the royal house.

Various signs of the early drama are here manifest. Half the play is lyric; there is no complication of plot; the whole action is recited by messengers; and the fatality whereby the predicted mutual slaughter of the princes is brought about is no accidental stroke of destiny, but the choice of the king Eteocles himself. On the other hand, the opening is no longer lyric (like the two earlier plays) but dramatic; the main scene, where the messenger reports at length the names of the seven assailants, and the king appoints the seven defenders, each man going off in silence to his post, must have been an impressive spectacle. One novelty should not be overlooked. There is here the first passage of *διάνοια*, or general reflexion of life, which later became a regular feature of tragedy. Eteocles muses on the fate which involves an innocent man in the company of the wicked so that he shares unjustly their deserved fate. The passage (*Theb.* 597-608) is interesting; and the whole part of Eteocles shows a new effort of the poet to draw character, which may have something to do with the rise of Sophocles, who in the year before (468) won with his first play, now lost, the prize of tragedy.

There remain only the *Prometheus* and the *Oresteia*, which show such marked advance that (it may almost be said) when we think of Aeschylus it is these four plays we have in mind.

Prometheus.—The Prometheus-trilogy consisted of three plays: *Prometheus the Fire-bringer*, *Prometheus Bound*, *Prometheus Unbound*. The two last necessarily came in that order; the *Fire-bringer* is probably the first, though recently it has been held by some scholars to be the last, of the trilogy. That Prometheus sinned against Zeus, by stealing fire from heaven; that he was punished by fearful tortures for ages; that he finally was reconciled to Zeus and set free,—all this was the ancient tale indisputably. Those who hold the *Fire-bringer* (Πυρφόρος) to be the final play, conjecture that it dealt with the establishment of the worship of Prometheus under that title, which is known to have existed at Athens. But the other order is on all grounds more probable; it keeps the natural sequence—crime, punishment, reconciliation, which is also the sequence in the *Oresteia*. And if the reconciliation was achieved in the second play, no scheme of action sufficing for the third drama seems even plausible.[1]

However that may be, the play that survives is a poem of unsurpassed force and impressiveness. Nevertheless, from the point of view of the development of drama, there seems at first sight little scope in the story for the normal human interest of a tragedy, since the actors are all divine, except Io, who is a distracted wanderer, victim of Zeus' cruelty; and between the opening where Prometheus is nailed to the Scythian rock, and the close where the earthquake engulfs the rock, the hero and the chorus, action in the ordinary sense is *ipso facto* impossible. This is just the opportunity for the poet's bold inventiveness and fine imagination. The tortured sufferer is visited by the Oceanic Nymphs, who float in, borne by an (imaginary) winged car, to console; Oceanus (riding a griffin, doubtless also imaginary) follows, kind but timid, to advise submission; then appears Io, victim of Zeus' love and Hera's jealousy, to whom Prometheus prophesies her future wanderings and his own fate; lastly Hermes, insolent messenger of the gods, who tries in vain to extort Prometheus' secret knowledge of the future. Oceanus, the well-meaning palavering old mentor, and Hermes, the blustering and futile jack-in-office, gods though they be, are vigorous, audacious and very human character-sketches; the soft entrance of the consoling nymphs is unspeakably beautiful; and the prophecy of Io's wanderings is a striking example of that new keen interest in the world outside which was felt by the Greeks of the 5th century, as it was felt by the Elizabethan English in a very similar epoch of national spirit and enterprise two thousand years later. Thus, though dramatic action is by the nature of the case impossible for the hero, the visitors provide real drama.

Another important point in the development of tragedy is what we may call the "balanced issue." The question in *Suppliants* is the protection of the threatened fugitives; in *Persae* the humiliation of overweening pride. So far the sympathy of the audience is not doubtful or divided. In the *Septem* there is an approach to conflict of feeling; the banished brother has a personal grievance, though guilty of the impious crime of attacking his own country. The sympathy must be for the defender Eteocles; but it is at least somewhat qualified by his injustice to his brother. In *Prometheus* the issue is more nearly balanced. The hero is both a victim and a rebel. He is punished for his benefits to man; but though Zeus is tyrannous and ungrateful, the hero's reckless defiance is shocking to Greek feeling. As the play goes on, this is subtly and delicately indicated by the attitude of the chorus. They enter overflowing with pity. They are slowly chilled and alienated by the hero's violence and impiety; but they nobly decline, at the last crisis, the mean advice of Hermes to desert Prometheus and save themselves; and in the final crash they share his fate.

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[1] The *Eumenides* is quoted as a parallel, because there the establishment of this worship at Athens concludes the whole trilogy; but it is forgotten that in *Eumenides* there is much besides—the pursuit of Orestes, the refuge at Athens, the trial, the acquittal, the conciliation by Athena of the Furies; while here the story would be finished before the last play began.

Oresteia.—The last and greatest work of Aeschylus is the *Oresteia*, which also has the interest of being the only complete trilogy preserved to us. It is a three-act drama of family fate, like the Oedipus-trilogy; and the acts are the sin, the revenge, the reconciliation, as in the Prometheus-trilogy. Again, as in *Prometheus*, the plot, at first sight, is such that the conditions of drama seem to exclude much development in character-drawing. The gods are everywhere at the root of the action. The inspired prophet, Calchas, has demanded the sacrifice of the king's daughter Iphigenia, to appease the offended Artemis. The inspired Cassandra, brought in as a spear-won slave from conquered Troy, reveals the murderous past of the Pelopid house, and the imminent slaughter of the king by his wife. Apollo orders the son, Orestes, to avenge his father by killing the murderess, and protects him when after the deed he takes sanctuary at Delphi. The Erinnyes (" Furies ") pursue him over land and sea; and at last Athena gives him shelter at Athens, summons an Athenian council to judge his guilt, and when the court is equally divided gives her casting vote for mercy. The last act ends with the reconciliation of Athena and the Furies; and the latter receive a shrine and worship at Athens, and promise favour and prosperity to the great city. The scope for human drama seems deliberately restricted, if not closed, by such a story so handled. Nevertheless, as a fact, the growth of characterization is, in spite of all, not only visible but remarkable. Clytemnestra is one of the most powerfully presented characters of the Greek drama. Her manly courage, her vindictive and unshaken purpose, her hardly hidden contempt for her tool and accomplice, Aegisthus, her cold scorn for the feebly vacillating elders, and her unflinching acceptance (in the second play) of inevitable fate, when she faces at last the avowed avenger, are all portrayed with matchless force—her very craft being scornfully assumed, as needful to her purpose, and contemptuously dropped when the purpose is served. And there is one other noticeable point. In this trilogy Aeschylus, for the first time, has attempted some touches of character in two of the humbler parts, the Watchman in *Agamemnon*, and the Nurse in the *Choephoroe*. The Watchman opens the play, and the vivid and almost humorous sententiousness of his language, his dark hints, his pregnant metaphors drawn from common speech, at once give a striking touch of realism, and form a pointed contrast to the terrible drama that impends. A very similar effect is produced at the crisis of the *Choephoroe* by the speech of the Nurse, who coming on a message to Aegisthus pours out to the chorus her sorrow at the reported death of Orestes and her fond memories of his babyhood—with the most homely details; and the most striking realistic touch is perhaps the broken structure and almost inconsequent utterance of the old faithful slave's speech. These two are veritable figures drawn from contemporary life; and though both appear only once, and are quite unimportant in the drama, the innovation is most significant, and especially as adopted by Aeschylus.

It remains to say a word on two more points, the religious ideas of Aeschylus and some of the main characteristics of his poetry.

Characteristics.

The religious aspect of the drama in one sense was prominent from the first, owing to its evolution from the choral celebration of the god Dionysus. But the new spirit imported by the genius of Aeschylus into the early drama was religious in a profounder meaning of the term. The sadness of human lot, the power and mysterious dealings of the gods, their terrible and inscrutable wrath and jealousy (ἄγα and *φθόνος*), their certain vengeance upon sinners, all the more fearful if delayed,—such are the poet's constant themes, delivered with stange solemnity and impressiveness in the lyric songs, especially in the *Oresteia*. And at times, particularly in the *Trilogy*, in his reference to the divine power of Zeus, he almost approaches a stern and sombre monotheism. " One God above all, who directs all, who is the cause of all " (*Ag.* 163, 1485); the watchfulness of this Power over human action (363-367), especially over the punishment of their sins; and the mysterious law whereby sin always begets new sin (*Ag.* 758-760):—these are ideas on which Aeschylus dwells in the *Agamemnon* with peculiar force, in a strain at once lofty and sombre. One specially noteworthy point in that play is his explicit repudiation of the common Hellenic view that prosperity brings ruin. In other places he seems to share the feeling; but here (*Ag.* 730) he goes deeper, and declares that it is not ὄλβος but always wickedness that brings about men's fall. All through there is a recurring note of *fear* in his view of man's destiny, expressed in vivid images—the " death that lurks behind the wall " (*Ag.* 1004), the " hidden reef which wrecks the bark, unable to weather the headland " (*Eum.* 561-565). In one remarkable passage of the *Eumenides* (517-525) this fear is extolled as a moral power which ought to be enthroned in men's hearts, to deter them from impious or violent acts, or from the pride that impels them to such sins.

Of the poetic qualities of Aeschylus' drama and diction, both in the lyrics and the dialogue, no adequate account can be attempted; the briefest word must here suffice. He is everywhere distinguished by grandeur and power of conception, presentation and expression, and most of all in the latest works, the *Prometheus* and the *Trilogy*. He is pre-eminent in depicting the slow approach of fear, as in the *Persae*; the imminent horror of impending fate, as in the broken cries and visions of Cassandra in the *Agamemnon* (1072-1177), the long lament and prayers to the nether powers in the *Choephoroe* (315-478), and the gradual rousing of the slumbering Furies in the *Eumenides* (117-139). The fatal end in these tragedies is foreseen; but the effect is due to its measured advance, to the slowly darkening suspense which no poet has more powerfully rendered. Again, he is a master of contrasts, especially of the Beautiful with the Tragic: as when the floating vision of consoling nymphs appears to the tortured Prometheus (115-135); or the unmatched lyrics which tell (in the *Agamemnon*, 228-247) of the death of Iphigenia; or the vision of his lost love that the night brings to Menelaus (410-426). And not least noticeable is the extraordinary range, force and imaginativeness of his diction. One example of his lyrics may be given which will illustrate more than one of these points. It is taken from the long lament in the *Septem*, sung by the chorus and the two sisters, while following the funeral procession of the two princes. These laments may at times be wearisome to the modern reader, who does not see, and imperfectly imagines, the stately and pathetic spectacle; but to the ancient feeling they were as solemn and impressive as they were ceremonially indispensable. The solemnity is here heightened by the following lines sung by one of the chorus of Theban women (*Sept.* 854-860):—

Nay, with the wafting gale of your sighs, my sisters,
Beat on your heads with your hands the stroke as of oars,
The stroke that passes ever across Acheron,
Speeding on its way the black-robed sacred bark,—
The bark Apollo comes not near,
The bark that is hidden from the sunlight—
To the shore of darkness that welcomes all!

AUTHORITIES.—The chief authority for the text is a single MS. at Florence, of the early 11th century, known as the Medicean or M., written by a professional scribe and revised by a contemporary scholar, who corrected the copyist's mistakes, added the scholia, the arguments and the dramatis personae of three plays (*Theb.*, *Agam.*, *Eum.*), and at the end the *Life of Aeschylus* and the *Catalogue* of his Dramas. The MS. has also been further corrected by later hands. In 1896 the Italian Ministry of Public Instruction publishd the MS. in photographic facsimile, with an instructive preface by Signor Rostagno. Besides M. there are some eight later MSS. (13th to 15th century), and numerous copies of the three select plays (*Sept.*, *Pers.*, *Prom.*) which were most read in the later Byzantine period, when Greek literature was reduced to gradually diminishing excerpts. These later MSS. are of little value or authority.

The editions, from the beginning of the 15th century to the present time, are very numerous, and the text has been further continuously improved by isolated suggestions from a host of scholars. The three first printed copies (Aldine, 1518; Turnebus and Robortello, 1552) give only those parts of *Agamemnon* found in M., from which MS. some leaves were lost; in 1557 the full text was restored by Vettori (Victorius) from later MSS. After these four, the chief editions of the seven plays were those of Schütz, Porson, Butler, Wellauer, Dindorf, Bothe, Ahrens, Paley, Hermann, Hartung, Weil, Merkel, Kirchhoff and Wecklein. Besides these, over a hundred scholars have thrown light on the corruptions or obscurities of the text, by editions of separate plays, by emendations, by special studies of the poet's work, or in other ways. Among recent writers who have made such contributions may be mentioned Wilamowitz-Moellendorf, Enger, Conington, Blaydes, Cobet, Meineke, Madvig, Ellis, W. Headlam, Davies, Tucker, Verrall and Haigh. The *Fragments* have been edited by Nauck and also by Wecklein. The Aeschylean staging is discussed in Albert Müller's *Lehrbuch der griechischen Buhnenalterthümer*; in "Die Bühne des Aeschylos," by Wilamowitz (*Hermes*, xxi.); in Smith's *Dict. of Antiquities*, art. "Theatrum" (R. C. Jebb); in Dörpfeld and Reisch (*Das griechische Theater*), Haigh's *Attic Theatre*, and Gardner and Jevons' *Manual of Greek Antiquities*. English Verse Translations: *Agamemnon*, Milman and R. Browning: *Oresteia*, *Suppliants*, *Persae*, *Seven against Thebes*, *Prometheus Vinctus*, by E. D. A. Morshead; *Prometheus*, E. B. Browning; the whole seven plays, Lewis Campbell. (A. Si.)

AESCULAPIUS (Gr. Ἀσκλήπιος), the legendary Greek god of medicine, the son of Apollo and the nymph Coronis. Tricca in Thessaly and Epidaurus in Argolis disputed the honour of his birthplace, but an oracle declared in favour of Epidaurus. He was educated by the centaur Cheiron, who taught him the art of healing and hunting. His skill in curing disease and restoring the dead to life aroused the anger of Zeus, who, being afraid that he might render all men immortal, slew him with a thunderbolt (Apollodorus iii. 10; Pindar, *Phthia*, 3; Diod. Sic. iv. 71). Homer mentions him as a skilful physician, whose sons, Machaon and Podalirius, are the physicians in the Greek camp before Troy (*Iliad*, ii. 731). Temples were erected to Aesculapius in many parts of Greece, near healing springs or on high mountains. The practice of sleeping (*incubatio*) in these sanctuaries was very common, it being supposed that the god effected cures or prescribed remedies to the sick in dreams. All who were healed offered sacrifice—especially a cock—and hung up votive tablets, on which were recorded their names, their diseases and the manner in which they had been cured. Many of these votive tablets have been discovered in the course of excavations at Epidaurus. Here was the god's most famous shrine, and games were celebrated in his honour every five years, accompanied by solemn processions. Herodas (*Mimes*, 4) gives a description of one of his temples, and of the offerings made to him. His worship was introduced into Rome by order of the Sibylline books (293 B.C.), to avert a pestilence. The god was fetched from Epidaurus in the form of a snake and a temple assigned him on the island in the Tiber (Livy x. 47; Ovid, *Metam.* xv. 622). Aesculapius was a favourite subject of ancient artists. He is commonly represented standing, dressed in a long cloak, with bare breast; his usual attribute is a club-like staff with a serpent (the symbol of renovation) coiled round it. He is often accompanied by Telesphorus, the boy genius of healing, and his daughter Hygieia, the goddess of health. Votive reliefs representing such groups have been found near the temple of Aesculapius at Athens. The British Museum possesses a beautiful head of Aesculapius (or possibly Zeus) from Melos, and the Louvre a magnificent statue.

AUTHORITIES.—L. Dyer, *The Gods in Greece* (1891); Jane E. Harrison, *Prolegomena to the Study of Greek Religion* (1903); R. Caton, *Temples and Ritual of A. at Epidaurus and Athens* (1900); articles in Pauly-Wissowa's *Real-Encyclopädie*, Roscher's *Lexikon der Mythologie*; T. Panofka, *Asklepios und die Asklepiaden* (1846); Alice Walton, "The Cult of Asklepios," in *Cornell Studies in Classical Philology*, iii. (New York, 1894); W. H. D. Rouse, *Greek Votive Offerings* (1902).

AESERNIA (mod. *Isernia*), a Samnite town on the road from Beneventum to Corfinium, 58 m. to the north-east of the former, at the junction of a road going past Venafrum to the Via Latina. These routes are all followed by modern railways—the lines to Campobasso, Sulmona and Caianello. A Roman colony was established there in 263 B.C. It became the headquarters of the Italian revolt after the loss of Corfinium, and was only recovered by Sulla at the end of the war, in 80 B.C. Remains of its fortifications are still preserved—massive cyclopean walls, which serve as foundation to the walls of the modern town and of a Roman bridge, and the subterranean channel of an aqueduct, cut in the rock, and dating from Roman times.

AESOP (Gr. Αἴσωπος), famous for his *Fables*, is supposed to have lived from about 620 to 560 B.C. The place of his birth is uncertain—Thrace, Phrygia, Aethiopia, Samos, Athens and Sardis all claiming the honour. We possess little trustworthy information concerning his life, except that he was the slave of Iadmon of Samos and met with a violent death at the hands of the inhabitants of Delphi. A pestilence that ensued being attributed to this crime, the Delphians declared their willingness to make compensation, which, in default of a nearer connexion, was claimed and received by Iadmon, the grandson of his old master. Herodotus, who is our authority for this (ii. 134), does not state the cause of his death; various reasons are assigned by later writers—his insulting sarcasms, the embezzlement of money entrusted to him by Croesus for distribution at Delphi, the theft of a silver cup.

Aesop must have received his freedom from Iadmon, or he could not have conducted the public defence of a certain Samian demagogue (Aristotle, *Rhetoric*, ii. 20). According to the story, he subsequently lived at the court of Croesus, where he met Solon, and dined in the company of the Seven Sages of Greece with Periander at Corinth. During the reign of Peisistratus he is said to have visited Athens, on which occasion he related the fable of *The Frogs asking for a King*, to dissuade the citizens from attempting to exchange Peisistratus for another ruler. The popular stories current regarding him are derived from a life, or rather romance, prefixed to a book of fables, purporting to be his, collected by Maximus Planudes, a monk of the 14th century. In this he is described as a monster of ugliness and deformity, as he is also represented in a well-known marble figure in the Villa Albani at Rome. That this life, however, was in existence a century before Planudes, appears from a 13th-century MS. of it found at Florence. In Plutarch's *Symposium of the Seven Sages*, at which Aesop is a guest, there are many jests on his original servile condition, but nothing derogatory is said about his personal appearance. We are further told that the Athenians erected in his honour a noble statue by the famous sculptor Lysippus, which furnishes a strong argument against the fiction of his deformity. Lastly, the obscurity in which the history of Aesop is involved has induced some scholars to deny his existence altogether.

It is probable that Aesop did not commit his fables to writing; Aristophanes (*Wasps*, 1259) represents Philocleon as having learnt the "absurdities" of Aesop from conversation at banquets, and Socrates whiles away his time in prison by turning some of Aesop's fables "which he knew" into verse (Plato, *Phaedo*, 61 b). Demetrius of Phalerum (345–283 B.C.) made a collection in ten books, probably in prose (Λόλων Αἰσωπείων συναγωγαί) for the use of orators, which has been lost. Next appeared an edition in elegiac verse, often cited by Suidas, but the author's name is unknown. Babrius, according to Crusius, a Roman and tutor to the son of Alexander Severus, turned the fables into choliambics in the earlier part of the 3rd century A.D. The most celebrated of the Latin adapters is Phaedrus, a freedman of Augustus. Avianus (of uncertain date, perhaps the 4th century) translated 42 of the fables into Latin elegiacs. The collections which we possess under the name of *Aesop's Fables* are late renderings of Babrius's version or Προγυμνάσματα, rhetorical exercises of varying age and merit. Syntipas translated Babrius into Syriac, and Andreopulos put the Syriac back again into Greek. Ignatius Diaconus, in the 9th century, made a version of 53 fables in choliambic tetrameters. Stories from Oriental sources were added, and from these collections Maximus Planudes made and edited the collection which has come down to us under the name of Aesop, and from which the popular fables of modern Europe have been derived.

For further information see the article FABLE; Bentley, *Dissertation on the Fables of Aesop*; Du Méril, *Poésies inédites du moyen âge* (1854); J. Jacobs, *The Fables of Aesop* (1889): i. The history of the Aesopic fable; ii. The Fables of Aesop, as first printed by William Caxton, 1484, from his French translation; Hervieux, *Les Fabulistes Latins* (1893–1899).

Before any Greek text appeared, a Latin translation of 100 *Fabulae Aesopicae* by an Italian scholar named Ranuzio (Renutius) was published at Rome, 1476. About 1480 the collection of Planudes was brought out at Milan by Buono Accorso (Accursius), together with Ranuzio's translation. This edition, which contained 144 fables, was frequently reprinted and additions made from time to time from various MSS.—the Heidelberg (Palatine), Florentine, Vatican and Augsburg—by Stephanus (1547), Nevelet (1610), Hudson (1718), Hauptmann (1741), Furia (1810), Coray (1810), Schneider (1812) and others. A critical edition of all the previously known fables, prepared by Carl von Halm from the collections of Furia, Coray and Schneider, was published in the Teubner series of Greek and Latin texts. A *Fabularum Aesopicarum sylloge* (233 in number) from a Paris MS., with critical notes by Sternbach, appeared in a Cracow University publication, *Rosprawy akademii umiejetnosci* (1894).

AESOPUS, a Greek historian who wrote a history of Alexander the Great, a Latin translation of which, by Julius Valerius, was discovered by Mai in 1816.

AESOPUS, CLODIUS, the most eminent Roman tragedian, flourished during the time of Cicero, but the dates of his birth and death are not known. The name seems to show that he was a freedman of some member of the Clodian gens. Cicero was on friendly terms with both him and Roscius, the equally distinguished comedian, and did not disdain to profit by their instruction. Plutarch (*Cicero*, 5) mentions it as reported of Aesopus, that, while representing Atreus deliberating how he should revenge himself on Thyestes, the actor forgot himself so far in the heat of action that with his truncheon he struck and killed one of the servants crossing the stage. Aesopus made a last appearance in 55 B.C.—when Cicero tells us that he was advanced in years—on the occasion of the splendid games given by Pompey at the dedication of his theatre. In spite of his somewhat extravagant living, he left an ample fortune to his spendthrift son, who did his best to squander it as soon as possible. Horace (*Sat.* iii. 3. 239) mentions his taking a pearl from the ear-drop of Caecilia Metella and dissolving it in vinegar, that he might have the satisfaction of swallowing eight thousand pounds' worth at a draught.

Cicero, *De Divinatione*, i. 37; *pro Sestio*, 56, 58; Quint., *Instit.* xi. 3, 111; Macrobius, *Sat.* iii. 14.

Preliminary definition.

AESTHETICS, a branch of study variously defined as the philosophy or science of the beautiful, of taste or of the fine arts. The name is something of an accident. In its original Greek form (*αἰσθητικός*) it means what has to do with sense-perception as a source of knowledge; and this is still its meaning in Kant's philosophy ("Transcendental Aesthetic"). Its limitation to that function of sensuous perception which we know as the contemplative enjoyment of beauty is due to A. G. Baumgarten. Although the subject does not readily lend itself to precise definition at the outset, we may indicate its scope and aim, as understood by recent writers, by saying that it deals successively with one great department of human experience, viz. the pleasurable activities of pure contemplation. By pure contemplation is here understood that manner of regarding objects of sense-perception, and more particularly sights and sounds, which is entirely motived by the pleasure of the act itself. The term "object" means whatever can be perceived through one of the senses, *e.g.* a flower, a landscape, the flight of a bird, a sequence of tones. The contemplation may be *immediate* when (as mostly happens) the object is present to sense; or it may be *mediate*, when as in reading poetry we dwell on images of objects of sense. Whenever we become interested in an object merely as presented for our contemplation our whole state of mind may be described as an aesthetic attitude, and our experience as an aesthetic experience. Other expressions such as the pleasure of taste, the enjoyment and appreciation of beauty (in the larger sense of this term), will serve less precisely to mark off this department of experience.

Differentiation of aesthetic experience. Its characteristics as feeling.

Aesthetic experience is differentiated from other kinds of experience by a number of characteristics. We commonly speak of it as enjoyment, as an exercise and cultivation of feeling. The appreciation of beauty is pervaded and sustained by pleasurable feeling. In aesthetic enjoyment our capacities of feeling attain their fullest and most perfect development. Yet, as its dependence on a quiet attitude of contemplation might tell us, aesthetic experience is characterized by a certain degree of calmness and moderation of feeling. Even when we are moved by a tragedy our feeling is comparatively restrained. A rare exhibition of beauty may thrill the soul for a moment, yet in general the enjoyment of it is far removed from the excitement of passion. On the other hand, aesthetic pleasure is pure enjoyment. Even when a disagreeable element is present, as in a musical dissonance or in the suffering of a tragic hero, it contributes to a higher measure of enjoyment. It is, moreover, free from the painful elements of craving, fatigue, conflict, anxiety and disappointment, which are apt to accompany other kinds of enjoyment; such as the satisfaction of the appetites and other needs. To this purity of aesthetic pleasure must be added its refinement, which implies not merely a certain remoteness from the bodily needs, but the effect of a union of sense and mind in giving amplitude as well as delicacy to our enjoyment of beauty. As the region of most pure and refined feeling, aesthetic experience is clearly marked off from practical life, with its urgent desires and the rest. In aesthetic contemplation desire and will as a whole are almost dormant. This detachment from the daily life of practical needs and aims is brought out in Kant's postulate that aesthetic enjoyment must be disinterested ("ohne Interesse"), that when we regard an object aesthetically we are not in the least concerned with its practical significance and value: one cannot, for example, at the same moment aesthetically enjoy looking at a painting and desire to be its possessor. In like manner, even if less apparently, aesthetic contemplation is marked off from the arduous mental work which enters into the pursuit of knowledge. In contemplating an aesthetic object we are mentally occupied with the *concrete*, whereas all the more serious intellectual work of science involves the difficulties of the *abstract*. The contemplation is, moreover, free from those restraints which are imposed on our mental activity by the desire to obtain knowledge.

Marked off from practical activity, also from intellectual activity.

Uniformity of aesthetic experience.

While as the highest phase of feeling aesthetic experience appears to belong to our subjective life, the hidden region of the soul, it is connected just as clearly, through the act of sense-perception, with the world of objects which is our common possession. Being thus dependent on a contemplation of things in this common world it raises the question whether, like the perception of these objects, it is a uniform experience, the same for others as for myself. We touch here on the last characteristic of aesthetic experience which needs to be noted at this stage, its uniformity or subjection to law. It is a common idea that men's judgments about matters of taste disagree to so large an extent that each individual is left very much to his subjective impressions. With regard to many of the subtler matters of aesthetic appreciation, at any rate, there is undoubtedly on a first view the appearance of a want of agreement. Contrasted with logical judgments or even with ethical ones, aesthetic judgments may no doubt look uncertain and "subjective." The proposition "this tree is a birch" seems to lend itself much better to critical discussion and to general acceptance or rejection than the proposition "this tree is beautiful." This circumstance, as Kant shrewdly suggests, helps to explain why we have come to employ the word "taste" in dealing with aesthetic matters; for the pronouncements of the sense of taste are recognized as among the most uncertain and "subjective" of our sense-impressions. Yet viewed as a species of pleasurable feelings, aesthetic experiences will be found to exhibit a large amount of uniformity, of objective agreement as between different experiences of the same person and experiences of different persons. This general agreement appears to be clearly implied in the ordinary form of our aesthetic judgments. To say "this rose is beautiful" means more than to say "the sight of this rose affects

The aesthetic judgment.

Logical judgment and judgment of value.

me agreeably.” It means that the rose has a general power of so affecting me (at different times) and others as well. The judgment is not the same as a logical one. It does not say or imply that as a matter of fact it always does please—even if we add the limitation, those who possess the sensibilities and the taste presupposed; for, as we know, our varying mood and state of receptivity make a profound difference in the fulness of the aesthetic enjoyment. It is a “ judgment of value ” which claims for the rose aesthetic rank as an object properly qualified to please contemplative subjects. This value, it is plain, is relative to conscious subjects; yet since it is relative to *all* competent ones, it may be regarded as “ objective ”—that is to say, as belonging to the object.[1]

Late development of the science.

This slight preliminary inspection of the subject will prepare one for the circumstance that the scientific treatment of it has begun late, and is even now far from being complete. This slowness of development is in part explained by the detachment of aesthetic experience from the urgent needs of life. In a comparatively early stage of human progress some thought had to be bestowed on such pressing problems as to how to cope with the forces of nature and to turn them to useful account; how to secure in human communities obedience to custom and law. But the problem of throwing light on our aesthetic pleasures had no such urgency.[2] To this it must be added that aesthetic experience (in all but its simpler and cruder forms) has been, and still is confined to a small number of persons; so that the subject does not appeal to a wide popular interest; while, on the other hand, the subjects of this experience not infrequently have a strong sentimental dislike to the idea of introducing into the region of refined feeling the cold light of scientific investigation. Lastly, there are special difficulties inherent in the subject. One serious obstacle to a scientific theory of aesthetic experience is the illusive character of many of its finer elements—for example, the subtle differences of feeling-tone—produced by the several colours as well as by their several tones and shades, by the several musical intervals, and so forth. Finally, there is the circumstance just touched on that much of this region of experience, instead of at once disclosing uniformity, seems to be rather the abode of caprice and uncertainty. The variations in taste at different levels of culture, among different races and nations and among the individual members of the same community are numerous and striking, and might at first seem to bar the way to a scientific treatment of the subject. These considerations suggest that an adequate theory of aesthetic experience could only be attempted after the requisite scientific skill had been developed in other and more pressing departments of inquiry.

Inadequate theories of subject.

If we glance at the modes of treating the subject up to a quite recent date we find but little of serious effort to apply to it a strictly scientific method of investigation. The whole extent of concrete experience has not been adequately recognized, still less adequately examined. For the greater part thinkers have been in haste to reach some simple formula of beauty which might seem to cover the more obvious facts. This has commonly been derived deductively from some more comprehensive idea of experience or human life as a whole. Thus in German treatises on aesthetics which have been largely thought out under the influence of philosophic idealism the beautiful is subsumed under the idea, of which it is regarded as one special manifestation, and its place in human experience has been determined by defining its logical relations to the other great co-ordinate concepts, the good and the true. These attempts to reach a general conception of beauty have often led to one-sidedness of view. And this one-sidedness has sometimes characterized the theories of those who, like Alison, have made a wider survey of aesthetic facts.

Aesthetics as normative science.

Aesthetics not a practical science.

Aesthetics, like Ethics, is a Normative Science, that is to say, concerned with determining the nature of a species of the desirable or the good (in the large sense). It seeks one or more regulative principles which may help us to distinguish a real from an apparent aesthetic value, and to set the higher and more perfect illustrations of beauty above the lower and less perfect. As a science it will seek to realize its normative function by the aid of a patient, methodical investigation of facts, and by processes of observation, analysis and induction similar to those carried out in the natural sciences. In speaking of aesthetics as a normative science we do not mean that it is a practical one in the sense that it supplies practical rules which may serve as definite guidance for the artist and the lover of beauty, in their particular problems of selecting and arranging elements of aesthetic value. It is no more a practical science than logic. The supposition that it is so is probably favoured by the idea that aesthetic theory has art for its special subject. But this is to confuse a general aesthetic theory—what the Germans call “ General Aesthetics ”—with a theory of art (Kunstwissenschaft). The former, with which we are here concerned, has to examine aesthetic experience as a whole; which, as we shall presently see, includes more than the enjoyment and appreciation of art.

Problems of the science.

Is beauty a single quality in objects?

Beauty not a physical quality.

We may now indicate with more fulness the main problems of our science, seeking to give them as precise a form as possible. At the outset we are confronted with an old and almost baffling question: “ Is beauty a single quality inherent in objects of perception like form or colour?” Common language certainly suggests that it is. Aesthetics, too, began its inquiry at the same point of view, and its history shows how much pains men have taken in trying to determine the nature of this attribute, as well as that of the faculty of the soul by which it is perceived. Yet a little examination of the facts suffices to show that the theory is beset with serious difficulties. Whatever beauty may be it is certainly not a quality of an object in the same way in which the colour or the form of it is a quality. These are physical qualities, known to us by specific modifications of our sensations. The beauty of a rose or of a peach is clearly not a physical quality. Nor do we in attributing beauty to some particular quality in an object, say colour, conceive of it as a phase of this quality, like depth or brilliance of colour, which, again, is known by a special modification of the sensations of colour. Hence we must say that beauty, though undoubtedly referred to a physical object, is extraneous to the group of qualities which makes it a physical object.

Beauty attributed to different qualities in objects.

Formalists and expressionalists.

Beauty is frequently attributed to a concrete object as a whole—to a flower or shell, for example, as a visible whole. Our everyday aesthetic judgments are wont to leave the attributes thus vaguely referred to the concrete object. Yet it is equally certain that we not infrequently speak of the beauty of some definable aspect or quality of an object, as when we pronounce the contour of a mountain or of a vase to be beautiful. And it may be asked whether, in thus localizing beauty, so to speak, in one of the constituent qualities of an object, we always place it in the same quality. A mere glance at the facts will suffice to convince us that we do not. We call the façade of a Greek temple beautiful with special reference to its admirable form; whereas in predicating beauty of the ruin of a Norman castle we refer rather to what the ruin means—to the effect of an imagination of its past proud strength and slow vanquishment by the unrelenting strokes of time. This fact that beauty appertains now more to one quality, now more to another, helps us to understand why certain theorists, known as formalists, regard all beauty as formal or residing in *form*, whereas others, the idealists or expressionalists, view it as residing in ideal content or *expression*. These theories, however, like other attempts to find an adequate single principle of beauty, are unsatisfactory. Form and ideal content are each a great source of aesthetic enjoyment, and either can be found in a degree of supremacy which practically renders the co-operation of the other unimportant. The two buildings cited above, two human faces, two musical compositions, may exhibit in an impressive and engrossing way the beauty of form and of expression respectively. Nor is this all. Beauty refuses to be confined even to these two. There are the various beauties of colour, for example, as exhibited in such familiar phenomena of nature as sea and sky, autumn moors and woods. A slight analysis of the constituents of objects to which we attribute beauty shows that there are at least three distinct modes of this attribute, namely (1) sensuous beauty, (2) beauty of form and (3) beauty of meaning or expression, nor do these appear to be reducible to any higher or more comprehensive principle. It requires a certain boldness to attempt to effect a *rapprochement* between the formal and the expressional factor.[1] An apparent unification of the three seems at present only possible by substituting for beauty another concept at least equally vague, such as perfection,[2] which seems to imply the idea of purposiveness, and to apply clearly only to certain domains of beauty, *e.g.* organic form.

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[1] See below for Kant's view of the aesthetic judgment, as having subjective universal validity. On the meaning of judgments of value see J. Cohn, *Allgem. Ästhetik*, Einleitung, pp. 7 ff., and Teil i., Kap. 2 and 3.

[2] Cf. Ladd, *Introduction to Philosophy*, pp. 330, 331.

Three ultimate modes of beauty.

We may now take another step and say that beauty appears to be a quality in objects which is not sharply differentiated from other and allied qualities. If we look at the usages of speech we shall find that beauty has its kindred conceptions, such as gracefulness, prettiness and others. Writers on aesthetics have spent much time on these "Modifications of the Beautiful." The point emphasized here is the difficulty of drawing the line between them. Even an expert may hesitate long before saying whether a human face, a flower or a cameo should be called beautiful or pretty. Must we postulate as many allied qualities as there are names for these pleasing aspects of objects? Or must we do violence to usage and so stretch the word "Beauty" as to make it cover all qualities or aspects of objects which have aesthetic value, including those "modifications of the beautiful" which we know as the sublime, the comic and the rest? But the wider we try in this way to make the denotation of the term the vaguer grows the connotation. We are thus left equally incapable of saying what the quality is, and in which aspect or attribute of the object it inheres.[3]

Beauty and allied conceptions.

It seems to follow that in constructing a scientific theory we do well to dispense with the assumption of an objective quality of beauty. Aesthetics will return to Kant and confine itself to the examination of objects called beautiful in their relation to, and in their manner of affecting our minds.[4] The aesthetic value of such an object will be viewed as consisting in the possession of certain assignable characteristics by means of which it is fitted to affect us in a certain desirable way, to draw us into the enjoyable mood of aesthetic contemplation. These characteristics may conveniently be called aesthetic qualities.[5] Objects which are found to possess one or more of these qualities in the required degree of fulness claim a certain aesthetic value, even though they fall short of being "beautiful," in the more exacting use of this word. They are *in the direction*—"im Sinne," as Fechner says—of beauty, conceived as something fuller and richer, answering to a higher standard of aesthetic enjoyment and a severer demand on our part. The word "beauty" may still be used occasionally, where no ambiguity arises, as a convenient expression for aesthetic value in all its degrees. Yet it is better to keep the term applicable to the objects commonly denoted by it by making it represent the fuller aesthetic satisfactions which flow from a rare and commanding exhibition of one or more of these qualities, from what may be described as an appreciable excellence of aesthetic quality.

Assumption of objective quality of beauty dispensed with.

Aesthetic qualities.

By thus dispensing with the concept of beauty as some occult undefinable quality, we get rid of much of the contradiction which appears to inhere in our aesthetic experience. For example, a bit of brilliant colour in a bonnet which pleases the wearer but offends her superior in aesthetic matters takes its place as something which *per se* has a certain degree of aesthetic value even though the particular relations into which it has now thrust itself, palpable to the trained eye, may practically rob it of its value. In thus substituting the relative idea of aesthetic value for the absolute idea of beauty we may no doubt seem to be destroying the reality of the object of aesthetic perception. This point may more conveniently be taken up later when we consider the whole question of aesthetic illusion.

This new way of envisaging aesthetic objects requires us to make the study of their effect a prominent part of our investigation. In all the valuable recent work on the subject, attention has been largely concentrated on this effect. More particularly we have to investigate and illumine scientifically the pleasurable side of the experience. In doing this we shall make use of all the light we can obtain from a study of known laws of pleasure. Thus we shall avail ourselves not only of the theory of the pleasure-tones of sensation but of that of the conditions of an agreeable exercise of the attention upon objects, more particularly of the characteristics of objects which adequately stimulate the attention without confusing or burdening it. Yet this does not require that we should treat the aesthetic problem as a part of the more general science of pleasure, as has been attempted by some, *e.g.* Grant Allen (*Physiological Aesthetics*) and Rutgers Marshall (*Pain, Pleasure and Aesthetics*, and *Aesthetic Principles*). To do so would be to run the risk of considering only the more general aspects and conditions of aesthetic enjoyment, whereas what we need is a theory of it as a specific kind of pleasurable experience. What is required at the present stage of development of the science is a deeper investigation of the aesthetic attitude of mind as a whole, of what we may call the aesthetic psychosis. We need to probe the act of contemplation itself, the mode of activity of attention involved in this calm, half-dreamlike gazing on the mere look of things unconcerned with their ordinary and weightier imports. We need further to determine the effect of this contemplative attitude upon the several mental processes involved, the act of perception itself, with its grasp of manifold relations, the flow of ideas, the partial resurgence and transformation of emotion. In examining these effects we must keep in view the double side of the contemplative attitude, the wide range of free movement which perception and imagination claim and enjoy, and the willing subjection of the contemplative mind to the spell of the object. A deeper inspection of the contemplative mood may be expected to render clearer the difference between the mental activity employed in aesthetic perception and imagination and intellectual activity proper; between, say, the differencing of allied tints involved in the finer aesthetic enjoyment of colour and the sharper, clearer discrimination of tints required in scientific observation, and between such a grasp of relations as is required for a just appreciation of beautiful form and that severe analysis and measurement of formal elements and their relations which is insisted upon by science. As a result of a finer distinction here we may probably be in a better position to determine the point—touched on more than once in recent works on aesthetics—how far intellectual pleasure proper, *e.g.* that of recognizing and classifying objects, enters as a subordinate element into aesthetic enjoyment.

Problem of aesthetic effect.

Aesthetics and laws of pleasure.

Problem of aesthetic enjoyment a special one.

The attitude of aesthetic contemplation.

Intellectual and aesthetic activity further differentiated.

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[1] For example, that hinted at by Bosanquet in his definition of the beautiful, *History of Aesthetic*, p. 5.

[2] Beauty is defined as Perfection by P. Souriau, *La Beauté rationnelle*, 2me partie.

[3] K. Groos argues well against this violent stretching of the word beautiful, *Einleitung in die Ästhetik*, pp. 46 seq.

[4] Kant, in developing his idea of beauty as subjective, was probably influenced by Hume, who wrote: "Beauty is no quality in things themselves; it exists merely in the mind which contemplates them" (*Essays*, xxii.).

[5] On the nature of these qualities see S. Witasek, *Grundsüge der allgem. Ästhetik*, p. 11.

Is aesthetic enjoyment essentially social?

One point in the characterization of aesthetic experience has been reserved, namely, the question whether it is essentially a form of *social* enjoyment. No one doubts that a man often enjoys beauty, *e.g.* that of a landscape, when alone; yet at such a moment he not only recognizes that his pleasure is a possible one for others, but is probably aware of a sub-conscious wish that others were present to share his enjoyment. Kant went so far as to say that on a desert island a man would adorn neither his hut nor his person. However this be, it seems certain that as a rule we tend to indulge our aesthetic tastes in company with others. This habit of making aesthetic enjoyment a social experience would in itself tend to develop the sympathies and the sympathetic intelligence and thus to promote exchanges of aesthetic experience. The content, too, of our aesthetic experiences would be favourable to such conjoint acts of aesthetic contemplation, and to the mutual sharing of aesthetic experiences; for, as disinterested and universal modes of enjoyment detached from personal interests, they are clearly free from the egoistic exclusiveness which characterizes our private enjoyments which at best can only be participated in by one or two closely attached friends. Our aesthetic enjoyments are thus eminently fitted to be social ones; and as such they become greatly amplified by sympathetic resonance.

The aesthetic senses.

Aesthetic claims of touch.

We are now in a position to consider a point much discussed of late, namely, the special connexion of aesthetic enjoyment with the two senses, sight and hearing. Two questions arise here: (1) Do the other and "lower" senses take any part in aesthetic experience? (2) What are the characteristics which give the predominance to the two "higher" ones? With regard to the first it is coming to be recognized that aesthetic pleasure is not strictly confined to the two senses in question. Common language suggests that we find in certain odours and even in certain flavours a value analogous to that implied in calling an object beautiful. Hegel excluded the other senses—even touch—on the ground that aesthetics had to do only with art, in which there was no place for perceptions of touch. A closer examination has shown that this important sense plays a considerable part in art-effects. And even if this were not so, Hegel's exclusion of touch from the rank of aesthetic senses would be a striking illustration of the narrowing effect on scientific theory of the identification of aesthetic objects with productions of art. To say that the experience of exploring with the fingers a velvety petal or the smooth surface of a sea-rounded pebble has no aesthetic element savours of a perverse arbitrariness. Touch is no doubt wanting in a prerogative of hearing and sight which we shall presently see to be important, namely, that being acted on by objects at a distance they admit of a simultaneous perception by a number of persons—as indeed even the sense of smell does in a measure. This is probably the chief reason why, according to certain testimony, the blind receive but little aesthetic enjoyment from tactual experience.[1] Yet this drawback is compensated to some extent by the fact that agreeable tactual experience may be taken up as suggested meaning into our visual perceptions.

Prerogatives of sight and hearing.

The two privileged senses, sight and hearing, owe their superiority to a number of considerations. They are the farthest removed from the necessary life functions, with the pressing needs and disturbing cravings which belong to these. Even touch, though important as a source of knowledge, has for its primary function to examine the things which approach our organisms in their relation to this as injurious or harmless. The two higher senses present to us material objects in their least aggressive and menacing manner: visible forms and colours, tones and their combinations, appear when compared with objects felt to be in contact with our body, to be rather semblances or distant signs of material realities than these realities themselves; and this circumstance fits these senses to be in a special way the organs of aesthetic perception with its calm, dreamlike detachment and its enjoyable freedom of movement. They are, moreover, the two senses by the use of which a number of persons may join most perfectly in a common act of aesthetic contemplation. This distinction strengthens their claims to be in a special manner the aesthetic senses, and this for a double reason. (1) It makes them sense-avenues by which each of us obtains the most immediate and most impressive conviction that aesthetic experience is a common possession of the many, and is largely similar in the case of different individuals. (2) It marks them off as the senses by the exercise of which perceptual enjoyment may most readily and certainly be increased through the resonant effects of sympathy. The experiences of the theatre and of the concert-hall sufficiently illustrate these distinguishing functions of the two senses. Other distinguishing prerogatives of sight and hearing flow from the characteristics of their sensations and perceptions, a point to be touched on later.[2]

Aesthetic activity and play. (a) Points of affinity between them.

(b) Points of difference.

Our determination of the characteristics of the aesthetic attitude has now been carried far enough to enable us to consider another point much discussed in recent aesthetic literature, viz. the relation of this attitude to that of Play. The affinities of the two are striking and are disclosed in everyday language, as when we speak of the "play" of imagination or of "playing" on a musical instrument. Both play and aesthetic contemplation are activities which are controlled by no extraneous end, which run on freely directed only by the intrinsic delight of the activity. Hence they both contrast with the serious work imposed on us and controlled by what we mark off as the necessities of life, such as providing for bodily wants, or rearing a family. They each add a sort of luxurious fringe to life. In aesthetic enjoyment our senses, our intelligence and our emotions are alike released from the constraint of these necessary ends, and may be said to refresh themselves in a kind of play. Finally, they are both characterized by a strong infusion of make-believe, a disposition to substitute productions of the imagination for everyday realities. In this respect, again, they form a contrast to that serious concern with fact and practical truth which the necessary aims of life impose on us. Little wonder, then, that Plato recognized in the contrast between the representative and the useful arts an analogy between play and earnest,[3] and that since the time of Schiller so much use has been made of the analogy in aesthetic works. Yet though similar, the two kinds of activity are distinguishable in important respects. For one thing, aesthetic contemplation pure and simple is a comparatively tranquil and passive attitude, whereas play means doing something and commonly involves some amount of strenuous exertion, either of body or of mind. A closer analogy might be drawn between play and artistic production. Yet even when the parallel is thus narrowed, pretty obvious differences disclose themselves. It is only in their more primitive phases that the two attitudes exhibit a close similarity. As they develop, striking divergences begin to appear. The play mood, instead of approaching the calm contemplative mood of the lover of beauty, involves feelings and impulses which lie at the roots of our practical interests, viz. ambition, rivalry and struggle. It has, moreover, in all its stages a palpable utility—even though this is not realized by the player—serving for the exercise and development of body, intelligence and character. Beauty and art rise high above play in purity of the disinterested attitude, in placid detachment from the serviceable and the necessary, and, still more, in range and variety of refined interest, comprehended in "the love of beauty." Finally, aesthetic activities are directed by ideal conceptions and standards to which hardly anything corresponds in play save where games of skill take on something of the dignity of a fine art.[1]

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[1] See J. Cohn, *Allgem. Ästhetik*, p. 95.

[2] Originally, as pointed out by Home and others, sight was regarded as the sense by which we received impressions of beauty. Yet the recognition of the claims of hearing date back to Plato. (See Bosanquet, *Hist. of Aesth.* pp. 51-52). For recent discussions of the claims of sight and hearing see article by J. Volkelt, "Der Aesth. Werth der niederen Sinne," in *Zeitschrift für Psych. u. Phys. der Sinnesorgane*, vol. xxix. pp. 402 ff.; see also below, *Bibliography.*

[3] *Laws*, 889 (see Bosanquet, *op. cit.* p. 54).

Methods of research in aesthetics.

So far as to the preliminary delimiting work in aesthetic science. Only a bare indication can be made as to the methods of research by which its advance can be furthered, and as to the several directions of inquiry which it will have to follow. With regard to the former the method of investigation will consist in a careful inquiry into two orders of fact: (1) Objects which common testimony or the history of art show to be widely recognized objects of aesthetic value; (2) records of the aesthetic experience of individuals, whether artists or amateurs.

Examination of aesthetic objects.

Nature as supplying aesthetic objects.

Since aesthetic experience is brought about and its modes determined by objects possessing certain qualities, it seems evident that scientific aesthetics must make an examination and comparison of these a fundamental part of its problem. These objects will, as already hinted, include both natural ones in the inorganic and organic worlds, and works of art which can be shown to be objects of general or widely recognized aesthetic value. Without attempting here to discuss adequately the relation of natural beauty to that of art we may note one or two points. Some contemplation and appreciation of the beautiful aspects of nature is not only prior in time to art, but is a condition of its genesis. The enjoyment of the pleasing aspects of land and sea, of mountain and dale, of the innumerable organic forms, has steadily grown with the development of culture; and this growth, though undoubtedly aided by that of the feeling for art—especially painting and poetry—is to a large extent independent of it.[2] Some of the finest insight into the secrets of beauty has been gained by those who had only a limited acquaintance with art. What is still more important in the present connexion is that the aesthetic experience gained by the direct contemplation of nature includes varieties which art cannot reproduce. It is enough to recall what Helmholtz and others have told us about the limitations of the powers of pictorial art to represent the more brilliant degrees of light; the admissions of painters themselves as to the limits of their art when it seeks to render the finer gradations of light and colour in such common objects as a tree-trunk or a bit of old wall. Nature, moreover, in spreading out her spaces of earth, sea and sky, and in exhibiting the action of her forces, does so on a scale which seems to make sublimity her prerogative in which art vainly endeavours to participate.

Use of works of art by the theorist.

Difficulties in using works of art as material.

Effects of custom on artistic preference.

On the other hand, it is coming to be seen that the construction of a theory of aesthetic values must be assisted by a much more precise examination than aestheticists are commonly content to make, of works of art. The importance of including these is that they are well-defined objective expressions of what the aesthetic consciousness approves and prefers. In inquiring, for example, into the pleasing relations of colour we might have to wait long for a theory if we were dependent on what even so gifted a writer as Ruskin can tell us about nature's juxtapositions: whereas if it can be shown that throughout the history of chromatic art or during its better period there has been a tendency to prefer certain combinations, this fact becomes a piece of convincing evidence as to their aesthetic value. Even here, however, there are sources of uncertainty. It is not true to say that a work of art is a pure outcome of the aesthetic feeling of the artist, even if we take this in a comprehensive sense. It is subject to the influence of all the temporary feelings and tendencies of the time which produced it. The aesthetic motive which is supposed to originate it is apt to be complicated and disguised by other motives, *e.g.* utility in architecture,[3] an impulse to instruct if not to reform in modern fiction. Again, if it is said that a certain degree of permanence assures us of the aesthetic value of a feature of art, we are met by the difficulty that custom plays an important part in art, the result of convention fixed by tradition often simulating the aspect of a deep-seated aesthetic preference. In this connexion it is to be remarked that even so permanent an element as symmetry may owe its quasi-aesthetic value to custom, by which is understood its wide and impressive display in the organic and even the inorganic world.[4] Yet the influence of custom taken in this larger sense need not greatly disturb us. In aesthetics, as in ethics, the question of validity has to be kept distinct from that of origin. If symmetry (in general) is appreciated as aesthetically pleasing, the question of its genesis becomes immaterial. Another difficulty, not peculiar to aesthetic investigation, is that of reconstructing the modes of aesthetic consciousness represented by forms of art which differ widely from those of our own age and type of culture.

Value of primitive art for aesthetics.

Evolution as criterion of aesthetic height.

Exact measurement of characteristics of art-work.

In utilizing art material for aesthetic theory the theorist will need to note the work recently done by English and German writers on primitive art. And this not merely because of the value of the early forms of art for a theory of the evolution of the aesthetic consciousness; but because the embryonic stages of art are likely to have a peculiar interest as illustrating in a comparatively isolated form some of the simpler modes of aesthetic appreciation, *e.g.* in the grouping of colours, in the mode of covering a surface with linear ornament. Yet it is not necessary to give primitive art a considerable place in a general aesthetics. As a normative science, it is to be remembered, this is much more immediately concerned with the higher stages of aesthetic culture. In seeking to establish norms or regulative principles, we must, it is evident, make a special study of objects of art which belong to our own level of culture. For these reasons it would appear necessary to include in a general aesthetic theory some reference to the evolution of art and of the aesthetic consciousness. A further reason for including it is that the evolution of art supplies a most valuable auxiliary criterion of degree or height of aesthetic value. Provided that we distinguish what is a real process of evolution from one of mere change of fashion in taste, and that we confine ourselves to the larger features of the process, we may make the principle of evolution a serviceable one by regarding those forms and features of art as higher in respect of aesthetic value which grow distinct and relatively fixed in the later and better stages of the evolution of art.[5] This part of aesthetic investigation should be made as exact as possible. Thus in dealing with the triads of colour said to be most frequently employed in the best period of Italian painting the observer should note and record as far as this is possible not only the precise tints, but also the precise degrees of their several luminosities. With regard to elements of form in art, the judicious use of photography and careful measurement would probably help us to understand the practices of art in its better periods. This examination of art material by the aesthetic theorist should be supplemented by a study of what artists have written about their methods, of the rules laid down for students of art, and lastly of the generalizations reached by the more scientific kind of writer upon art.[6]

A proper methodical inquiry into aesthetic objects aided by a knowledge of the practices of art would lead to inductions of the type "objects in so far as they possess such and such characteristics are aesthetically valuable."[1] **Aesthetic Inductions.** This preliminary work of aesthetic science in collecting and analysing facts may be extended in two directions: by an examination (*a*) of the earlier and simpler forms of aesthetic experience, and (*b*) of the fuller and more complex experiences of those specially trained in the perception and enjoyment of beauty. **Germs of aesthetic preference in children, etc.** (*a*) The former would be illustrated by a more methodical investigation into the rudimentary aesthetic likings of children, and of the surviving lower races. Such inquiries may be expected to add to our knowledge of the simpler and more universal forms of aesthetic enjoyment. Some attention has been paid by Darwin and others to germs of taste in birds and other animals. Yet this line of inquiry, though of some value for a theory of the evolution of taste, seems to throw but little light on aesthetic preferences as found in man.[2] **Aesthetic experiment.** An important feature in this new investigation into simpler modes of aesthetic preference is that it proceeds by way of *experiment*, that is to say, a methodical testing of the aesthetic preferences of a number of individuals. Fechner introduced the method of experiment into aesthetics in his researches on the preferability (according to Zeising) of the proportion known as the "golden section."[3] Since his time other experimental inquiries have been made, both as to what forms (*e.g.* what variety of rectangle) and what combinations of colours are most pleasing. The results of these experiments are distinctly promising, though they have not yet been carried far enough to be made the basis of perfectly trustworthy generalizations.[4] **Experience and judgments of experts.** (*b*) A valuable portion of the data for a science of aesthetics lies in the recorded experiences of artists, art critics and others who have specially developed their tastes. This source of information has certainly never been made use of in a complete and methodical manner by theorists, a quotation now and again from writers like Goethe and Ruskin having been deemed sufficient. Yet it is safe to say that an adequate understanding of the finer effects of beauty, both in nature and in art, presupposes the assimilation of what is best in these records. And this not only because they commonly supply us with new and valuable varieties of experience of the more refined kind, but because the aesthetic judgments on nature and art of men in whom the feeling of beauty has been specially cultivated have a greater value than those of others.[5] It may be added that these records are wont to contain reflexions which, though wanting in scientific precision, can be utilized by science.

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[1] Plato had a glimpse of the resemblance of art to play (see Bosanquet, *op. cit.* p. 54). Among modern writers the idea is specially connected with the names of Schiller and Herbert Spencer. In recent works the subject is touched on by S. Wittasek, *Grundzüge der allgem. Ästhetik*, pp. 223 ff.; Bray, *Du Beau*, pp. 62 ff., and by Rutgers Marshall and others referred to below in *Bibliography*.

[2] Hence to say, as Bosanquet says (*op. cit.* pp. 3-4), that art is to nature as the scientific conception of the world to that of the ordinary observer, seems wide of the mark.

[3] K. Lange goes very far in attributing a practical motive to features of architecture commonly supposed to have aesthetic value, *e.g.* a regular series of similar forms (*Das Wesen der Kunst*, Bd. i. pp. 277 ff.).

[4] K. Lange thinks that even symmetry probably has a technical origin (*op. cit.* pp. 283-284).

[5] The question of the place of the historical development of art in aesthetic theory is carefully considered by J. Volkelt, *System der Ästhetik*, Bd. i. 5^{es} Kap.

[6] See, for example, a little work, *The Genesis of Art-form*, by G. L. Raymond.

We now come to the work of scientific construction proper. **Psychological analysis of material.** The finer analysis of the objects which please aesthetically as well as of the agreeable type of consciousness to which they minister belongs to the psychologist, and it is noteworthy that the best recent contributions to the science have been made by men who were either known as psychologists or at least had trained themselves in psychological analysis. A word or two must suffice to indicate the more important directions of the theoretic interpretation. We may in illustrating this set out from the convenient triple division of the factors in aesthetic experience: (A) the sensuous, (B) the perceptual or formal, (C) the imaginative, including all that is suggested by the aesthetic presentation, its meaning and expressiveness.

The sensuous factor. Physiological aesthetics.

(A) In dealing with the sensuous factor the psychologist is materially aided by the physiologist. It is sufficient to point to the contribution made to the analysis of musical sensations by the classical researches of Helmholtz (see below). Yet the application of a knowledge of physiological conditions seems as yet to be of little service when we come to the finer aspects of this sensuous experience, to the subtle effects of colour-combination, for example, and to the nuances of feeling-tone attaching to different tints. In the finer analysis of the sensuous material of aesthetic enjoyment it is the psychologist who counts.[6] **Psychological problems.** Among the valuable contributions recently made in this domain one may instance the careful determination of the aesthetically important characteristics of the sensations of sight and hearing, such as the finely graduated variety of their qualities (colour and tone), their capability of entering into combinations in which they preserve their individuality, including the important combinations of time and space form. With these are to be included the distinguishing characteristics of the concomitant feeling-tones, *e.g.* their comparative calmness and their clear separation from the sensations which they accompany. These characteristics help us to understand the greater refinement of these senses and also the more prolonged as well as varying enjoyment which they contribute, as well as the extension of this enjoyment by imaginative reproduction.[7] Next to this determination of important aesthetic characteristics of the two senses may be named a finer probing of the nuances of pleasurable tone exhibited by the several colours and tones. A point still needing special investigation is extent of the sensuous factor in aesthetic enjoyment. There has been a tendency in aesthetic theory to over-intellectualize aesthetic experience and to find the value even of the sensuous factor in some intellectual principle, as when it is said (by Plato and Hegel among others) that a smooth or level tone and a uniform mass of colour owe their value to the principle of unity. But such prolongation (within obvious limits) in time or space is a condition of the full enjoyment of the distinctive quality of an individual tone or colour, and as such has a sensuous value. Aesthetics has to prove the sensuous value, the pleasure which is due not only to the feeling-tones of the several sensations but to those of their various combinations. Spite of a tendency of late to disparage the co-operation of the "motor sensations" connected with movements of the eye in the aesthetic appreciation of linear form, *e.g.* curves, evidence suggests that certain curves, like fine gradations of colour, may owe a considerable part of their value to a mode of varying the sensuous experience which is in a peculiar manner agreeable. On the other hand, this theoretic investigation of sense-material will need to determine with care the added value due to the action of experience in giving something of meaning to particular colours and tones and their combinations, *e.g.* warmth of colour, height of tone.

The perceptual factor.

(B) Under the scientific treatment of the perceptual or formal factor in aesthetic experience we have many special problems, of which only a few can be touched on here. Taking this factor to include all combinations of elements in which there is a more or less distinct perception of pleasing relations, we meet here with such work as that of C. Stumpf (*Ton-psychologie*) in determining the way in which tones combine and tend to fuse. Later experiments have added to our knowledge of the obscure subject of colour harmony, enabling us to distinguish pleasing contrasts of colour from the more restful combinations of nearly allied tints. Our knowledge of pleasing form in the narrower sense, that is to say, space and time form, has been advanced by a number of recent inquiries. The value of symmetry, the meaning of proportion and the aesthetic value to be set on certain proportions, the forms of rhythm—these are some of the points dealt with in more general and in special works.[1] In the case of forms, still more than in that of sensuous elements, it is needful to determine the extent to which the value of the formal aspect is modified by experience and the acquisition of meaning. This is pretty certainly the source of the aesthetic value claimed for certain proportions, whether in the human figure or other organic forms or in the freer constructions of form in art.[2] Another problem is to determine the influence of the feeling-tones of the combining elements on the pleasing character of the whole. It is probable that a particular combination of colours owes something of its pleasure-value to a harmony of the feeling-tones of the elements. This is pretty certainly the case where the feeling-tones of the elements are closely akin, as in the case of a number of low tones of colours, or of architectural or other forms where one formal element—say, a vertical line, a rectangle of a certain proportion or a particular variety of arch—repeats itself and becomes a dominating feature of the whole.

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[1] Kant, stopping short of an analysis of the beauty of a concrete object, said there were no aesthetic judgments of this universal form (see below). On the importance of these inductions see K. H. von Stein, *Vorlesungen über Ästhetik* (Einleitung).

[2] Curiously enough Thomas Reid recognized a germ of aesthetic taste in animals. *Essays*, Of Taste, ch. v. The aesthetic importance of the observations made on animals is dealt with by L. Bray, *Du Beau*, pp. 233 ff.

[3] See below, and Bosanquet, *op. cit.* pp. 382 ff.

[4] The chief lines of experimental aesthetics are indicated by W. Wundt in his *Physiol. Psychologie* (5e Auflage), Bd. iii. pp. 142 ff. and 147 ff.

[5] On the value of judgments of experts see K. Groos, *Der ästh. Genuss*, p. 149.

[6] Examples of a forcing of the physiological method in aesthetics may be found in the *Physiological Aesthetics* of Grant Allen, and the *Aufgabe der Kunstphysiologie*, by Georg Hirsch.

[7] These aesthetic prerogatives of the sensations of hearing and sight have been well brought out in the article by J. Volkelt, already referred to.

The imaginative factor.

(C) The imaginative factor—which corresponds with what Fechner calls the "indirect"—includes all that imaginative activity adds to our enjoyment when we contemplate an aesthetic object. It may consist first of all in recalling concrete experiences firmly associated with the object, as when the sight of wild-flowers in a London street calls up an image of fields and lanes. In order that these images may add to the aesthetic value of the object they must correspond to our common associations, as distinguished from accidental individual ones. A large increase of aesthetic enjoyment comes to us through such suggested images. Although in general it is images of concrete objects which are called up, ideas of a more abstract character may take part though they tend in this case to assume a concrete aspect. This is illustrated in the appreciation of "typical beauty" in which a concrete form represents in an exceptional way the common form of a species, and in that of symbolic representation. An important part of this work of association is to render objects expressive of mental states, as when we read off the particular shade of feeling expressed by a natural scene.[3]

Freer play of imagination.

In the poetic contemplation of nature, her forces, her gladness and other moods, this imaginative activity, though still deriving its material from association, takes a freer form, leading to an investment of natural objects with a new and more fanciful meaning, as when we "apperceive" a willow drooping over a pond or the front of an old cottage under a quasi-human form, endowing it with something akin to our own feelings and memories. What, it may be asked, is the whole range of this freer play of a life-giving fancy in our aesthetic enjoyment? Some recent theorists have attempted to answer this question by saying that it constitutes a vital element in all aesthetic contemplation. Th. Lipps and others who follow him seek to show that this vitalizing activity of the fancy, which produces a new and illusory object, is the essential ingredient in the aesthetic enjoyment of the forms of material objects. According to this theory, when in the aesthetic mood I enjoy the form of a tree, of a church steeple or of the front of a Greek temple, I am not only ascribing life and feeling to it, but am projecting myself in fancy into the object thus constructed, feeling for the moment that I *am* the tree or the steeple. The process of vivification is carried out as follows. Lines represent certain movements, and in the aesthetic mood we translate all lines and so all forms back into the corresponding movements, which may be merely imagined (as Lipps himself thinks) or may be realized in part by sensuous elements, viz. motor sensations; which again may be regarded either as concomitants of eye movements, or as arising from an organically connected impulse to move the hand along the lines followed by the eye.[4] Thus the columns of a temple represent upward movement, and are apperceived as striving upwards so as to resist the downward pressure of the entablature. Since movements are the great means of expression in man, this imaginative reading of movement into motionless and even massive and stable forms enables us to endow them with quasi-human feelings. In looking, for example, at the weighty masses of a building we enter sympathetically into the successful strivings of the supporting structures to resist the downward thrust of gravity in the supported masses. The theory here briefly indicated[5] is interesting as illustrating an attempt from the psychological side to find a scientific support for philosophic idealism or expressionalism. It is already beginning to be recognized in Germany as an exaggeration. It may be enough to say that as applied to forms generally, including those of sculpture and architecture, the theory is opposed by our ordinary way of speaking, which implies quite another point of view in the aesthetic contemplation of form, namely, that of a spectator external to the object contemplated. When our eye glides over the beauties of a statue, our imaginative activity so far from transporting us *within* the object carries us as tactual feelers *outside* the surface. Similarly, when we delight in the divided spaces of a Gothic roof, so far from being imaginatively engaged in taking part in the efforts and strains of pillar, arch and the rest, we move in fancy along the pathways defined by the designer, tactually feeling and appreciating each dimension, each detail of form. The attempt to force a theory fitted for poetry on sculpture and architecture would rob these of their distinctive aesthetic values; in the one case, of the plastic beauty of finely moulded marble surfaces as realized by imaginative excursions of the hand; and in the other case, of the perfect stillness and stability which give to great structures their solemn and quieting aspect.[6]

Aesthetic illusion.

The theory of a vitalizing play of imagination (*Einfühlung*) running through all modes of aesthetic contemplation is an exaggeration of the element of illusion which certainly characterizes this contemplation. As suggested above, by blotting out for the moment the perception of all save that which pleases it substitutes a new for the more solid reality of our practical mood. Moreover, as a state of perceptual absorption in which one loses consciousness of the ordinary self and its world, it has a certain resemblance to the state of ecstasy and of the hypnotic trance.[7] It is favourable to the play-like indulgence in a fanciful transformation of what is seen or heard, which may be described as a "willing self-deception," more or less complete. Yet as we have seen, something of the real everyday world survives even in our freer aesthetic contemplation of form. Hence there is much to be said for the idea that we have in aesthetic illusion to do with a kind of double consciousness, a tendency to an illusory acceptance of the product of our fancy as the reality, restrained by a subconscious recognition of the everyday tangible reality behind.[8]

It is evident that both in the more confined and in the freer form the element of imaginative activity in aesthetic experience will vary greatly among individuals and among peoples. Differences in past experience leading to diverse habits of association,

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[1] On the later investigations into musical consonance and harmony, harmony of colours, rhythmic and pleasing spatial forms, see Wundt, *op. cit.* Bd. ii. pp. 419 ff., and iii. 135 ff., 140 ff., 147 ff. and 154 ff. Time-form in music is specially discussed by E. Gurney, *The Power of Sound*, v.

[2] K. Lange, who recognizes the influence of nature and custom, here denies that proportion is an aesthetic principle (*Das Wesen der Kunst*, 11tes Kap.).

[3] Alison and other English Associationists have emphasized the aesthetic importance of the principle of association. Among more recent advocates of it is G. T. Fechner, *Vorschule der Ästhetik*, and O. Külpe, "Über den associativ. Factor des ästhet. Eindrucks," *Vierteljahrsschrift für wissensch. Philosophie*, xxiii. pp. 145 ff.

[4] This idea of imitative hand-movement in contemplating form is supported by K. Groos, *Der ästh. Genuss*, pp. 49 ff.

[5] It is commonly spoken of as "feeling oneself into" (*Einfühlen*), or as "sympathetic feeling" (*Mitempfinden*).

[6] Lipps' theory is developed in a number of works, the chief of which is *Ästhetik: Psychologie des Schönen und der Kunst*, see esp. 1er Theil, 1er to 3er Abschnitt; cf. Paul Stern, *Einfühlung und Association*, in which is to be found an historical sketch of the theory, and A. Hildebrand, *Form in der bildenden Kunst*. The play of imagination in the contemplation of form is discussed also by P. Souriau, *L'Esthétique du mouvement*, 3ème part., and *La Suggestion dans l'art*, pp. 300 ff. Cf. works of Karl Groos and K. Lange named below (*Bibliography*).

[7] See P. Souriau, *La Suggestion dans l'art* (1ère partie).

[8] Cf. K. Lange, *op. cit.* Bd. i. p. 208.

Variations of imaginative activity.

as well as in those natural dispositions which prompt one person to prefer motor images, another visual, another audile, will modify the process in this enjoyable enlargement and transformation of what is presented to sense. It is for aesthetics at once to recognize these variations of imaginative activity and to determine the more common and universal directions which it follows.

Form and expression not absolutely distinct.

The recent inquiry into our way of contemplating form is, in spite of exaggeration, valuable as showing that our distinctions of form and expression are not absolute. Just as there is the rudiment of ideal significance in colour, so form, even in its more abstract and elementary aspects, is not wholly expressionless, but may be endowed with something of life by the imagination. The recognition of this truth does not, however, affect the validity of our treating form and expression as two broadly distinguishable factors of aesthetic pleasure. A line may be pleasing to sense-perception, and in addition illustrate expressional value by suggested ease of movement or pose. Similarly, a concrete form, *e.g.* that of a sculptured human figure in repose, or of a graceful birch or fern, owes its aesthetic value to a happy combination of pleasing lines and of interesting ideas.

Aesthetic emotion.

In close connexion with the determination of the imaginative factor in aesthetic contemplation, the psychologist is called on to define the special characteristics of aesthetic emotion. That our attitude when we watch a beautiful object, say the curl of a breaker as it falls, or some choice piece of sculpture, is an emotional one is certain, and ingenious attempts have been made by Home (Lord Kames) and others to equip the emotion with a full accompaniment of corporeal activity, such as heightened respiratory activity.[1] Yet aesthetic emotion is to be contrasted with the more violent and passionate state of love and other emotions, and this difference calls for further investigation. A closer inquiry into the features of that calm yet intense emotion which a rapt state of aesthetic contemplation induces is a necessary preliminary to a scientific demarcation of the sphere of beauty in the narrow or more exclusive sense, from that of the sublime, the tragic and the comic. Each of these departments of aesthetic experience has well-marked emotional characteristics; and the definition of these "modifications of the beautiful" has in the main been reached through an analysis of the emotional states involved. This chapter in the psychological treatment of aesthetic experience has to consider two points which have occupied a prominent place in aesthetic theory. The first is the nature of "revived" or "ideal" emotion, such as is illustrated in the feeling excited sympathetically when we witness or hear of another's sorrow or joy. The second point is the nature of those mixed emotional states which are illustrated in our aesthetic enjoyment of the sublime and the other "modifications," in all of which we can recognize a kind of double emotional consciousness in which painful elements accompany and modify pleasurable ones, in such a manner that in the end the latter appear to be rather strengthened than weakened.[2]

Limits of analysis in aesthetics.

The psychological treatment of aesthetic data here sketched out cannot stop at an analysis of the aesthetic state or attitude into a number of recognizable elements each of which contributes its own quantum of pleasurableness. Our enjoyment in contemplating, say, a green alp set above dark crags, is an indivisible whole. And it is a consciousness of this fact which makes men disposed to resent the dissection of their aesthetic enjoyment into a number of constituent pleasures. Nor is this all. Every aesthetic object is something unique, differing in individual characteristics from all others; and as the object, so the mood of the contemplator. One may almost say that there are as many modes of musical delight as there are worthy compositions. It would seem either that this feeling of a unique indivisible whole must be dismissed as an illusion, or that we have to admit an unexplained residue in our aesthetic experience, which may some day be explained by help of a larger and more exact conception of aesthetic harmony, of the laws of interaction and of fusion of psychical elements.[3]

Construction of aesthetic norms.

We may now glance at the *ideal* purpose of this scientific analysis and interpretation, namely, the construction of norms or regulative principles corresponding to the severally essential elements of aesthetic value ascertained. The later psychological treatment of the subject has led up to the formulation of certain ideal requirements in beautiful objects. The work of Fechner in this direction (*Vorschule der Ästhetik*) was a noteworthy contribution to this kind of construction, at once scientific and directed to the construction of ideal demands, and is still a model for workers in the same field. He has taught us how the attempt to formulate one all-comprehensive principle—*e.g.* unity in variety, has led to a barren abstractedness, and that we need in its place a number of more concrete principles. In formulating these principles care must be taken to determine their respective scopes and their mutual relations—to decide, for example, whether expression, to which our modern feeling undoubtedly ascribes a high value, is a universal demand in the same sense as unity or harmony of parts is admitted to be. A system of norms must further supply some comprehensive criterion by help of which *degrees* of aesthetic value may be determined, as determined by the degrees of completeness of the several pleasurable activities,—sensuous, perceptual and imaginative,—and justify the form of judgment "this object is more beautiful (or of a higher kind of beauty) than that." Such regulative principles and standards of comparison will, it is clear, fail us just at the point where analysis stops. Edmund Gurney urges that an aesthetic principle such as unity in variety is complied with equally well by musical compositions which are commonplace and leave us cold and by those which evoke the full thrill of aesthetic delight, and he concludes that the special beauty of form in the latter instance is appreciated by a kind of intuition which cannot be analysed (see *The Power of Sound*, ix.). The argument is hard to combat. It would seem that after all our efforts to define aesthetic qualities and enumerate corresponding ideal requirements we are left with an unexplained remainder. This can only be tentatively defined as the concrete object itself in its wholeness, which is not only a perfectly harmonized combination of sensuous, formal and expressional values, but impresses us as something which has a fresh individuality and the distinction of aesthetic excellence.

Connexion between aesthetic and other experience: (a) with intellectual interests.

Aesthetics is wont to treat of a certain kind of experience as if it were a closed compartment. Yet there is in reality no such perfect seclusion. Our enjoyment of beauty, though to be distinguished from our intellectual and our practical interests, touches and interacts with these. With regard to intellectual interests it is clear that much of the mental activity which enters into our aesthetic enjoyment is intellectual—*e.g.* in the perception of the relations of form, even though it stops short of the abstract analysis of scientific observation. Again, in appreciating beauty of type which involves according to Taine a recognition of the most important characters of the species, we are, it is evident, close to the scientific point of view. Similarly, when scientific knowledge enables us in the mood of aesthetic contemplation to retrace imaginatively the mode of formation of a cloud or a mountain form, or the mode in which a climbing plant finds its way upwards. It is for aesthetics to recognize the fact, and to discriminate a legitimate aesthetic function of scientific ideas when they enlarge the scope of a pleasurable play of the imagination, and are freed from the control of a serious purpose of explaining what is seen.

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[1] See a curious passage in Home's *Elements of Criticism*, chap. iv., in which the emotions excited by great and elevated objects are said to express themselves externally by a special inflating inspiration, and by stretching upward and standing "a-tiptoe" respectively; also an article on "Recent Aesthetics" by Vernon Lee in the *Quarterly Review*, 1904, part i. pp. 420-443.

[2] See Hume, *Essays*, "Essay of Tragedy," and the important discussions on the meaning of Aristotle's doctrine of the emotions of tragedy and of emotional purification or "alleviating discharge" (*κάθαρσις*) touched on by Bosanquet, *op. cit.* pp. 64 ff. and 234 ff.

[3] That beauty implies a peculiar blending of formal and spiritual (*geistige*) factors is recognized by H. Riegel, *Die bildende Künste*, pp. 16 ff.

(b) with practical interests.

Biological treatment of beauty.

A similar remark applies to the contacts of our aesthetic with our practical interests. While as dominant factors the latter are excluded from aesthetic activity they may influence our feeling for beauty in an indirect and subordinate way. This is recognized by those (*e.g.* Home) who insist on a particular kind of aesthetic value under the name of *relative beauty*, or the pleasing aspect of fitness for a purpose. If a drinking-vessel please in part because of its perfect adaptation to its purpose, the aesthetic value ascribed to it seems to derive something from a feeling of respect for utility itself. In another way beauty reasserts in modern aesthetics that kinship with utility on which it insisted in the days of Socrates. The idea that typical beauty coincides with what is vigorous and conducive to the conservation of the species is as old as Hobbes.[1] Darwin and his followers have developed the biological conception that sexual selection tends to develop aesthetic preferences along lines which correspond to what subserves the maintenance of the species or tribe. Recent writers have shown how the rude germs of aesthetic activity in primitive types of community would subserve necessary tribal ends—*e.g.* musical rhythm by exercising members of the tribe in concerted war-like action.[2] Yet these interesting speculations have to do rather with the earlier stages of the evolution of the aesthetic faculty than with its functions in the higher stages. An idea of a social utility in aesthetic experience which does demand the attention of the theorist is that the culture of beauty and art has a socializing influence, helping to give to our emotional experience new forms of expression whereby our sympathies are deepened and enlarged.[3] The further elucidation of this element of humanizing influence in aesthetic enjoyment may be expected to throw new light on the question, much discussed throughout the history of aesthetics, of the relation of the science to ethics, by showing that they have a common root in our sympathetic nature and interest in humanity.

Aesthetics and ethics.

Aesthetic theory and problems of art.

In order to complete the outline of aesthetic theory we need to glance at the relation of general aesthetics to the special problems of Fine Art. It is evident that the definition of the aims and methods of art, both as a whole and in its several forms, involving as it does special technical knowledge, may with advantage be treated apart from a general theory. (See Fine Arts.) At the same time the study of art raises larger problems which require to be dealt with to some extent by this theory. We may instance the group of problems which have to do with the relation of art to "beauty" in its narrower sense, such as the function of the painful and of the ugly in art, the meaning of artistic imitation and truth to nature, of idealization, and the nature of artistic illusion; also the question of the didactic and of the moral function of art. Even more special problems of art, such as the effect of the tragic, the nature of musical expression, can only be adequately treated in the light of a general aesthetic theory.

In conclusion, it may be pointed out that the psychological theorist has of late been busy in an outlying region of art-lore, inquiring into the nature of the artistic impulse and temperament, and into the processes of imaginative creation. These inquiries have been carried out to some extent in connexion with studies of the origin of art, and of the relation of art to the social environment. Their importance for aesthetics lies in the circumstance that they are fitted to throw light upon the aesthetic consciousness as it is developed in those who are not only in a special sense cultivators of it, but represent in a peculiar manner the ideas and the aims of art.[1]

History of Theories

In the following summary of the most important contributions to aesthetic doctrine, only such writings will be recognized as contribute to a general conception of aesthetic objects or experience. These include the more systematic treatment of the subject in philosophic works as well as the more thoughtful kind of discussion of principles to be met with in writings on art by critics and others.

1. *Greek Speculations.*—Ancient Greece supplies us with the first important contributions to aesthetic theory, though these are scarcely, in quality or in quantity, what one might have expected from a people which had so high an appreciation of beauty and so strong a bent for philosophic speculation. The first Greek thinker of whose views on the subject we really know something is Socrates. We learn from Xenophon's account of him that he regarded the beautiful as coincident with the good, and both of them are resolvable into the useful. Every beautiful object is so called because it serves some rational end, whether the security or the gratification of man. Socrates appears to have attached little importance to the *immediate* gratification which a beautiful object affords to perception and contemplation, but to have emphasized rather its power of furthering the more necessary ends of life. The really valuable point in his doctrine is the relativity of beauty. Unlike Plato, he recognized no self-beauty (αὐτὸ τὸ καλὸν) existing absolutely and out of all relation to a percipient mind.

Plato.

Of the views of Plato on the subject, it is hardly less difficult to gain a clear conception from the *Dialogues*, than it is in the case of ethical good. In some of these, various definitions of the beautiful are rejected as inadequate by the Platonic Socrates. At the same time we may conclude that Plato's mind leaned decidedly to the conception of an absolute beauty, which took its place in his scheme of ideas or self-existing forms. This true beauty is nothing discoverable as an attribute in another thing, for these are only beautiful things, not the beautiful itself. Love (Eros) produces aspiration towards this pure idea. Elsewhere the soul's intuition of the self-beautiful is said to be a reminiscence of its prenatal existence. As to the precise forms in which the idea of beauty reveals itself, Plato is not very decided. His theory of an absolute beauty does not easily adjust itself to the notion of its contributing merely a variety of sensuous pleasure, to which he appears to lean in some dialogues. He tends to identify the self-beautiful with the conceptions of the true and the good, and thus there arose the Platonic formula καλοκἀγαθία. So far as his writings embody the notion of any common element in beautiful objects, it is proportion, harmony or unity among their parts. He emphasizes unity in its simplest aspect as seen in evenness of line and purity of colour. He recognizes in places the beauty of the mind, and seems to think that the highest beauty of proportion is to be found in the union of a beautiful mind with a beautiful body. He had but a poor opinion of art, regarding it as a trick of imitation (μίμησις) which takes us another step farther from the luminous sphere of rational intuition into the shadowy region of the semblances of sense. Accordingly, in his scheme for an ideal republic, he provided for the most inexorable censorship of poets, &c., so as to make art as far as possible an instrument of moral and political training.

Aristotle.

Aristotle proceeded to a more serious investigation of the aesthetic phenomena so as to develop by scientific analysis certain principles of beauty and art. In his treatises on poetry and rhetoric he gives us, along with a theory of these arts, certain general principles of beauty; and scattered among his other writings we find many valuable suggestions on the same subject. He seeks (in the *Metaphysics*) to distinguish the good and the beautiful by saying that the former is always in action (ἐν πράξει) whereas the latter may exist in motionless things as well (ἐν ἀκινήτοις). At the same time he had as a Greek to allow that though essentially different things the good might under certain conditions be called beautiful. He further distinguished the beautiful from the fit, and in a passage of the *Politics* set beauty above the useful and necessary. He helped to determine another characteristic of the beautiful, the absence of all lust or desire in the pleasure it bestows. The universal elements of beauty, again, Aristotle finds (in the *Metaphysics*) to be order (τάξις), symmetry and definiteness or determinateness (τὸ ὡρισμένον). In the *Poetics* he adds another essential, namely, a certain magnitude; it being desirable for a synoptic view of the whole that the object should not be too large, while clearness of perception requires that it should not be too small. Aristotle's views on art are an immense advance on those of Plato. He distinctly recognized (in the *Politics* and elsewhere) that its aim is immediate pleasure, as distinct from utility, which is the end of the mechanical arts. He took a higher view of artistic imitation than Plato, holding that so far from being an unworthy trick, it implied knowledge and discovery, that its objects not only comprised particular things which happen to most, but contemplated what is probable and what necessarily exists. The celebrated passage in the *Poetics*, where he declares poetry to be more philosophical and serious a matter (σπουδαιότερον) than philosophy, brings out the advance of Aristotle on his predecessor. He gives us no complete classification of the fine arts, and it is doubtful how far his principles, *e.g.* his celebrated idea of a purification of the passions by tragedy, are to be taken as applicable to other than the poetic art.

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[1] See passage in *Human Nature* (first part of *Tripos*), ch. viii. § 5 (Molesworth's edition of *Works*, vol. iv. p. 38).

[2] See among others, R. Wallascheck, *Primitive Music*, pp. 270 ff., and Y. Hirn, *The Origin of Art*, pp. 9 ff.; cf. W. Jerusalem, *Einleitung in die Philosophie*, pp. 116, 117.

[3] The idea of this social utility in aesthetic enjoyment is touched on by Kant, *Critique of Judgment* (Bernard's trans.), p. 174; and is more fully worked out by Guyau, *L'Art au point de vue sociologique*, ch. ii. and iii.; cf. Rutgers Marshall, *Aesthetic Principles*, pp. 81-82.

[1] On the nature of the primitive art-culture, see Rutgers Marshall, *Aesthetic Principles*, ch. iii.; M. Baldwin, *Social and Ethical Interpretations*, pp. 151 ff; Y. Hirn, *The Origin of Art*, ch. ii. On artistic genius and its creative process, see H. Taine, *The Philosophy of Art*, Part ii.; P. Souriau, *L'Imagination de l'artiste*; G. Séailles, *Essai sur la génie dans l'art*; E. Grosse, *Kunstwissenschaftliche Studien*, iii.; Arréat, *Psychologie du peintre*; L. Dauriac, *Essai sur l'esprit musical*.

Plotinus.

Of the later Greek and Roman writers the Neo-Platonist Plotinus deserves to be mentioned. According to him, objective reason (νοῦς) as self-moving, becomes the formative influence which reduces dead matter to form. Matter when thus formed becomes a notion (λόγος), and its form is beauty. Objects are ugly so far as they are unacted upon by reason, and therefore formless. The creative reason is absolute beauty, and is called the more than beautiful. There are three degrees or stages of manifested beauty: that of human reason, which is the highest; of the human soul, which is less perfect through its connexion with a material body; and of real objects, which is the lowest manifestation of all. As to the precise forms of beauty, he supposed, in opposition to Aristotle, that a single thing not divisible into parts might be beautiful through its unity and simplicity. He gives a high place to the beauty of colours in which material darkness is overpowered by light and warmth. In reference to artistic beauty he said that when the artist has notions as models for his creations, these may become more beautiful than natural objects. This is clearly a step away from Plato's doctrine towards our modern conception of artistic idealization.

German writers. (a) Systematic treatises: Baumgarten.

2. *German Writers.*—We may pass by the few thoughts on the subject to be found among medieval writers and turn to modern theories, beginning with those of German writers as the most numerous and most elaborately set forth. The first of the Germans who attempted to develop an aesthetic theory as a part of a system of philosophy was Baumgarten (*Aesthetica*). Adopting the Leibnitz-Wolffian theory of knowledge, he sought to complete it by setting over against the clear scientific or "logical" knowledge of the understanding, the confused knowledge of the senses, to which (as we have seen) he gave the name "aesthetic." Beauty with him thus corresponds with perfect sense-knowledge. Baumgarten is clearly an intellectualist in aesthetics, reducing taste to an intellectual act and ignoring the element of feeling. The details of his aesthetics are mostly unimportant. Arguing from Leibnitz's theory of the world as the best possible, Baumgarten concluded that nature is the highest embodiment of beauty, and that art must seek its supreme function in the strictest possible imitation of nature.

Kant.

The next important treatment of aesthetics by a philosopher is that of Kant. He deals with the "Judgment of Taste" in the *Critique of the Power of Judgment* (J. H. Bernard's translation, 1892), which treatises supplements the two better-known critiques (*vide* KANT), and by investigating the conditions of the validity of feeling mediates between their respective subjects, cognition and desire (volition). He takes an important step in denying objective existence to beauty. Aesthetic value for him is fitness to please as object of pure contemplation. This aesthetic satisfaction is more than mere agreeableness, since it must be disinterested and free—that is to say, from all concern about the real existence of the object, and about our dependence on it. He appears to concede a certain formal objectivity to beauty in his doctrine of an appearance of purposiveness (*Zweckmässigkeit*) in the beautiful object, this being defined as its harmony with the cognative faculties involved in an aesthetic judgment (imagination and understanding); a harmony the consciousness of which underlies our aesthetic pleasure. Yet this part of his doctrine is very imperfectly developed. While beauty thus ceases with Kant to have objective validity and remains valid only for the contemplator, he claims for it *universal* subjective validity, since the object we pronounce to be beautiful is fitted to please all men. We know that this must be so from reflecting on the disinterestedness of our pleasure, on its entire independence of personal inclination. Kant insists that the aesthetic judgment is always, in logical phrase, an "individual" *i.e.* a singular one, of the form "This object (*e.g.* rose) is beautiful." He denies that we can reach a valid universal aesthetic judgment of the form "All objects possessing such and such qualities are beautiful." (A judgment of this form would, he considers, be logical, not aesthetic.) In dealing with beauty Kant is thinking of nature, ranking this as a source of aesthetic pleasure high above art, for which he shows something of contempt. He seems to retreat from his doctrine of pure subjectivity when he says that the highest significance of beauty is to symbolize moral good; going further than Ruskin when he attaches ideals of modesty, frankness, courage, &c., to the seven primary colours of Newton's system. He has made a solid contribution to the theory of the sublime, and has put forth a suggestive if a rather inadequate view of the ludicrous. But his main service to aesthetics consists in the preliminary critical determination of its aim and its fundamental problems.

Schelling.

Schelling is the first thinker to attempt a Philosophy of Art. He develops this as the third part of his system of transcendental idealism following theoretic and practical philosophy. (See SCHELLING; also Schelling's *Werke*, Bd. v., and J. Watson, *Schelling's Transcendental Idealism*, ch. vii., Chicago, 1882.) According to Schelling a new philosophical significance is given to art by the doctrine that the identity of subject and object—which is half disguised in ordinary perception and volition—is only clearly seen in artistic perception. The perfect perception of its real self by intelligence in the work of art is accompanied by a feeling of infinite satisfaction. Art in thus effecting a revelation of the absolute seems to attain a dignity not merely above that of nature but above that of philosophy itself. Schelling throws but little light on the concrete forms of beauty. His classification of the arts, based on his antithesis of object and subject, is a curiosity in intricate arrangement. He applies his conception in a suggestive way to classical tragedy.

Hegel.

In Hegel's system of philosophy art is viewed as the first stage of the absolute spirit. (See HEGEL; also *Werke*, Bd. x., and Bosanquet's *Introduction to Hegel's Philosophy of Fine Art*.) In this stage the absolute is immediately present to sense-perception, an idea which shows the writer's complete rupture with Kant's doctrine of the "subjectivity" of beauty. The beautiful is defined as the ideal showing itself to sense or through a sensuous medium. It is said to have its life in show or semblance (*Schein*) and so differs from the true, which is not really sensuous, but the universal idea contained in sense for thought. The form of the beautiful is unity of the manifold. The notion (*Begriff*) gives necessity in mutual dependence of parts (unity), while the reality demands the semblance (*Schein*) of liberty in the parts. He discusses very fully the beauty of nature as immediate unity of notion and reality, and lays great emphasis on the beauty of organic life. But it is in art that, like Schelling, Hegel finds the highest revelation of the beautiful. Art makes up for the deficiencies of natural beauty by bringing the idea into clearer light, by showing the external world in its life and spiritual animation. The several species of art in the ancient and modern worlds depend on the various combinations of matter and form. He classifies the individual arts according to this same principle of the relative supremacy of form and matter, the lowest being architecture, the highest, poetry.

Dialectic of the Hegelians.

Curious developments of the Hegelian conception are to be found in the dialectical treatment of beauty in its relation to the ugly, the sublime, &c., by Hegel's disciples, *e.g.* C. H. Weisse and J. K. F. Rosenkranz. The most important product of the Hegelian School is the elaborate system of aesthetics published by F. T. Vischer (*Ästhetik*, 3 Theile, 1846–1854). It illustrates the difficulties of the Hegelian thought and terminology; yet in dealing with art it is full of knowledge and highly suggestive.

Schopenhauer.

The aesthetic problem is also treated by two other philosophers whose thought set out from certain tendencies in Kant's system, viz. Schopenhauer and Herbart. Schopenhauer (see SCHOPENHAUER, also *The World as Will and Idea*, translated by R. B. Haldane, esp. vol. i. pp. 219-346), abandoning also Kant's doctrine of the subjectivity of beauty, found in aesthetic contemplation the perfect emancipation of intellect from will. In this contemplation the mind is filled with pure intellectual forms, the "Platonic Ideas" as he calls them, which are objectifications of the will at a certain grade of completeness of representation. He exalts the state of artistic contemplation as the one in which, as pure intellect set free from will, the misery of existence is surmounted and something of blissful ecstasy attained. He holds that all things are in some degree beautiful, ugliness being viewed as merely imperfect manifestation or objectification of will. In this way the beauty of nature, somewhat slighted by Schelling and Hegel, is rehabilitated.

Herbart.

J. F. Herbart (*q.v.*) struck out another way of escaping from Kant's idea of a purely subjective beauty (Kerbach's edition of *Werke*, Bd. ii. pp. 339 *et seq.*; Bd. iv. pp. 105 *et seq.*, and Bd. ix. pp. 92 *et seq.*). He did, indeed, adopt Kant's view of the aesthetic judgment as singular ("individual"); though he secures a certain degree of logical universality for it by emphasizing the point that the predicate (beauty) is permanently true of the same aesthetic object. At the same time, by referring the beauty of concrete objects to certain aesthetic relations, he virtually accepted the possibility of universal aesthetic judgments (cf. *supra*). Since he thus reduces beauty to abstract relations he is known as a formalist, and the founder of the formalistic school in aesthetics. He sets out with the idea that only relations please—in the Kantian sense of producing pleasure devoid of desire; and his aim is to determine the "aesthetic elementary relations," or the simplest relations which produce this pleasure. These include those of will, so that, as he admits, ethical judgments are in a manner brought under an aesthetic form. His typical example of aesthetic relations in objects of sense-perception is that of harmony between tones. The science of thorough-bass has, he thinks, done for music what should be done also for other departments of aesthetic experience. This doctrine of elementary relations is brought into connexion with the author's psychological doctrine of presentations with their tendencies to mutual inhibition and to fusion, and of the varying feeling-tones to which these processes give rise. This mode of treating the problem of beauty and aesthetic perception has been greatly developed and worked up into a complete system of aesthetics by one of Herbart's disciples, Robert Zimmermann (*Ästhetik*, 1858).

Lessing.

Lessing, in his *Laocoon* and elsewhere, sought to deduce the special function of an art from a consideration of the means at its disposal. He took pains to define the boundaries of poetry and painting, and in so doing he reached general reflexions upon the ends and appliances of art. Among these his distinction between arts which employ the coexistent in space and those which employ the successive (as poetry and music) is of lasting value. In his dramatic criticisms he similarly endeavoured to develop clear general principles on such points as poetic truth, improving upon Aristotle, on whose teaching he mainly relies.

Goethe. Schiller.

Goethe wrote several tracts on aesthetic topics, as well as many aphorisms. He attempts to mediate between the claims of ideal beauty, as taught by J. J. Winckelmann, and the aims of individualization. Schiller (*q.v.*) discusses, in a number of disconnected essays and letters, some of the main questions in the philosophy of art. He looks at art from the side of culture and the forces of human nature, and finds in an aesthetically cultivated soul the reconciliation of the sensual and rational. His letters on aesthetic education (*Über die ästhetische Erziehung des Menschen*, trans. by J. Weiss, Boston, 1845) are valuable, bringing out among other points the connexion between aesthetic activity and the universal impulse to play (*Spieltrieb*). Schiller's thoughts on aesthetic subjects are pervaded with the spirit of Kant's philosophy. Another example of this kind of reflective discussion of art by literary men is afforded us in the *Vorschule der Ästhetik* of Jean Paul Richter. This is a rather ambitious discussion of the sublime and ludicrous, which, however, contains much valuable matter on the nature of humour in romantic poetry. Among other writers who reflect more or less philosophically on the problems to which modern poetry gives rise are Wilhelm von Humboldt, the two Schlegels and Gervinus.

Jean Paul.

Contributions by German savants.

A word may be said in conclusion on the attempts of German savants to apply a knowledge of physiological conditions to the investigation of the sensuous elements of aesthetic effect, as well as to introduce into the study of the simpler aesthetic forms the methods of natural science. The classic work of Helmholtz on "Sensations of Tone" is a highly successful attempt to ground the known facts and laws of musical composition on physics and physiology. The endeavour to determine with a like degree of precision the physiological conditions of the pleasurable effects of colours and their combinations by E. W. Brücke, Ewald Hering and more recent investigators, has so far failed to realize the desideratum laid down by Herbart, that there should be a theory of colour-relations equal in completeness and exactness to that of tone-relations. The experimental inquiry into simple aesthetically pleasing forms was begun by G. T. Fechner in seeking to test the soundness of Adolf Zeising's hypothesis that the most pleasing proportion in dividing a line, say the vertical part of a cross, is the "golden section," where the smaller division is to the larger as the latter to the sum. He describes in his work on "Experimental Aesthetics" (*Zur experimentalen Ästhetik*) a series of experiments carried out on a large number of persons, bearing on this point, the results of which he considers to be in favour of Zeising's hypothesis.

Discussions of more concrete problems.

3. *French Writers.*—In France aesthetic speculation grew out of the discussion by poets and critics on the relation of modern art, and especially poetry, to ancient. The writings of Malherbe and Boileau in the 17th century, the development of the dispute between the "ancients" and the "moderns" at the end of the 17th century by B. le Bouvier de Fontenelle and Charles Perrault, and the continuation of the discussion as to the aims of poetry and of art generally in the 18th century by Voltaire, Bayle, Diderot and others, not only offer to the modern theorists valuable material in the shape of a record by experts of their aesthetic experience, but disclose glimpses of important aesthetic principles. A more systematic examination of the several arts (corresponding to that of Lessing) is to be found in the *Cours de belles lettres* of Charles Batteux (1765), in which the meaning and value of the imitation of nature by art are further elucidated, and the arts are classified (as by Lessing) according as they employ the forms of space or those of time.

Theories of organic beauty. Buffier.

Taine.

The beginning of a more scientific investigation of beauty in general is connected with the name of Père Buffier (see *First Truths*, English translation, 1780). He confines himself to organic form, and illustrates his theory by the human face. A beautiful face is at once the most common and most rare among members of the species. This seems to be a clumsy way of saying that it is a clear expression of the typical form of the species. This idea of typical beauty (which was adopted by Reynolds) has been worked out more recently by H. Taine. In his work, *The Ideal in Art* (trans. by J. Durand), he proceeds in the manner of a botanist to determine a scale of characters in the physical and moral man. The degree of the universality or importance of a character, and of its beneficence or adaptation to the ends of life, determine the measure of its aesthetic value, and render the work of art, which seeks to represent it in its purity, an ideal work.

French systems of aesthetics: The spiritualistes.

Leveque.

The only elaborated systems of aesthetics in French literature are those constructed by the *spiritualistes*, the philosophic writers who under the influence of German thinkers effected a reaction against the crude sensationalism of the 18th century. They aim at elucidating the higher and spiritual element in aesthetic impressions, appearing to ignore any capability in the sensuous material of affording a true aesthetic delight. V. Cousin and Jean Charles Lévêque are the principal writers of this school. The latter developed an elaborate system of the subject (*La Science du beau*). All beauty is regarded as spiritual in its nature. The several beautiful characters of an organic body—of which the principal are magnitude, unity and variety of parts, intensity of colour, grace or flexibility, and correspondence to environment—may be brought under the conception of the ideal grandeur and order of the species. These are perceived by reason to be the manifestations of an invisible vital force. Similarly the beauties of inorganic nature are to be viewed as the grand and orderly displays of an immaterial physical force. Thus all beauty is in its objective essence either spirit or unconscious force acting with fulness and in order.

4. *English Writers.*—There is nothing answering to the German conception of a system of aesthetics in English literature. The inquiries of English thinkers have been directed for the most part to such modest problems as the psychological process by which we perceive the beautiful—discussions which are apt to be regarded by German historians as devoid of real philosophical value. The writers may be conveniently arranged in two divisions, answering to the two opposed directions of English thought: (1) the Intuitionalists, those who recognize the existence of an objective beauty which is a simple unanalysable attribute or principle of things; and (2) the Analytical theorists, those who follow the analytical and psychological method, concerning themselves with the sentiment of beauty as a complex growth out of simpler elements.

The intuitionalists. Shaftesbury.

Shaftesbury is the first of the intuitional writers on beauty. In his *Characteristics* the beautiful and the good are combined in one ideal conception, much as with Plato. Matter in itself is ugly. The order of the world, wherein all beauty really resides, is a spiritual principle, all motion and life being the product of spirit. The principle of beauty is perceived not with the outer sense, but with an internal or moral sense which apprehends the good as well. This perception yields the only true delight, namely, spiritual enjoyment.

Hutcheson.

Francis Hutcheson, in his *System of Moral Philosophy*, though he adopts many of Shaftesbury's ideas, distinctly disclaims any independent self-existing beauty in objects. "All beauty," he says, "is relative to the sense of some mind perceiving it." The cause of beauty is to be found not in a simple sensation such as colour or tone, but in a certain order among the parts, or "uniformity amidst variety." The faculty by which this principle is discerned is an internal sense which is defined as "a passive power of receiving ideas of beauty from all objects in which there is uniformity in variety." This inner sense resembles the external senses in the immediateness of the pleasure which its activity brings; and further in the necessity of its impressions: a beautiful thing being always, whether we will or no, beautiful. He distinguishes two kinds of beauty, absolute or original, and relative or comparative. The latter is discerned in an object which is regarded as an imitation or semblance of another. He distinctly states that "an exact imitation may still be beautiful though the original were entirely devoid of it." He seeks to prove the universality of this sense of beauty, by showing that all men, in proportion to the enlargement of their intellectual capacity, are more delighted with uniformity than the opposite.

Reid.

In his *Essays on the Intellectual Powers* (viii. "Of Taste") Thomas Reid applies his principle of common sense to the problem of beauty by saying that objects of beauty agree not only in producing a certain agreeable emotion, but in the excitation along with this emotion of a belief that they possess some perfection or excellence, that beauty exists in the objects independently of our minds. His theory of beauty is severely spiritual. All beauty resides primarily in the faculties of the mind, intellectual and moral. The beauty which is spread over the face of visible nature is an emanation from this spiritual beauty, and is beauty because it symbolizes and expresses the latter. Thus the beauty of a plant resides in its perfect adaptation to its end, a perfection which is an expression of the wisdom of its Creator.

Hamilton.

In his *Lectures on Metaphysics* Sir W. Hamilton gives a short account of the sentiments of taste, which (with a superficial resemblance to Kant) he regards as subserving both the subsidiary and the elaborative faculties in cognition, that is, the imagination and the understanding. The activity of the former corresponds to the element of variety in a beautiful object, that of the latter with its unity. He explicitly excludes all other kinds of pleasure, such as the sensuous, from the proper gratification of beauty. He denies that the attribute of beauty belongs to fitness.

Ruskin.

John Ruskin's well-known speculations on the nature of beauty in *Modern Painters* ("Of ideas of beauty"), though sadly wanting in scientific precision, have a certain value in the history of aesthetics. For him beauty is spiritual and typical of divine attributes. Its true nature is appreciated by the theoretic faculty which is concerned in the moral conception and appreciation of ideas of beauty, and must be distinguished from the imaginative or artistic faculty, which is employed in regarding in a certain way and combining the ideas received from external nature. He distinguishes between typical and vital beauty. The former is the external quality of bodies, which typifies some divine attribute. The latter consists in "the appearance of felicitous fulfilment of function in living things." The forms of typical beauty are:—(1) infinity, the type of the divine incomprehensibility; (2) unity, the type of the divine comprehensiveness; (3) repose, the type of the divine permanence; (4) symmetry, the type of the divine justice; (5) purity, the type of the divine energy; and (6) moderation, the type of government by law. Vital beauty, again, is regarded as relative when the degree of exaltation of the function is estimated, or generic if only the degree of conformity of an individual to the appointed functions of the species is taken into account. Ruskin's writings illustrate the extreme tendency to identify aesthetic with moral perception.

The analytical theorists. Addison.

Addison's "Essays on the Imagination," contributed to the *Spectator*, though they belong to popular literature, contain the germ of scientific analysis in the statement that the pleasures of imagination (which arise originally from sight) fall into two classes:—(1) primary pleasures, which entirely proceed from objects before our eyes; and (2) secondary pleasures, flowing from the *ideas* of visible objects. The latter are greatly extended by the addition of the proper enjoyment of resemblance, which is at the basis of all mimicry and wit. Addison recognizes, too, to some extent, the influence of association upon our aesthetic preferences.

Home.

In the *Elements of Criticism* of Home (Lord Kames) another attempt is made to resolve the pleasure of beauty into its elements. Beauty and ugliness are simply the pleasant and unpleasant in the higher senses of sight and hearing. He appears to admit no general characteristic of beautiful objects beyond this power of yielding pleasure. Like Hutcheson, he divides beauty into intrinsic and relative, but understands by the latter the appearance of fitness and utility, which is excluded from the beautiful by Hutcheson.

Hogarth.

Passing by the name of Sir Joshua Reynolds, whose theory of beauty closely resembles that of Père Buffier, we come to the speculations of another artist and painter, William Hogarth. He discusses, in his *Analysis of Beauty*, all the elements of visual beauty. He finds in this the following elements:—(1) fitness of the parts to some design; (2) variety in as many ways as possible; (3) uniformity, regularity or symmetry, which is only beautiful when it helps to preserve the character of fitness; (4) simplicity or distinctness, which gives pleasure not in itself, but through its enabling the eye to enjoy variety with ease; (5) intricacy, which provides employment for our active energies, leading the eye "a wanton kind of chase"; (6) quantity or magnitude, which draws our attention and produces admiration and awe. The beauty of proportion he resolves into the needs of fitness. Hogarth applies these principles to the determination of the degrees of beauty in lines, figures and groups of forms. Among lines he singles out for special honour the serpentine (formed by drawing a line once round from the base to the apex of a long slender cone).

Burke.

Burke's speculations, in his *Inquiry into the Origin of our Ideas of the Sublime and Beautiful*, illustrate the tendency of English writers to treat the problem as a psychological one and to introduce physiological considerations. He finds the elements of beauty to be:—(1) smallness; (2) smoothness; (3) gradual variation of direction in gentle curves; (4) delicacy, or the appearance of fragility; (5) brightness, purity and softness of colour. The sublime is rather crudely resolved into astonishment, which he thinks always contains an element of terror. Thus "infinity has a tendency to fill the mind with a delightful horror." Burke seeks what he calls "efficient causes" for these aesthetic impressions in certain affections of the nerves of sight analogous to those of other senses, namely, the soothing effect of a relaxation of the nerve fibres. The arbitrariness and narrowness of this theory cannot well escape the reader's attention.

Alison.

Alison, in his well-known *Essays on the Nature and Principles of Taste*, proceeds by a method exactly the opposite to that of Hogarth and Burke. He seeks to analyse the mental process when we experience the emotion of beauty or sublimity. He finds that this consists in a peculiar operation of the imagination, namely, the flow of a train of ideas through the mind, which ideas always correspond to some simple affection or emotion (*e.g.* cheerfulness, sadness, awe) awakened by the object. He thus makes association the sole source of aesthetic delight, and denies the existence of a primary source in sensations themselves. He illustrates the working of the principle of association at great length, and with much skill; yet his attempt to make it the unique source of aesthetic pleasure fails completely. Francis Jeffrey's Essays on Beauty (in the *Edinburgh Review*, and *Encyclopaedia Britannica*, 8th edition) are little more than a modification of Alison's theory.

Dugald Stewart.

D. Stewart's chief contribution to aesthetic discussion in his *Philosophical Essays* consists in pointing out the unwarranted assumption lurking in the doctrine of a single quality running through all varieties of beautiful object. He seeks to show how the successive changes in the meaning of the term "beautiful" have arisen. He suggests that it originally connoted the pleasure of colour. The value of his discussion resides more in the criticism of his predecessors than in the contribution of new ideas. His conception of the sublime, suggested by the etymology of the word, emphasizes the element of height in objects.

Bain.

Of the association psychologists James Mill did little more towards the analysis of the sentiments of beauty than re-state Alison's doctrine. Alexander Bain, in his treatise, *The Emotions and the Will* ("Aesthetic Emotions"), carries this examination considerably further. He seeks to differentiate aesthetic from other varieties of pleasurable emotion by three characteristics:—(1) their freedom from life-serving uses, being gratifications sought for their own sakes; (2) their purity from all disagreeable concomitants; (3) their eminently sympathetic or shareable nature. He takes a comprehensive view of the constituents of aesthetic enjoyment, including the pleasures of sensation and of its revived or its "ideal" form; of revived emotional states; and lastly the satisfaction of those wide-ranging susceptibilities which we call the love of novelty, of contrast and of harmony. The effect of sublimity is connected with the manifestation of superior power in its highest degrees, which manifestation excites a sympathetic elation in the beholder. The ludicrous, again, is defined by Bain, improving on Aristotle and Hobbes, as the degradation of something possessing dignity in circumstances that excite no other strong emotion.

Herbert Spencer.

Herbert Spencer, in his *First Principles*, *Principles of Psychology* and *Essays*, has given an interesting turn to the psychology of aesthetics by the application of his doctrine of evolution. Adopting Schiller's idea of a connexion between aesthetic activity and play, he seeks to make it the starting-point in tracing the evolution of aesthetic activity. Play is defined as the outcome of the superfluous energies of the organism: as the activity of organs and faculties which, owing to a prolonged period of inactivity, have become specially ready to discharge their function, and as a consequence vent themselves in *simulated* actions. Aesthetic activities supply a similar mode of self-relieving discharge to the higher organs of perception and emotion; and they further agree with play in not directly subserving any processes conducive to life; in being gratifications sought for their own sake only. Spencer seeks to construct a hierarchy of aesthetic pleasures according to the degree of complexity of the faculty exercised: from those of sensation up to the revived emotional experiences which constitute the aesthetic sentiment proper. Among the more vaguely revived emotions Spencer includes more permanent feelings of the race transmitted by heredity; as when he refers the deep and indefinable emotion excited by music to associations with vocal tones expressive of feeling built up during the past history of our species. His biological treatment of aesthetic activity has had a wide influence, some (*e.g.* Grant Allen) being content to develop his evolutional method. Yet, as suggested above, his theory is now recognized as taking us only a little way towards an adequate understanding of our aesthetic experience.

BIBLIOGRAPHY.[1]—(a) *Works on General Aesthetics.*

English and American.—There are no important recent works which deal with the whole subject. The following will be found helpful: Herbert Spencer, *Principles of Psychology*, pt. viii. c. 9. "Aesthetic Sentiments," and the papers on "Use and Beauty," "Origin and Function of Music" and others in the *Essays;* A. Bain, *Emotions and Will*, "Aesthetic Emotions"; J. Sully, *Human Mind*, ii. "Aesthetic Sentiment"; Grant Allen, "Physiological Aesthetics" (Meth., Pl., Senses, Play); Rutgers Marshall, *Pain, Pleasure and Aesthetics*, and *Aesthetic Principles* (Meth., Pl., Play).

French and Italian Works.—M. Guyéu, *Les Problèmes de l'esthétique contemporaine* (1884)(Pl., Play); E. Véron, L'Esthétique (1890) (slight Pl.); L. Bray, *Du Beau* (1902), (Pl., Play); P. Sauriau, *La Beauté rationnelle* (1904) (Meth., Pl., Senses, Einf.); M. Pilo, *Estetica* (Pl., Senses); A. Rolla, *Storia delle idee estetiche in Italia* (1905) (full account of ideas of Dante and other medieval writers, as well as of modern systems).

German Works.—K. Köstlin, *Prolegomena sur Ästhetik* (1889)

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[1] Only recent works are included. Important points in each are indicated by abbreviations, namely:—

Einf., for Einfühlung (expressional element in form).
Evol., for bearings of evolution.
Ill., for aesthetic illusion.
Judg., for aesthetic judgment.
Meth., for method of aesthetics.
Norm., for normative function of aesthetics.
Pl., for theory of pleasure.
Play, for Play and aesthetic enjoyment.
Senses, for aesthetic value of higher senses.
Val., for aesthetic value.

(good introduction to subject); K. Groos, *Der ästhetische Genuss* (1902) (Meth., Judg., Play, Senses, Einf. and Ill.); J. Volkelt, *System der Ästhetik* (1905) (very full and clear) (Meth., Norm., Evol., Senses, Einf.); J. Cohn, *Allgemeine Ästhetik* (1901) (Val., Play, Einf.); K. Lange, *Das Wesen der Kunst* (1901) (Meth., Einf., Ill., Play).

(b) *Works on History of Aesthetics.*—H. Lotze, *Geschichte der Ästhetik in Deutschland*; M. Schasler, *Kritische Geschichte der Ästhetik* (full and elaborate, dealing with ancient and modern theories); E. von Hartmann, *Die deutsche Ästhetik seit Kant* (Ausgewählte Werke, iii.); K. H. von Stein, *Die Entstehung der neueren Ästhetik* (theories of French critics, &c.); F. Brunetière, *L'Évolution des genres* (History of critical discussions in the 17th and 18th centuries); B. Bosanquet, *History of Aesthetics* (very full, especially on ancient theories and German systems); W. Knight, *Philosophy of the Beautiful*, pt. i. "History" (Univ. Extension Manuals, a popular résumé with quotations). (J. S.)

AESTIVATION (from Lat. *aestivare*, to spend the *aestas*, or summer; the word is sometimes spelled "estivation"), literally "summer residence," a term used in zoology for the condition of torpor into which certain animals pass during the hottest season in hot and dry countries, contrasted with the similar winter condition known as hibernation (*q.v.*). In botany the word is used of the praefloration or folded arrangement of the petals in a flower before expansion in the summer, contrasted with "vernation" of leaves which unfold in the spring.

ÆTHELBALD, king of Mercia, succeeded Ceolred A.D. 716. According to Felix, *Life of St Guthlac*, he visited the saint at Crowland, when exiled by Ceolred and pursued by his emissaries before his accession, and was cheered by predictions of his future greatness. According to Bede, the whole of Britain as far north as the Humber was included within the sphere of his authority. His energy in preserving his influence is shown by several entries in the *Chronicle*. He made an expedition against Wessex in 733, in which year he took the royal vill of Somerton. In 740 he took advantage of the absence of Eadberht of Northumbria in a campaign against the Picts to invade his kingdom. In 743 he fought with Cuthred, king of Wessex, against the Welsh, but the alliance did not last long, as in 752 Cuthred took up arms against him. In 757 Æthelbald was slain by his guards at Seckington (Warwickshire) and buried at Repton. He seems to have been the most powerful and energetic king of Mercia between Penda and Offa. A letter of St Boniface is preserved, in which he rebukes this king for his immoralities and encroachments on church property, while recognizing his merits as a monarch. By a charter of 749 he freed ecclesiastical lands from all obligations except the *trinoda necessitas*.

See Bede, *Hist. Ecc.* (ed. Plummer), v. 23 and Continuatio *s.a.* 740, 750, 757; *Saxon Chronicle* (Earle and Plummer), *s.a.* 716, 733, 737, 740, 741, 743, 755; Mabillon, *Acta Sanctorum*, ii. pp. 264, 275, 276, 279, 283-284; P. Jaffé, *Monumenta Moguntiaca*, iii. pp. 168-177; W. de G. Birch, *Cartul. Saxon.* 178 (1885-1893). (F. G. M. B.)

ÆTHELBALD, king of Wessex, was the son of Æthelwulf, with whom he led the West Saxons to victory against the Danes at Aclea, 851. According to Asser he rebelled against his father on the latter's return from Rome in 856, and deprived him of Wessex, which he ruled until his death in 860. On his father's death in 858 he married his widow, Judith.

See Asser, *Life of Alfred* (W. H. Stevenson, 1904), 12; *Saxon Chronicle, s.a.* 851, 855, 860.

ÆTHELBERHT, king of Kent, son of Eormenric, probably came to the throne in A.D. 560. The first recorded event of his reign was a serious reverse at the hands of Ceawlin of Wessex in the year 568 (*Chronicle*) at a place called Wibbandune. Æthelberht married Berhta, daughter of Charibert, king of Paris, who brought over Bishop Liudhard as her private confessor. According to Bede, Æthelberht's supremacy in 597 stretched over all the English kingdoms as far as the Humber. The nature of this supremacy has been much disputed, but it was at any rate sufficient to guarantee the safety of Augustine in his conference with the British bishops. Æthelberht exercised a stricter sway over Essex, where his nephew Saberht was king. In 597 the mission of Augustine landed in Thanet and was received at first with some hesitation by the king. He seems to have acted with prudence and moderation during the conversion of his kingdom and did not countenance compulsory proselytism. Æthelberht gave Augustine a dwelling-place in Canterbury, and Christ Church was consecrated in 603. He also made grants to found the see of Rochester, of which Justus became first bishop in 604, and his influence established Mellitus at London in the same year. A code of laws issued by him which is still extant is probably the oldest document in the English language, and contains a list of money fines for various crimes. Towards the close of his reign his pre-eminence as Bretwalda was disturbed by the increasing power of Rædwald of East Anglia. He died probably in 616, and was succeeded by his son Eadbald.

See Bede, *Hist. Ecc.* (Plummer) i. 25, 26, ii. 3, 5; *Saxon Chronicle* (Earle and Plummer), *s.a.* 568. (F. G. M. B.)

ÆTHELBERHT, king of the West Saxons, succeeded to the sub-kingdom of Kent during the lifetime of his father Æthelwulf, and retained it until the death of his elder brother Æthelbald in 860, when he became sole king of Wessex and Kent, the younger brothers Æthelred and Alfred renouncing their claim. He ruled these kingdoms for five years and died in 865. His reign was marked by two serious attacks on the part of the Danes, who destroyed Winchester in 860, in spite of the resistance of the ealdormen Osric and Æthelwulf with the levies of Hampshire and Berkshire, while in 865 they treacherously ravaged Kent.

See *Saxon Chronicle* (Earle and Plummer), *s.a.* 860, 865; *King Alfred's Will*; W. de G. Birch, *Cartul. Saxon.* 553.

ÆTHELFLAED (ETHELFLEDA), the "Lady of the Mercians," the eldest child of Alfred the Great, was educated with her brother Edward at her father's court. As soon as she was of marriageable age (probably about A.D. 886), she was married to Æthelred, earl of Mercia, to whom Alfred entrusted the control of Mercia. On the accession of her brother Edward, Æthelflaed and her husband continued to hold Mercia. In 907 they fortified Chester, and in 909 and 910 either Æthelflaed or her husband must have led the Mercian host at the battles of Tettenhall and Wednesfield (or Tettenhall-Wednesfield, if these battles are one and the same). It was probably about this time that Æthelred fell ill, and the Norwegians and Danes from Ireland unsuccessfully besieged Chester. Æthelflaed won the support of the Danes against the Norwegians, and seems also to have entered into an alliance with the Scots and the Welsh against the pagans. In 911 Æthelred died and Edward took over Middlesex and Oxfordshire. Except for this Æthelflaed's authority remained unimpaired. In 912 she fortified "Scergeat" and Bridgenorth, Tamworth and Stafford in 913, Eddisbury and Warwick in 914, Cherbury, "Weardbyrig" and Runcorn in 915. In 916 she sent an expedition against the Welsh, which advanced as far as Brecknock. In 917 Derby was captured from the Danes, and in the next year Leicester and York both submitted to her. She died in the same year at Tamworth (June 12), and was buried in St Peter's church at Gloucester. This noble queen, whose career was as distinguished as that of her father and brother, left one daughter, Ælfwyn. For some eighteen months Ælfwyn seems to have wielded her mother's authority, and then, just before the Christmas of 919, Edward took Mercia into his own hands, and Ælfwyn was "led away" into Wessex. Æthelflaed and her husband wielded almost kingly authority, and the royal title is often given them by the chroniclers.

See *The Saxon Chronicle, sub ann.* (especially the Mercian register in MSS. B, C and D); Florence of Worcester; *Fragments of Irish Annals* (ed. O'Conor), pp. 227-237; D.N.B., *s.v.* (A. Mw.)

ÆTHELFRITH, king of Northumbria, is said to have come to the throne in A.D. 593, being the son of Æthelric (probably reigned 568-572). He married Acha, daughter of Ella (Ælle), king of Deira, whom he succeeded probably in 605, expelling his son Edwin. In 603 he repelled the attack of Aidan, king of the Dalriad Scots, at Daegsastan, defeating him with great loss. The appearance of Hering, son of Hussa, Æthelfrith's predecessor, on the side of the invaders seems to indicate family quarrels in the royal house of Bernicia. Later in his reign, probably in 614, he defeated the Welsh in a great battle at Chester and massacred the monks of Bangor who were assembled to aid them by their prayers. This war may have been due partly to Æthelfrith's persecution of Edwin, but it had a strategic importance in the separation of the North Welsh from the Strathclyde Britons. In 617 Æthelfrith was defeated and slain at the river Idle by Rædwald of East Anglia, whom Edwin had persuaded to take up his cause.

See Bede, *Chronica Majora*, § 531; *Hist. Ecc.* (Plummer) i. 34, ii. 2; *Saxon Chronicle*, *s.a.* 593, 603, 605, 616; *Hist. Brittonum*, §§ 57, 63; *Annales Cambriae*, *s.a.* 613. (F. G. M. B.)

ÆTHELING, an Anglo-Saxon word compounded of *æthele*, or *ethel*, meaning noble, and *ing*, belonging to, and akin to the modern German words *Adel*, nobility, and *adelig*, noble. During the earliest years of the Anglo-Saxon rule in England the word was probably used to denote any person of noble birth. Its use was, however, soon restricted to members of a royal family, and in the *Anglo-Saxon Chronicle* it is used almost exclusively for members of the royal house of Wessex. It was occasionally used after the Norman Conquest to designate members of the royal family. The earlier part of the word formed part of the name of several Anglo-Saxon kings, *e.g.* Æthelbert, Æthelwulf, Æthelred, and was used obviously to indicate their noble birth. According to a document which probably dates from the 10th century, the wergild of an ætheling was fixed at 15,000 thrymsas, or 11,250 shillings. This wergild is equal to that of an archbishop and one-half of that of a king.

ÆTHELNOTH (d. 1038), archbishop of Canterbury, known also as Egelnodus or Ednodus, was a son of the ealdorman Æthelmaer, and a member of the royal family of Wessex. He became a monk at Glastonbury, then dean of the monastery of Christ Church, Canterbury, and chaplain to King Canute, and on the 13th of November 1020 was consecrated archbishop of Canterbury. In 1022 he went to Rome to obtain the pallium, and was received with great respect by Pope Benedict VIII. Returning from Rome he purchased at Pavia a relic said to be an arm of St Augustine of Hippo, for a hundred talents of silver and one of gold, and presented it to the abbey of Coventry. He appears to have exercised considerable influence over Canute, largely by whose aid he restored his cathedral at Canterbury. A story of doubtful authenticity tells how he refused to crown King Harold I., as he had promised Canute to crown none but a son of the king by his wife, Emma. Æthelnoth, who was called the "Good," died on the 29th of October 1038, and his name appears in the lists of saints.

ÆTHELRED, king of Mercia, succeeded his brother Wulfhere in A.D. 675. In 676 he ravaged Kent with fire and sword, destroying the monasteries and churches and taking Rochester. Æthelred married Osthryth, the sister of Ecgfrith, king of Northumbria, but in spite of this connexion a quarrel arose between the two kings, presumably over the possession of the province of Lindsey, which Ecgfrith had won back at the close of the reign of Wulfhere. In a battle on the banks of the Trent in 679, the king of Mercia was victorious and regained the province. Ælfwine, the brother of Ecgfrith, was slain on this occasion, but at the intervention of Theodore, archbishop of Canterbury, Æthelred agreed to pay a wergild for the Northumbrian prince and so prevented further hostilities. Osthryth was murdered in 697 and Æthelred abdicated in 704, choosing Cœnred as his successor. He then became abbot of Bardney, and, according to Eddius, recommended Wilfrid to Cœnred on his return from Rome. Æthelred died at Bardney in 716. (See Wilfrid.)

Sources.—Eddius, *Vita Wilfridi* (Raine), 23 40, 43, 45-48, 57; Bede, *Hist. Ecc.* (ed. Plummer), iii. 11, iv. 12, 21; *Saxon Chronicle*, *s.a.* 676, 679, 704, 716. (F. G. M. B.)

ÆTHELRED I., king of Wessex and Kent (866–871), was the fourth son of Æthelwulf of Wessex, and should, by his father's will, have succeeded to Wessex on the death of his eldest brother Æthelbald. He seems, however, to have stood aside in favour of his brother Æthelberht, king of Kent, to whose joint kingdoms he succeeded in 866. Æthelred's reign was one long struggle against the Danes. In the year of his succession a large Danish force landed in East Anglia, and in the year 868 Æthelred and his brother Alfred went to help Burgred, or Burhred, of Mercia, against this host, but the Mercians soon made peace with their foes. In 871 the Danes encamped at Reading, where they defeated Æthelred and his brother, but later in the year the English won a great victory at "Æscesdun." A fortnight later they were defeated at Basing, but partially retrieved their fortune by a victory at "Mæretun" (perhaps Marden in Wiltshire), though the Danes held the field. In the Easter of this year Æthelred died, perhaps of wounds received in the wars against the Danes, and was buried at Wimborne. He left a son, Æthelwold, who gave some trouble to his cousin Edward the Elder, when the latter succeeded to the kingdom. Æthelweard the historian was also a descendant of this king.

Authorities.—*The Saxon Chronicle*, *sub ann.*; Birch, *Cartul. Saxon.* vol. ii. Nos. 516-526; D.N.B., *s.v.*; *Eng. Hist. Review*, i. 218-234. (A. Mw.)

ÆTHELRED II. (or Ethelred) (*c.* 968–1016), king of the English (surnamed The Unready, *i.e.* without *rede* or counsel), son of King Edgar by his second wife Ælfthryth, was born in 968 or 969 and succeeded to the throne on the murder of his step-brother Edward (the Martyr) in 979. His reign was disastrous from the beginning. The year after his accession the Danish invasions, long unintermitted under Edgar the Peaceful, recommenced; though as yet their object was plunder only, not conquest, and the attacks were repeated in 981, 982 and 988. In 991 the Danes burned Ipswich, and defeated and slew the East Saxon ealdorman Brihtnoth at Maldon. After this, peace was purchased by a payment of £10,000—a disastrous expedient. The Danes were to desist from their ravages, but were allowed to stay in England. Next year Æthelred himself broke the peace by an attack on the Danish ships. Despite the treachery of Ælfric, the English were victorious; and the Danes sailed off to ravage Lindsey and Northumbria. In 994 Olaf Tryggvason, king of Norway, and Sweyn, king of Denmark, united in a great invasion and attacked London. Foiled by the valour of the citizens, they sailed away and harried the coast from Essex to Hampshire. Æthelred now resorted to the old experiment and bought them off for £16,000 and a promise of supplies. Olaf also visited Æthelred at the latter's request and, receiving a most honourable welcome, was induced to promise that he would never again come to England with hostile intent, an engagement which he faithfully kept. The Danish attacks were repeated in 997, 998, 999, and in 1000 Æthelred availed himself of the temporary absence of the Danes in Normandy to invade Cumberland, at that time a Viking stronghold. Next year, however, the Northmen returned and inflicted worse evil than ever. The national defence seemed to have broken down altogether. In despair Æthelred again offered them money, which they again accepted, the sum paid on this occasion being £24,000. But soon afterwards the king, suspecting treachery, resolved to get rid of his enemies once and for all. Orders were issued commanding the slaughter on St Brice's day (December 2) of "all the Danish men who were in England." Such a decree could obviously not be carried out literally; but we cannot doubt that the slaughter was great. This violence, however, only made matters worse. Next year Sweyn returned, his hostility fanned by the desire for revenge. For two years he ravaged and slew; in 1003 Exeter was destroyed; Norwich and Thetford in 1004. No effectual resistance was offered, despite a gallant effort here and there; the disorganization of the country was complete. In 1005 the Danes were absent in Denmark, but came back next year, and emboldened by the utter lack of resistance, they ranged far inland. In 1007 Æthelred bought them off for a larger sum than ever (£36,000), and for two years the land enjoyed peace. In 1009, however, in accordance with a resolution made by the witan in the preceding year, Æthelred collected such a fleet "as never before had been in England in any king's day"; but owing to a miserable court quarrel the effort came to nothing. The king then summoned a general levy of the nation, with no better result. Just as he was about to attack, the traitor Edric prevented him from doing so, and the opportunity was lost. In 1010 the Danes returned, to find the kingdom more utterly disorganized than ever. "There was not a chief man in the kingdom who could gather a force, but each fled as he best might; nor even at last would any there resist another." Incapable of offering resistance, the king again offered money, this time no less than £48,000. While it was being collected, the Danes sacked Canterbury and barbarously slew the archbishop Alphege. The tribute was paid soon afterwards; and about the same time the Danish leader Thurkill entered the English service. From 1013 an important change is discernible in the character of the Danish attacks, which now became definitely political in their aim. In this year Sweyn sailed up the Trent and received the submission of northern England, and then marching south, he attacked London. Failing to take it, he hastened west and at Bath received the submission of Wessex. Then he returned northwards, and after that "all the nation considered him as full king." London soon acknowledged him, and Æthelred, after taking refuge for a while with Thurkill's fleet, escaped to Normandy. Sweyn died in February 1014, and Æthelred was recalled by the witan, on giving a promise to reign better in future. At once he hastened north against Canute, Sweyn's son, who claimed to succeed his father, but Canute sailed away, only to return next year, when the traitor Edric joined him and Wessex submitted. Together Canute and Edric harried Mercia, and were preparing to reduce London, when Æthelred died there on the 23rd of April 1016. Weak, self-indulgent, improvident, he had pursued a policy of opportunism to a fatal conclusion.

Æthelred's wife was Emma, or Ælfgifu, daughter of Richard I. the Fearless, duke of the Normans, whom he married in 1002. After the king's death Emma became the wife of Canute the Great, and after his death in 1035 she struggled hard to secure England for her son, Hardicanute. In 1037, however, when Harold Harefoot became sole king, she was banished; she went to Flanders, returning to England with Hardicanute in 1040. In 1043, after Edward the Confessor had become king he seized the greater part of Emma's great wealth, and the queen lived in retirement at Winchester until her death on the 6th of March 1052. By Æthelred Emma had two sons, Edward the Confessor and the ætheling Ælfred (d. 1036), and by Canute she was the mother of Hardicanute. Emma's marriage with Æthelred was an important step in the history of the relations between England and Normandy, and J. R. Green says "it suddenly opened for its rulers a distinct policy, a distinct course of action, which led to the Norman conquest of England. From the moment of Emma's marriage Normandy became a chief factor in English politics."

Authorities.—*The Anglo-Saxon Chronicle* (edition by C. Plummer, 2 vols. Oxford, 1892–1899); Florence of Worcester (ed. B. Thorpe, London, 1848–1849); *Encomium Emmae* (ed. by G. H. Pertz in the *Scriptores Rerum Germanicarum*, Band xix., Hanover, 1866) for the latter part of the reign. See also J. M. Kemble, *Codex Diplomaticus aevi Saxonici* (London, 1839–1848); and B. Thorpe, *Ancient Laws* (London, 1840). (C. S. P.*)

ÆTHELSTAN (*c.* 894–940), Saxon king, was the son (probably illegitimate) of Edward the elder. He had been the favourite of his grandfather Alfred, and was brought up in the household of his aunt Æthelflaed, the "Lady of the Mercians." On the death of his father in 924, at some date after the 12th of November, Æthelstan succeeded him and was crowned at Kingston shortly after. The succession did not, however, take place without opposition. One Ælfred, probably a descendant of Æthelred I., formed a plot to seize the king at Winchester; the plot was discovered and Ælfred was sent to Rome to defend himself, but died shortly after. The king's own legitimate brother Edwin made no attempt on the throne, but in 933 he was drowned at sea under somewhat mysterious circumstances; the later chroniclers ascribe his death to foul play on the part of the king, but this seems more than doubtful.

One of Æthelstan's first public acts was to hold a conference at Tamworth with Sihtric, the Scandinavian king of Northumbria, and as a result Sihtric received Æthelstan's sister in marriage. In the next year Sihtric died and Æthelstan took over the Northumbrian kingdom. He now received, at Dacre in Cumberland, the submission of all the kings of the island, viz. Howel Dda, king of West Wales, Owen, king of Cumbria, Constantine, king of the Scots, and Ealdred of Bamburgh, and henceforth he calls himself "rex totius Britanniae." About this time (the exact chronology is uncertain) Æthelstan expelled Sihtric's brother Guthfrith, destroyed the Danish fortress at York, received the submission of the Welsh at Hereford, fixing their boundary along the line of the Wye, and drove the Cornishmen west of the Tamar, fortifying Exeter as an English city.

In 934 he invaded Scotland by land and sea, perhaps owing to an alliance between Constantine and Anlaf Sihtricsson. The army advanced as far north as Dunottar, in Kincardineshire, while the navy sailed to Caithness. Simeon of Durham speaks of a submission of Scotland as a result; if it ever took place it was a mere form, for three years later we find a great confederacy formed in Scotland against Æthelstan. This confederacy of 937 was joined by Constantine, king of Scotland, the Welsh of Strathclyde, and the Norwegian chieftains Anlaf Sihtricsson and Anlaf Godfredsson, who, though they came from Ireland, had powerful English connexions. A great battle was fought at Brunanburh (perhaps Brunswark or Birrenswark hill in S.E. Dumfriesshire), in which Æthelstan and his brother Edmund were completely victorious. England had been freed from its greatest danger since the days of the struggle of Alfred against Guthrum.

Æthelstan was the first Saxon king who could claim in any real sense to be lord paramount of Britain. In his charters he is continually called "rex totius Britanniae," and he adopts for the first time the Greek title *basileus*. This was not merely an idle flourish, for some of his charters are signed by Welsh and Scottish kings as *subreguli*. Further, Æthelstan was the first king to bring England into close touch with continental Europe. By the marriage of his half-sisters he was brought into connexion with the chief royal and princely houses of France and Germany. His sister Eadgifu married Charles the Simple, Eadhild became the wife of Hugh the Great, duke of France, Eadgyth was married to the emperor Otto the Great, and her sister Ælfgifu to a petty German prince. Embassies passed between Æthelstan and Harold Fairhair, first king of Norway, with the result that Harold's son Haakon was brought up in England and is known in Scandinavian history as Haakon Adalsteinsfóstri.

Æthelstan died at Gloucester in 940, and was buried at Malmesbury, an abbey which he had munificently endowed during his lifetime. Apparently he was never married, and he certainly had no issue.

A considerable body of law has come down to us in Æthelstan's name. The chief collections are those issued at Grately in Hampshire, at Exeter, at *Thunresfeld*, and the *Judicia civitatis Lundonie*. In the last-named one personal touch is found when the king tells the archbishop how grievous it is to put to death persons of twelve winters for stealing. The king secured the raising of the age limit to fifteen.

Authorities.—Primary: *The Saxon Chronicle*, *sub ann.*; William of Malmesbury, *Gesta Regum*, i. 141-157, Rolls Series, containing valuable original information (*v.* Stubbs' Introduction, II. lx.-lxvii.); Birch, *Cartul. Saxon.* vol. ii. Nos. 641-747; A.S. Laws, (ed. Liebermann), i. 146-183; Æthelweard, Florence of Worcester. Secondary: *Saxon Chronicle* (ed. Plummer), vol. ii. pp. 132-142; D.N.B., *s.v.* (A. Mw.)

ÆTHELWEARD (Ethelward), Anglo-Saxon historian, was the great-grandson of Æthelred, the brother of Alfred, and ealdorman or earl of the western provinces (*i.e.* probably of the whole of Wessex). He first signs as *dux* or ealdorman in 973, and continues to sign until 998, about which time his death must have taken place. In the year 991 he was associated with archbishop Sigeric in the conclusion of a peace with the victorious Danes from Maldon, and in 994 he was sent with Bishop Ælfheah (Alphege) of Winchester to make peace with Olaf at Andover. Æthelweard was the author of a Latin Chronicle extending to the year 975. Up to the year 892 he is largely dependent on the *Saxon Chronicle*, with a few details of his own; later he is largely independent of it. Æthelweard gave himself the bombastic title "Patricius Consul Quaestor Ethelwerdus," and unfortunately this title is only too characteristic of the man. His narrative is highly rhetorical, and as he at the same time attempts more than Tacitean brevity his narrative is often very obscure. Æthelweard was the friend and patron of Ælfric the grammarian.

Authorities.—Primary: *The Saxon Chronicle*, 994 E; Birch, *Cartularium Saxonicum*; A.S. Laws (ed. Liebermann), pp. 220-224; *Fabii Ethelwerdi Chron.*, Mon. Hist. Brit. 449-454. Secondary: Plummer, *Saxon Chronicle*, vol. ii. p. ci.; Napier and Stevenson, *Crawford Charters*, pp. 118-120; D.N.B., *s.v.* (A. Mw.)

ÆTHELWULF, king of the West Saxons, succeeded his father Ecgberht in A.D. 839. It is recorded in the *Saxon Chronicle* for 823 that he was sent with Eahlstan, bishop of Sherborne, and the ealdorman Wulfheard to drive out Baldred, king of Kent, which was successfully accomplished. On the accession of Æthelwulf, Æthelstan, his son or brother, was made sub-king of Kent, Surrey, Sussex and Essex. Æthelwulf's reign was chiefly occupied with struggles against the Danes. After the king's defeat 843–844, the Somerset and Dorset levies won a victory at the mouth of the Parret, *c.* 850. In 851 Ceorl, with the men of Devon, defeated the Danes at Wigganburg, and Æthelstan of Kent was victorious at Sandwich, in spite of which they wintered in England that year for the first time. In 851 also Æthelwulf and Æthelbald won their great victory at Aclea, probably the modern Ockley. In 853 Æthelwulf subdued the North Welsh, in answer to the appeal of Burgred of Mercia, and gave him his daughter Æthelswith in marriage. 855 is the year of the Donation of Æthelwulf and of his journey to Rome with Alfred. On his way home he married Judith, daughter of Charles the Bald. According to Asser he was compelled to give up Wessex to his son Æthelbald on his return, and content himself with the eastern sub-kingdom. He died in 858.

See Asser, *Life of Alfred* (W. H. Stevenson, 1904), 1-16; *Saxon Chronicle, s.a.* 823, 836, 840, 851, 853, 855. (F. G. M. B.)

AETHER, or ETHER (Gr. *αἰθήρ*, probably from *αἴθω*, I burn, though Plato in his *Cratylus* (410 B) derives the name from its perpetual motion—*ὅτι ἀεὶ θεῖ περὶ τὸν ἀέρα ῥέων, ἀειθεὴρ δικαίως ἂν καλοῖτο*), a material substance of a more subtle kind than visible bodies, supposed to exist in those parts of space which are apparently empty.

"The hypothesis of an aether has been maintained by different speculators for very different reasons. To those who maintained the existence of a plenum as a philosophical principle, nature's abhorrence of a vacuum was a sufficient reason for imagining an all-surrounding aether, even though every other argument should be against it. To Descartes, who made extension the sole essential property of matter, and matter a necessary condition of extension, the bare existence of bodies apparently at a distance was a proof of the existence of a continuous medium between them. But besides these high metaphysical necessities for a medium, there were more mundane uses to be fulfilled by aethers. Aethers were invented for the planets to swim in, to constitute electric atmospheres and magnetic effluvia, to convey sensations from one part of our bodies to another, and so on, till all space had been filled three or four times over with aethers. It is only when we remember the extensive and mischievous influence on science which hypotheses about aethers used formerly to exercise, that we can appreciate the horror of aethers which sober-minded men had during the 18th century, and which, probably as a sort of hereditary prejudice, descended even to John Stuart Mill. The disciples of Newton maintained that in the fact of the mutual gravitation of the heavenly bodies, according to Newton's law, they had a complete quantitative account of their motions; and they endeavoured to follow out the path which Newton had opened up by investigating and measuring the attractions and repulsions of electrified and magnetic bodies, and the cohesive forces in the interior of bodies, without attempting to account for these forces. Newton himself, however, endeavoured to account for gravitation by differences of pressure in an aether; but he did not publish his theory, 'because he was not able from experiment and observation to give a satisfactory account of this medium, and the manner of its operation in producing the chief phenomena of nature.' On the other hand, those who imagined aethers in order to explain phenomena could not specify the nature of the motion of these media, and could not prove that the media, as imagined by them, would produce the effects they were meant to explain. The only aether which has survived is that which was invented by Huygens to explain the propagation of light. The evidence for the existence of the luminiferous aether has accumulated as additional phenomena of light and other radiations have been discovered; and the properties of this medium, as deduced from the phenomena of light, have been found to be precisely those required to explain electromagnetic phenomena."

This description, quoted from James Clerk Maxwell's article in the 9th edition of the *Encyclopaedia Britannica*, represents the historical position of the subject up till about 1860, when Maxwell began those constructive speculations in electrical theory, based on the influence of the physical views of Faraday and Lord Kelvin, which have in their subsequent development largely transformed theoretical physics into the science of the aether.

In the remainder of the article referred to, Maxwell reviews the evidence for the necessity of an aether, from the fact that light takes time to travel, while it cannot travel as a substance, for if so two interfering lights could not mask each other in the dark fringes (see INTERFERENCE OF LIGHT). Light is therefore an influence propagated as wave-motion, and moreover by transverse undulations, for the reasons brought out by Thomas Young and Augustin Fresnel; so that the aether is a medium which possesses elasticity of a type analogous to rigidity. It must be very different from ordinary matter as we know it, for waves travelling in matter constitute sound, which is propagated hundreds of thousands of times slower than light.

If we suppose that the aether differs from ordinary matter in degree but not in kind, we can obtain some idea of its quality from a knowledge of the velocity of radiation and of its possible intensity near the sun, in a manner applied long ago by Lord Kelvin (*Trans. R. S. Edin.* xxi. 1854). According to modern measurements the solar radiation imparts almost 3 gramme-calories of energy per minute per square centimetre at the distance of the earth, which is about $1\cdot3\times10^{6}$ ergs per sec. per cm.^{2} The energy in sunlight per cubic cm. just outside the earth's atmosphere is therefore about 4×10^{-5} ergs; applying the law of inverse squares the value near the sun's surface would be 1·8 ergs. Let E be the effective elasticity of the aether; then $E=\rho c^{2}$, where ρ is its density, and c the velocity of light which is 3×10^{10} cm./sec. If $\xi=A\cos^{n}(t-x/c)$ is the linear vibration, the stress is $E\,d\xi/dx$; and the total energy, which is twice the kinetic energy $\frac{1}{2}\rho(d\xi/dt)^{2}dx$, is $\frac{1}{2}\rho n^{2}A^{2}$ per cm., which is thus equal to 1·8 ergs as above. Now $\lambda=2\pi c/n$, so that if $A/\lambda=k$, we have $\frac{1}{2}\rho(2\pi ck)^{2}=1\cdot8$, giving $\rho=10^{-22}k^{-2}$ and $E=10^{-1}k^{-2}$. Lord Kelvin assumed as a superior limit of k, the ratio of amplitude to wave-length, the value 10^{-2}, which is a very safe limit. It follows that the density of the aether must exceed 10^{-18}, and its elastic modulus must exceed 10^{3}, which is only about 10^{-8} of the modulus of rigidity of glass. It thus appears that if the amplitude of vibration could be as much as 10^{-2} of the wave-length, the aether would be an excessively rare medium with very slight elasticity; and yet it would be capable of transmitting the supply of solar energy on which all terrestrial activity depends. But on the modern theory, which includes the play of electrical phenomena as a function of the aether, there are other considerations which show that this number 10^{-2} is really an enormous overestimate; and it is not impossible that the co-efficient of ultimate inertia of the aether is greater than the co-efficient of inertia (of different kind) of any existing material substance.

The question of whether the aether is carried along by the earth's motion has been considered from the early days of the undulatory theory of light. In reviving that theory at the beginning of the 19th century, Thomas Young stated his conviction that material media offered an open structure to the substance called aether, which passed through them without hindrance "like the wind through a grove of trees." Any convection of that medium could be tested by the change of effective velocity of light, which would be revealed by a prism as was suggested by F. J. D. Arago. Before 1868 Maxwell conducted the experiment by sending light from the illuminated cross-wires of an observing telescope forward through the object-glass, and through a train of prisms, and then reflecting it back along the same path; any influence of convection would conspire in altering both refractions, but yet no displacement of the image depending on the earth's motion was detected. As will be seen later, modern experiments have confirmed the entire absence of any effect, such as convection would produce, to very high precision. It has further been verified by Sir Oliver Lodge that even in very narrow spaces the aether is not entrained by its surroundings when they are put into rapid motion.

A train of ideas which strongly impressed itself on Clerk Maxwell's mind, in the early stages of his theoretical views, was put forward by Lord Kelvin in 1858; he showed that the special characteristics of the rotation of the plane of polarization, discovered by Faraday in light propagated along a magnetic field, viz. that it is doubled instead of being undone when the light retraces its path, requires the operation of some directed agency of a rotational kind, which must be related to the magnetic field. Lord Kelvin was thereby induced to identify magnetic force with rotation, involving, therefore, angular momentum in the aether. Modern theory accepts the deduction, but ascribes the momentum to the revolving ions in the molecules of matter traversed by the light; for the magneto-optic effect is present only in material media. Long previously Lord Kelvin himself came nearer this view, in offering the opinion that magnetism consisted, in some way, in the angular momentum of the material molecules, of which the energy of irregular translations constitutes heat; but the essential idea of moving electric ions of both kinds, positive and negative, in the molecules had still to be introduced.

The question of the transparency of the celestial spaces presents itself in the present connexion. Light from stars at unfathomable distances reaches us in such quantity as to suggest that space itself is absolutely transparent, leaving open the question as to whether there is enough matter scattered through it to absorb a sensible part of the light in its journey of years from the luminous body. If the aether were itself constituted of discrete molecules, on the model of material bodies, such transparency would not be conceivable. We must be content to treat the aether as a *plenum*, which places it in a class by itself; and we can thus recognize that it may behave very differently from matter, though in some manner consistent with itself—a remark which is fundamental in the modern theory.

Action across a Distance contrasted with Transmitted Action.—In the mechanical processes which we can experimentally modify at will, and which therefore we learn to apprehend with greatest fulness, whenever an effect on a body, B, is in causal connexion with a process instituted in another body, A, it is usually possible to discover a mechanical connexion between the two bodies which allows the influence of A to be traced all the way across the intervening region. The question thus arises whether, in electric attractions across apparently empty space and in gravitational attraction across the celestial regions, we are invited or required to make search for some similar method of continuous transmission of the physical effect, or whether we should rest content with an exact knowledge of the laws according to which one body affects mechanically another body at a distance. The view that our knowledge in such cases may be completely represented by means of laws of action at a distance, expressible in terms of the positions (and possibly motions) of the interacting bodies without taking any heed of the intervening space, belongs to modern times. It could hardly have been thought of before Sir Isaac Newton's discovery of the actual facts regarding universal gravitation. Although, however, gravitation has formed the most perfect instance of an influence completely expressible, up to the most extreme refinement of accuracy, in terms of laws of direct action across space, yet, as is well known, the author of this ideally simple and perfect theory held the view that it is not possible to conceive of direct mechanical action independent of means of transmission. In this belief he differed from his pupil, Roger Cotes, and from most of the great mathematical astronomers of the 18th century, who worked out in detail the task sketched by the genius of Newton. They were content with a knowledge of the truth of the principle of gravitation; instead of essaying to explain it further by the properties of a transmitting medium, they in fact modelled the whole of their natural philosophy on that principle, and tried to express all kinds of material interaction in terms of laws of direct mechanical attraction across space. If material systems are constituted of discrete atoms, separated from each other by many times the diameter of any of them, this simple plan of exhibiting their interactions in terms of direct forces between them would indeed be exact enough to apply to a wide range of questions, provided we could be certain that the laws of the forces depended only on the positions and not also on the motions of the atoms. The most important example of its successful application has been the theory of capillary action elaborated by P. S. Laplace; though even here it appeared, in the hands of Young, and in complete fulness afterwards in those of C. F. Gauss, that the definite results attainable by the hypothesis of mutual atomic attractions really reposed on much wider and less special principles—those, namely, connected with the modern doctrine of energy.

Idea of an Aether.—The wider view, according to which the hypothesis of direct transmission of physical influences expresses only part of the facts, is that all space is filled with physical activity, and that while an influence is passing across from a body, A, to another body, B, there is some dynamical process in action in the intervening region, though it appears to the senses to be mere empty space. The problem is whether we can represent the facts more simply by supposing the intervening space to be occupied by a medium which transmits physical actions, after the manner that a continuous material medium, solid or liquid, transmits mechanical disturbance. Various analogies of this sort are open to us to follow up: for example, the way in which a fluid medium transmits pressure from one immersed solid to another—or from one vortex ring belonging to the fluid to another, which is a much wider and more suggestive case; or the way in which an elastic fluid like the atmosphere transmits sound; or the way in which an elastic solid transmits waves of transverse as well as longitudinal displacement. It is on our familiarity with modes of transmission such as these, and with the exact analyses of them which the science of mathematical physics has been able to make, that our predilection for filling space with an aethereal transmitting medium, constituting a universal connexion between material bodies, largely depends; perhaps ultimately it depends most of all, like all our physical conceptions, on the intimate knowledge that we can ourselves exert mechanical effect on outside bodies only through the agencies of our limbs and sinews. The problem thus arises, Can we form a consistent notion of such a connecting medium? It must be a medium which can be effective for transmitting all the types of physical action known to us; it would be worse than no solution to have one medium to transmit gravitation, another to transmit electric effects, another to transmit light, and so on. Thus the attempt to find out a constitution for the aether will involve a synthesis of intimate correlation of the various types of physical agencies, which appear so different to us mainly because we perceive them through different senses. The evidence for this view, that all these agencies are at bottom connected together and parts of the same scheme, was enormously strengthened during the latter half of the 19th century by the development of a relation of simple quantitative equivalence between them; it has been found that we can define quantities relating to them, under the names of mechanical energy, electric energy, thermal energy, and so on, so that when one of them disappears, it is replaced by the others to exactly equal amount. This single principle of energy has transformed physical science by making possible the construction of a network of ramifying connexions between its various departments; it thus stimulates the belief that these constitute a single whole, and encourages the search for the complete scheme of interconnexion of which the principle of energy and the links which it suggests form only a single feature.

In carrying out this scientific procedure false steps will from time to time be made, which will have to be retraced, or rather amended; but the combination of experimental science with theory has elevated our presumption of the rationality of all natural processes, so far as we can apprehend them at all, into practical certainty; so that, though the mode of presentation of the results may vary from age to age, it is hardly conceivable that the essentials of the method are not of permanent validity.

Atomic Structure of Matter.—The greatest obstacle to such a search for the fundamental medium is the illimitable complexity of matter, as contrasted with the theoretical simplicity and uniformity of the physical agencies which connect together its different parts. It has been maintained since the times of the early Greek philosophers, and possibly even more remote ages, that matter is constituted of independent indestructible units, which cannot ever become divided by means of any mutual actions they can exert. Since the period, a century ago, when Dalton and his contemporaries constructed from this idea a scientific basis for chemistry, the progress of that subject has been wonderful beyond any conception that could previously have been entertained; and the atomic theory in some form appears to be an indispensable part of the framework of physical science. Now this doctrine of material atoms is an almost necessary corollary to the doctrine of a universal aether. For if we held that matter is continuous, one of two alternatives would be open. We might consider that matter and aether can co-exist in the same space; this would involve the co-existence and interaction of a double set of properties, introducing great complication, which would place any coherent scheme of physical action probably beyond the powers of human analysis. Or we might consider that aether exists only where matter is not, thus making it a very rare and subtle and elastic kind of matter; then we should have to assign these very properties to the matter itself where it replaces aether, in addition to its more familiar properties, and the complication would remain. The other course is to consider matter as formed of ultimate atoms, each the nucleus or core of an intrinsic modification impressed on the surrounding region of the aether; this might conceivably be of the nature of vortical motion of a liquid round a ring-core, thus giving a vortex atom, or of an intrinsic strain of some sort radiating from a core, which would give an electric atom. We recognize an atom only through its physical activities, as manifested in its interactions with other atoms at a distance from it; this field of physical activity would be identical with the surrounding field of aethereal motion or strain that is inseparably associated with the nucleus, and is carried on along with it as it moves. Here then we have the basis of a view in which there are not two media to be considered, but one medium, homogeneous in essence and differentiated as regards its parts only by the presence of nuclei of intrinsic strain or motion—in which the physical activities of matter are identified with those arising from the atmospheres of modified aether which thus belong to its atoms. As regards laws of general physical interactions, the atom is fully represented by the constitution of this atmosphere, and its nucleus may be left out of our discussions; but in the problems of biology great tracts of invariable correlations have to be dealt with, which seem hopelessly more complex than any known or humanly possible physical scheme. To make room for these we have to remember that the atomic nucleus has remained entirely undefined and beyond our problem; so that what may occur, say when two molecules come into close relations, is outside physical science—not, however, altogether outside, for we know that when the vital *nexus* in any portion of matter is dissolved, the atoms will remain, in their number, and their atmospheres, and all inorganic relations, as they were before vitality supervened.

Nature of Properties of Material Bodies.—It thus appears that the doctrine of atomic material constitution and the doctrine of a universal aether stand to each other in a relation of mutual support; if the scheme of physical laws is to be as precise as observation and measurement appear to make it, both doctrines are required in our efforts towards synthesis. Our direct knowledge of matter can, however, never be more than a rough knowledge of the general average behaviour of its molecules; for the smallest material speck that is sensible to our coarse perceptions contains myriads of atoms. The properties of the most minute portion of matter which we can examine are thus of the nature of averages. We may gradually invent means of tracing more and more closely the average drifts of translation or orientation, or of changes of arrangement, of the atoms; but there will always remain an unaveraged residue devoid of any recognized regularity, which we can only estimate by its total amount. Thus, if we are treating of energy, we can separate out mechanical and electric and other constituents in it; and there will be a residue of which we know nothing except its quantity, and which we call thermal. This merely thermal energy—which is gradually but very slowly being restricted in amount as new subsidiary organized types become recognized in it—though transmutable in equivalent quantities with the other kinds, yet is so only to a limited extent; the tracing out of the laws of this limitation belongs to the science of thermodynamics. It is the business of that science to find out what is the greatest amount of thermal energy that can possibly be recoverable into organized kinds under given circumstances. The discovery of definite laws in this region might at first sight seem hopeless; but the argument rests on an implied postulate of stability and continuity of constitution of material substances, so that after a cycle of transformations we expect to recover them again as they were originally—on the postulate, in fact, that we do not expect them to melt out of organized existence in our hands. The laws of thermodynamics, including the fundamental principle that a physical property, called temperature, can be defined, which tends towards uniformity, are thus relations between the properties of types of material bodies that can exist permanently in presence of each other; why they so maintain themselves remains unknown, but the fact gives the *point d'appui*. The fundamental character of energy in material systems here comes into view; if there were any other independent scalar entity, besides mass and energy, that pervaded them with relations of equivalence, we should expect the existence of yet another set of qualities analogous to those connected with temperature. (See ENERGETICS.)

Returning now to the aether, on our present point of view no such complications there arise; it must be regarded as a continuous uniform medium free from any complexities of atomic aggregation, whose function is confined to the transmission of the various types of physical effect between the portions of matter. The problem of its constitution is thus one which can be attacked and continually approximated to, and which may possibly be definitely resolved. It has to be competent to transmit the transverse waves of light and electricity, and the other known radiant and electric actions; the way in which this is done is now in the main known, though there are still questions as to the mode of expression and formulation of our knowledge, and also as regards points of detail. This great advance, which is the result of the gradual focussing of a century's work in the minute exploration of the exact laws of optical and electric phenomena, clearly carries with it deeper insight into the physical nature of matter itself and its modes of inanimate interaction.

If we rest on the synthesis here described, the energy of the matter, even the thermal part, appears largely as potential energy of strain in the aether which interacts with the kinetic energy associated with disturbances involving finite velocity of matter. It may, however, be maintained that an ultimate analysis would go deeper, and resolve all phenomena of elastic resilience into consequences of the kinetic stability of steady motional states, so that only motions, but not strains, would remain. On such a view the aether might conceivably be a perfect fluid, its fundamental property of elastic reaction arising (as at one time suggested by Kelvin and G. F. FitzGerald) from a structure of tangled or interlaced vortex filaments pervading its substance, which might conceivably arrange themselves into a stable configuration and so resist deformation. This raises the further question as to whether the transmission of gravitation can be definitely recognized among the properties of an ultimate medium; if so, we know that it must be associated with some feature, perhaps very deep-seated, or on the other hand perhaps depending simply on incompressibility, which is not sensibly implicated in the electric and optical activities. With reference to all such further refinements of theory, it is to be borne in mind that the perfect fluid of hydrodynamic analysis is not a merely passive inert *plenum*; it is also a *continuum* with the property that no finite internal slip or discontinuity of motion can ever arise in it through any kind of disturbance; and this property must be postulated, as it cannot be explained.

Motion of Material Atoms through the Aether.—An important question arises whether, when a material body is moved through the aether, the nucleus of each atom carries some of the surrounding aether along with it; or whether it practically only carries on its strain-form or physical atmosphere, which is transferred from one portion of aether to another after the manner of a shadow, or rather like a loose knot which can slip along a rope without the rope being required to go with it. We can obtain a pertinent illustration from the motion of a vortex ring in a fluid; if the circular core of the ring is thin compared with its diameter, and the vorticity is not very great, it is the vortical state of motion that travels across the fluid without transporting the latter bodily with it except to a slight extent very close to the core. We might thus examine a structure formed of an aggregation of very thin vortex rings, which would move across the fluid without sensibly disturbing it; on the other hand, if formed of stronger vortices, it may transport the portion of the fluid that is within, or adjacent to, its own structure along with it as if it were a solid mass, and therefore also push aside the surrounding fluid as it passes. The motion of the well-known steady spherical vortex is an example of the latter case.

Convection of Optical Waves.—The nature of the motion, if any, that is produced in the surrounding regions of the aether by the translation of matter through it can be investigated by optical experiment. The obvious body to take in the first instance is the earth itself, which on account of its annual orbital motion is travelling through space at the rate of about 18 miles per second. If the surrounding aether is thereby disturbed, the waves of light arriving from the stars will partake of its movement; the ascertained phenomena of the astronomical aberration of light show that the rays travel to the observer, across this disturbed aether near the earth, in straight lines. Again, we may split a narrow beam of light by partial reflexion from a transparent plate, and recombine the constituent beams after they have traversed different circuits of nearly equivalent lengths, so as to obtain interference fringes. The position of these fringes will depend on the total retardation in time of the one beam with respect to the other; and thus it might be expected to vary with the direction of the earth's motion relative to the apparatus. But it is found not to vary at all, even up to the second order of the ratio of the earth's velocity to that of light. It has in fact been found, with the very great precision of which optical experiment is capable, that all terrestrial optical phenomena—reflexion, refraction, polarization linear and circular, diffraction—are entirely unaffected by the direction of the earth's motion, while the same result has recently been extended to electrostatic forces; and this is our main experimental clue.

We pass on now to the theory. We shall make the natural supposition that motion of the aether, say with velocity (u,v,w) at the point (x,y,z), is simply superposed on the velocity V of the optical undulations through that medium, the latter not being intrinsically altered. Now the direction and phase of the light are those of the ray which reaches the eye; and by Fermat's principle, established by Huygens for undulatory motion, the path of a ray is that track along which the disturbance travels in least time, in the restricted sense that any alteration of any *short* reach of the path will increase the time. Thus the path of the ray when the aether is at rest is the curve which makes $\int ds/V$ least; but when it is in motion it is the curve which makes $\int ds/(V+lu+mv+nw)$ least, where (l,m,n) is the direction vector of δs. The latter integral becomes, on expanding in a series,

$$\int ds/V-\int(udx+vdy+wdz)/V^2+\int(udx+vdy+wdz)^2/V^3ds+\ldots,$$

since $lds=dx$. If the path is to be unaltered by the motion of the aether, as the law of astronomical aberration suggests, this must differ from $\int ds/V$ by terms not depending on the path—that is, by terms involving only the beginning and end of it. In the case of the free aether V is constant; thus, if we neglect squares like $(u/V)^2$, the condition is that $udx+vdy+wdz$ be the exact differential of some function ϕ. If this relation is true along all paths, the velocity of the aether must be of irrotational type, like that of frictionless fluid. Moreover, this is precisely the condition for the absence of interference between the component of a split beam; because, the time of passage being to the first order

$$\int ds/V-\int(udx+vdy+wdz)V^2,$$

the second term will then be independent of the path (ϕ being a single valued function) and therefore the same for the paths of both the interfering beams. If therefore the aether can be put into motion, we conclude (with Stokes) that such motion, in free space, must be of strictly irrotational type.

But our experimental data are not confined to free space. If c is the velocity of radiation in free space and μ the refractive index of a transparent body, $V=c/\mu$; thus it is the expression $c^{-2}\int\mu^2(u'dx+v'dy+w'dz)$ that is to be integrable explicitly, where now (u',v',w') is what is added to V owing to the velocity (u,v,w) of the medium. As, however, our terrestrial optical apparatus is now all in motion along with the matter, we must deal with the rays relative to the moving system, and to these also Fermat's principle clearly applies; thus $V+(lu'+mv'+nw')$ is here the velocity of radiation in the direction of the ray, but relative to the moving material system. Now the expression above given cannot be integrable exactly, under all circumstances and whatever be the axes of co-ordinates, unless $(\mu^2u',\mu^2v',\mu^2w')$ is the gradient of a continuous function. In the simplest case, that of uniform translation, these components of the gradient will each be constant throughout the region; at a distant place in free aether where there is no motion, they must thus be equal to $-u,-v,-w$, as they refer to axes moving with the matter. Hence the paths and times of passage of all rays relative to the material system will not be altered by a uniform motion of the system, provided the velocity of radiation relative to the system, in material of index μ, is diminished by μ^{-2} times the velocity of the system in the direction of the radiation, that is, provided the absolute velocity of radiation is increased by $1-\mu^{-2}$ times the velocity of the material system; this involves that the free aether for which μ is unity shall remain at rest. This statement constitutes the famous hypothesis of Fresnel, which thus ensures that all phenomena of ray-path and refraction, and all those depending on phase, shall be unaffected by uniform convection of the material medium, in accordance with the results of experiment.

Is the Aether Stationary or Mobile?—This theory secures that the times of passage of the rays shall be independent of the motion of the system, only up to the first order of the ratio of its velocity to that of radiation. But a classical experiment of A. A. Michelson, in which the ray-path was wholly in air, showed that the independence extends to higher orders. This result is inconsistent with the aether remaining at rest, unless we assume that the dimensions of the moving system depend, though to an extent so small as to be not otherwise detectable, on its orientation with regard to the aether that is streaming through it. It is, however, in complete accordance with a view that would make the aether near the earth fully partake in its orbital motion—a view which the null effect of convection on all terrestrial optical and electrical phenomena also strongly suggests. But the aether at a great distance must in any case be at rest; while the facts of astronomical aberration require that the motion of that medium must be irrotational. These conditions cannot be consistent with sensible convection of the aether near the earth without involving discontinuity in its motion at some intermediate distance, so that we are thrown back on the previous theory.

Another powerful reason for taking the aether to be stationary is afforded by the character of the equations of electrodynamics; they are all of linear type, and superposition of effects is possible. Now the kinetics of a medium in which the parts can have finite relative motions will lead to equations which are not linear—as, for example, those of hydrodynamics—and the phenomena will be far more complexly involved. It is true that the theory of vortex rings in hydrodynamics is of a simpler type; but electric currents cannot be likened to permanent vortex rings, because their circuits can be broken and the element of cyclic steadiness on which the simplicity depends is thereby destroyed.

Dynamical Theories of the Aether.—The analytical equations which represent the propagation of light in free aether, and also in aether modified by the presence of matter, were originally developed on the analogy of the equations of propagation of elastic effects in solid media. Various types of elastic solid medium have thus been invented to represent the aether, without complete success in any case. In T. MacCullagh's hands the correct equations were derived from a single energy formula by the principle of least action; and while the validity of this dynamical method was maintained, it was frankly admitted that no mechanical analogy was forthcoming. When Clerk Maxwell pointed out the way to the common origin of optical and electrical phenomena, these equations naturally came to repose on an electric basis, the connexion having been first definitely exhibited by FitzGerald in 1878; and according as the independent variable was one or other of the vectors which represent electric force, magnetic force or electric polarity, they took the form appropriate to one or other of the elastic theories above mentioned.

In this place it must suffice to indicate the gist of the more recent developments of the electro-optical theory, which involve the dynamical verification of Fresnel's hypothesis regarding optical convection and the other relations above described. The aether is taken to be at rest; and the strain-forms belonging to the atoms are the electric fields of the intrinsic charges, or electrones, involved in their constitution. When the atoms are in motion these strain-forms produce straining and unstraining in the aether as they pass across it, which in its motional or kinetic aspect constitutes the resulting magnetic field; as the strains are slight the coefficient of ultimate inertia here involved must be great. True electric current arises solely from convection of the atomic charges or electrons; this current is therefore not restricted as to form in any way. But when the rate of change of aethereal strain—that is, of (f,g,h) specified as Maxwell's electric displacement in free aether—is added to it, an analytically convenient vector (u,v,w) is obtained which possesses the characteristic property of being circuital like the flow of an incompressible fluid, and has therefore been made fundamental in the theory by Maxwell under the name of the total electric current.

As already mentioned, all efforts to assimilate optical propagation to transmission of waves in an ordinary solid medium have failed; and though the idea of regions of intrinsic strain, as for example in unannealed glass, is familiar in physics, yet on account of the absence of mobility of the strain no attempt had been made to employ them to illustrate the electric fields of atomic charges. The idea of MacCullagh's aether, and its property of purely rotational elasticity which had been expounded objectively by W. J. M. Rankine, was therefore much vivified by Lord Kelvin's specification (*Comptes Rendus*, 1889) of a material gyrostatically constituted medium which would possess this character. More recently a way has been pointed out in which a mobile permanent field of electric force could exist in such a medium so as to travel freely in company with its nucleus or intrinsic charge—the nature of the mobility of the latter, as well as its intimate constitution, remaining unknown.

A dielectric substance is electrically polarized by a field of electric force, the atomic poles being made up of the displaced positive and negative intrinsic charges in the atom: the polarization per unit volume (f',g',h') may be defined on the analogy of magnetism, and $d/dt(f',g',h')$ thus constitutes true electric current of polarization, *i.e.* of electric separation in the molecules, specified per unit volume. The convection of a medium thus polarized involves electric disturbance, and therefore must contribute to the true electric current; the determination of this constituent of the current is the most delicate point in the investigation. The usual definition of the component current in any direction, as the net amount of electrons which crosses, towards the positive side, an element of surface *fixed in space* at right angles to that direction, per unit area per unit time, here gives no definite result. The establishment and convection of a single polar atom constitutes in fact a *quasi*-magnetization, in addition to the polarization current as above defined, the negative poles completing the current circuits of the positive ones. But in the transition from molecular theory to the electrodynamics of extended media, all magnetism has to be replaced by a distribution of current; the latter being now specified by volume as well as by flow so that $(u,v,w)\,\delta\tau$ is the current in the element of volume $\delta\tau$. In the present case the total dielectric contribution to this current works out to be the change per unit time in the electric separation in the molecules of the element of volume, as it moves *uniformly* with the matter, all other effects being compensated molecularly without affecting the propagation.[1] On subtracting from this total the current of establishment of polarization $d/dt/(f',g',h')$ as formulated above, there remains $v\,d/dx(f',g',h')$ as the current of convection of polarization when the convection is taken for simplicity to be in the direction of the axis of x with velocity v. The polarization itself is determined from the electric force (P,Q,R) by the usual statical formula of linear type which becomes tor an isotropic medium

$$(f',g',h')=\frac{K-1}{4\pi c^2}(P,Q,R),$$

because any change of the dielectric constant K arising from the convection of the material through the aether must be independent of the sign of v and therefore be of the second order. Now the *electric force* (P,Q,R) is the force acting on the electrons of the medium moving with velocity v; consequently by Faraday's electrodynamic law

$$(P,Q,R)=(P',Q'-vc,\ R'+vb)$$

where (P',Q',R') is the force that would act on electrons at rest, and (a,b,c) is the magnetic induction. The latter force is, by Maxwell's hypothesis or by the dynamical theory of an aether pervaded by electrons, the same as that which strains the aether, and may be called the *aethereal force*; it thereby produces an aethereal electric displacement, say (f,g,h), according to the relation

$$(f,g,h)=(4\pi c^2)^{-1}(P',Q',R^1),$$

in which c is a constant belonging to the aether, which turns out to be the velocity of light. The current of aethereal displacement $d/dt(f,g,h)$ is what adds on to the true electric current to produce the total circuital current of Maxwell.

We have now to substitute these data in the universally valid circuital relations—namely, (i) line integral of magnetic force round a circuit is equal to 4π times the current through its aperture, which may be regarded as a definition of the constitution of the aether and its relation to the electrons involved in it; and (ii) line integral of the electric force belonging to any material circuit (*i.e.* acting on the electrons situated on it which move with the velocity of the matter) is equal to *minus* the time-rate of change of the magnetic induction through that circuit as it moves with the matter, this being a dynamical consequence of the aethereal constitution assigned in (i).

We may now, as is somewhat the more natural course in the terrestrial application, take axes (x,y,z) which move with the matter; but the current must be invariably defined by the flux across surfaces fixed in space, so that we may say that relation (i) refers to a circuit fixed in space, while (ii) refers to one moving with the matter. These circuital relations, when expressed analytically, are then for a dielectric medium of types

$$\frac{d\gamma}{dy}-\frac{d\beta}{dz}=4\pi u, \dots, \dots,$$

where
$$(u,v,w)=\left(\frac{d}{dt}+v\frac{d}{dx}\right)(f',g',h')+\frac{d}{dt}(f,g,h),$$

and
$$\frac{dR}{dy}-\frac{dQ}{dz}=-\frac{da}{dt}, \dots, \dots\ .$$

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[1] See H. A. Lorentz, *loc. cit. infra*; J. Larmor, ***Aether and Matter***, p. 262 and *passim*.

where, when magnetic quality is inoperative, the magnetic induction (a,b,c) is identical with the magnetic force (α,β,γ).

These equations determine all the phenomena. They take this simple form, however, only when the movement of the matter is one of translation. If v varies with respect to locality, or if there is a velocity of convection (p,q,r) variable with respect to direction and position, and analytical expression of the relation (ii) assumes a more complex form; we thus derive the most general equations of electrodynamic propagation for matter treated as continuous, anyhow distributed and moving in any manner.

For the simplest case of polarized waves travelling parallel to the axis of x, with the magnetic oscillation γ along z and the electric oscillation Q along y, all the quantities are functions of x and t alone; the total current is along y and given with respect to our moving axes by

$$v=\left(\frac{d}{dt}-v\frac{d}{dx}\right)\frac{Q+v\gamma}{4\pi c^2}+\frac{d}{dt}\left(\frac{K-1}{4\pi c^2}\right)Q;$$

also the circuital relations here reduce to

$$-\frac{d\gamma}{dx}=4\pi v,\quad \frac{dQ}{dx}=-\frac{d\gamma}{dt};$$

thus

$$\frac{d^2Q}{dx^2}=4\pi\frac{dv}{dt}$$

giving, on substitution for v,

$$(c^2-v^2)\frac{d^2Q}{dx^2}=K\frac{d^2Q}{dt^2}-2v\frac{d^2Q}{dxdt}.$$

For a simple wave-train, Q varies as sin $m(x-Vt)$, leading on substitution to the velocity of propagation V relative to the moving material, by means of the equation $KV^2+2vV=c^2-v^2$; this gives, to the first order of v/c, $V=c/K^{\frac{1}{2}}-v/K$, which is in accordance with Fresnel's law. Trains of waves nearly but not quite homogeneous as regards wave-length will as usual be propagated as wave-groups travelling with the slightly different velocity $d(V\lambda^{-1})/d\lambda^{-1}$, the value of K occurring in V being a function of λ determined by the law of optical dispersion of the medium.

For purposes of theoretical discussions relating to moving radiators and reflectors, it is important to remember that the dynamics of all this theory of electrons involves the neglect of terms of the order $(v/c)^2$, not merely in the value of K but throughout.

Recent Experimental Developments.—The modification of the spectrum of a radiating gas by a magnetic field, such as would result from the hypothesis that the radiators are the system of revolving or oscillating electrons in the molecule, was detected by P. Zeeman in 1896, and worked up, in conjunction with H. A. Lorentz, on the general lines suggested by the electron-theory of molecular constitution. While it cannot be said that the full significance of this very definite phenomenon, consisting of the splitting of the spectral line into a number of polarized components, has yet been made out, a wide field of correlation with optical theory, especially in the neighbourhood of absorption bands, has been developed by Zeeman himself, by A. H. Becquerel, by D. Macaluso and O. M. Corbino, and by other workers.

The most fundamental experimental confirmation that the theory of the aether has received on the optical side in recent years has been the verification of Maxwell's proposition that radiation exerts mechanical force on a material system, on which it falls, which may be represented in all cases as the resultant of pressures operating along the rays, and of intensity equal at each point of free space to the density of radiant energy. A high vacuum is needed for the detection of the minute forces here concerned; but just in that case the indirect radiometer-effect of the heating of the residual gas masks the effect. P. N. Lebedew in 1900 succeeded, by operating on metallic vanes so thin that the exposed and averted faces were practically at the same temperature, in satisfactorily verifying the relation for metals; and very soon after, E. F. Nichols and G. F. Hull published accounts of an exact and extensive research, in which the principle had been fully and precisely confirmed as regards both transparent and opaque bodies. The experiment of J. H. Poynting may also be mentioned, in which the tangential component of the thrust of obliquely incident radiation is separately put in evidence, by the torsion produced in an arrangement which is not sensitive to the normal component or to the radiometer-pressure of the residual gas. (See RADIOMETER.)

Next to these researches on the pressure of radiation, which, by forming the mechanical link between radiation and matter, are fundamental for the thermodynamics of radiant energy, the most striking recent result has been the discovery of H. Rubens and E. Hagen that for dark heat rays of only about ten times the wave-length of luminous radiation, the properties of metals are determined by their electric resistance alone, which then masks all resonance due to periods of free vibration of the molecules; and, moreover, that the resistance for such alternations is practically the same as the ohmic resistance for ordinary steady currents. They found that the absorbing powers of the metals, and therefore, by the principle of exchanges, their radiating powers also, are proportional to the square roots of their electric conductivities. Maxwell had himself, at an early stage of his theory, tested the absorbing power of gold-leaf for light, and found that the effective conductivity for luminous vibrations must be very much greater than its steady ohmic value; it is, in fact, there a case of *incipient* conductivity, which is continually being undone on account of the rapid alternation of force before it is fully established. That, however, complete conduction should arrive with alternations only ten times slower than light was an unexpected and remarkable fact, which verifies the presumption that the process of conduction is one in which the dynamic activities of the molecules do not come into play. The corollary, that the electric resistance of a metal can be determined in absolute units by experiments on the reflexion of heat-rays from its surface, is a striking illustration of the unification of the various branches of physical science, which has come in the train of the development of the theory of the aether. (See RADIATION.)

Finally, reference should be made to the phenomena of radio-activity, whether excited by the electric discharge in vacuum tubes, foreshadowed in part by Sir Wm. Crookes and G. G. Stokes, and later by A. Schuster and others, but first fully developed with astonishing results including the experimental discovery of the free electron by J. J. Thomson, or the correlated phenomena occurring spontaneously in radio-active bodies as discovered by H. Becquerel and by M. and Mme Curie, and investigated by them and by E. Rutherford and others. These results constitute a far-reaching development of the modern or electrodynamic theory of the aether, of which the issue can hardly yet be foreseen.

REFERENCES.—Maxwell, *Collected Papers*, H. A. Lorentz, *Archives Néerlandaises*, xxi. 1887, and xxv. 1892, and a tract, *Versuch einer Theorie der electrischen und optischen Erscheinungen in bewegten Körpern* (Leyden, 1895); also recent articles "Elektrodynamik" and "Elektronentheorie" in the *Encyk. der Math. Wissenschaften*, Band v. 13, 14; O. Lodge, "On Aberration Problems," *Phil. Trans.* 1893 and 1897; J. Larmor, *Phil. Trans.* 1894-95-97, and a treatise, *Aether and Matter* (1900), where full references are given. Of recent years most treatises on physical optics, *e.g.* those of P. K. L. Drude, A. Schuster, R. W. Wood, have been written largely on the basis of the general physics of the aether; while the *Collected Papers* of Lord Rayleigh should be accessible to all who desire a first-hand knowledge of the development of the optical side of the subject. See also MOLECULE, ELECTRICITY, LIGHT and RADIATION. (J. L.*)

AETHICUS (=ETHICUS) **ISTER**, "the philosopher of Istria," the supposed but unknown author of a description of the world written in Greek. An abridgment, under the title of *Cosmographia Ethici*, written in barbarous Latin, and wrongly described as the work of St Jerome, probably belongs to the 7th century. After a discussion of the creation of the world and a description of the earth, an account of the wonderful journeys of Aethicus is given, with digressions on various subjects, such as Alexander the Great and the kings of Rome, full of obscure and fabulous details.

The name Aethicus is also attached to another geographical treatise probably dating from the 6th century, a reproduction, with some unimportant additions, of the cosmography—little else than a dry list of names—of Julius Honorius.

Editions.—D'Avezac (1852); Pertz (1853): Wuttke (1854): Riese's *Geographi Latini Minores* (1878); see also Bunbury, *History of Ancient Geography.*

AETIOLOGY, or Etiology (from Gr. *αἰτία*, cause, and *λογία*, discourse), strictly, the science or philosophy of causation, but generally used to denote the part of any special science (and especially of that of medicine and disease) which investigates the causes and origin of its phenomena. An *aetiological myth* is one which is regarded as having been invented *ex post facto* to explain some fact, name or coincidence, the true account or origin of which has been forgotten. Such myths were often based on grotesque philological analogies, according to which an existing connexion between two personalities (cities, &c.) was traced back to a common mythical origin. For a good example of the evolution of such myths, see the argument under Aegina, *History*.

AETION, or Eetion, a Greek painter, mentioned by Cicero, Pliny and Lucian. His most noted work, described in detail by Lucian (*Herodotus or Eetion*, 5), was a picture representing the marriage of Alexander and Roxana. He is said to have exhibited it at the Olympic games, and by it so to have won the favour of the president that he gave him his daughter in marriage. Through a misunderstanding of the words of Lucian, Aetion has been supposed to belong to the age of the Antonines; but there can be little doubt that he was a contemporary of Alexander and of Apelles (Brunn, *Geschichte der griechischen Künstler*, ii. p. 243). Pliny gives his date as 350 B.C.

AETIUS (fl. 350), surnamed "the Atheist," founder of an extreme sect of Arians, was a native of Coele-Syria. After working as a vine-dresser and then as a goldsmith he became a travelling doctor, and displayed great skill in disputations on medical subjects; but his controversial power soon found a wider field for its exercise in the great theological question of the time. He studied successively under the Arians, Paulinus, bishop of Antioch, Athanasius, bishop of Anazarbus, and the presbyter Antonius of Tarsus. In 350 he was ordained a deacon by Leontius of Antioch, but was shortly afterwards forced by the orthodox party to leave that town. At the first synod of Sirmium he won a dialectic victory over the homoiousian bishops, Basilius and Eustathius, who sought in consequence to stir up against him the enmity of Caesar Gallus. In 356 he went to Alexandria with Eunomius (*q.v.*) in order to advocate Arianism, but he was banished by Constantius. Julian recalled him from exile, bestowed upon him an estate in Lesbos, and retained him for a time at his court in Constantinople. Being consecrated a bishop, he used his office in the interests of Arianism by creating other bishops of that party. At the accession of Valens (364) he retired to his estate at Lesbos, but soon returned to Constantinople, where he died in 367. The Anomoean sect of the Arians, of whom he was the leader, are sometimes called after him *Aetians*. His work *De Fide* has been preserved in connexion with a refutation written by Epiphanius (*Haer.* lxxvi. 10). Its main thought is that the Homousia, *i.e.* the doctrine that the Son (therefore the Begotten) is essentially God, is self-contradictory, since the idea of unbegottenness is just that which constitutes the nature of God.

See A. Harnack, *History of Dogma*, vol. iv. *passim*.

AETIUS, a Greek physician, born at Amida in Mesopotamia, flourished at the beginning of the 6th century A.D. He studied at Alexandria, and became court physician at Byzantium and *comes obsequii*, one of the chief officers of the imperial household. He wrote a large medical work in sixteen books, founded on Oribasius and compiled from various sources, especially Galen [Galenos]. Superstition and mysticism play a great part in his remedies. Eight books of the Greek original were printed at Venice, 1534, and a complete Latin translation by Cornarius appeared at Basel, 1542.

See Weigel, *Aetianarum exercitationum specimen* (1791); Danelius, *Beitrag zur Augenheilkunde des Aetius* (1889); Zernos, *Aetii sermo sextidecimus et ultimus*, editio princeps (1901).

AETIUS (d. 454), a Roman general of the closing period of the Western empire, born at Dorostolus in Moesia, late in the 4th century. He was the son of Gaudentius, who, although possibly of barbarian family, rose in the service of the Western empire to be master of the horse, and later count of Africa. Aetius passed some years as hostage, first with Alaric and the Goths, and later in the camp of Rhuas, king of the Huns, acquiring in this way the knowledge which enabled him afterwards to defeat them. In 424 he led into Italy an army of 60,000 barbarians, mostly Huns, which he employed first to support the *primicerius* Joannes, who had proclaimed himself emperor, and, on the defeat of the latter, to enforce his claim to the supreme command of the army in Gaul upon Placidia, the empress-mother and regent for Valentinian III. His calumnies against his rival, Count Boniface, which were at first believed by the emperor, led Boniface to revolt and call the Vandals to Africa. Upon the discovery of the truth, Boniface, although defeated in Africa, was received into favour by Valentinian; but Aetius came down against Boniface from his Gallic wars, like another Julius Caesar, and in the battle which followed wounded Boniface fatally with his own javelin. From 433 to 450 Aetius was the dominating personality in the Western empire. In Gaul he won his military reputation, upholding for nearly twenty years, by combined policy and daring, the falling fortunes of the empire. His greatest victory was that of Châlons-sur-Marne (September 20, 451), in which he led the Gallic forces against Attila and the Huns. This was the last triumph of the empire. Three years later (454) Aetius presented himself at court to claim the emperor's daughter in marriage for his son Gaudentius; but Valentinian, suspecting him of designs upon the crown, slew him with his own hand.

See T. Hodgkin, *Italy and her Invaders*, vols. i. and ii. (1880).

AETOLIA, a district of northern Greece, bounded on the S. by the Corinthian Gulf, on the W. by the river Achelous, on the N. and E. by the western spurs of Parnassus and Oeta. The land naturally falls into two divisions. The basins of the lower Achelous (mod. *Aspropotamo*) and Euenus (*Phidharis*) form a series of alluvial valleys intersected by detached ridges which mostly run parallel to the coast. This district of "Old Aetolia" lacks a suitable sea-board, but the inland, and especially the plain of central Aetolia lying to the north of Lakes Hyria and Trichonis and Mount Aracynthus, forms a rich agricultural country. The northern and eastern regions are broken by an extensive complex of chains and peaks, whose rugged limestone flanks are clad at most with stunted shrubs and barely leave room for a few precarious mule-tracks. These heights often rise in the frontier-ranges of Tymphrestus, Oxia and Corax to more than 7000 ft.; the snow-capped pinnacle of Kiona attains to 8240 ft. A few defiles pass through this barrier to the other side of the north Greek watershed.

In early legend Old Aetolia, with its cities of Pleuron and Calydon, figures prominently. During the great migrations (see Dorians) the population was largely displaced, and the old inhabitants long remained in a backward condition. In the 5th century some tribes were still living in open villages under petty kings, addicted to plunder and piracy, and hardly recognized as Hellenes at all. Yet their military strength was not to be despised: in 426 their archers and slingers easily repelled an Athenian invasion under Demosthenes. In the 4th century the Aetolians began to take a greater part in Greek politics, and, in return for helping Epaminondas (367) and Philip of Macedon (338), recovered control of their sea-board, to which they annexed the Acarnanian coast and the Oeniadae. Aetolia's prosperity dates from the period of Macedonian supremacy. It may be ascribed partly to the wealth and influence acquired by Aetolian mercenaries in Hellenistic courts, but chiefly to the formation of a national Aetolian league, the first effective institution of this kind in Greece. Created originally to meet the peril of an invasion by the Macedonian regents Antipater and Craterus, who had undertaken a punitive expedition against Aetolia after the Lamian War (322), and by Cassander (314–311), the confederacy grew rapidly during the subsequent period of Macedonian weakness. Since 290 it had extended its power over all the uplands of central Greece, where its command over Heracleia (280) provided it with an important defensive position against northern invaders, its control of Delphi and the Amphictyonic council with a useful political instrument. The valour of the Aetolians was conspicuously displayed in 279, when they broke the strength of the Celtic irruption by slaughtering great hordes of marauders. The commemorative festival of the Soteria, which the league established at Delphi, obtained recognition from many leading Greek states. After annexing Boeotia (by 245) the Aetolians controlled all central Greece. Endeavouring next to expand into Peloponnesus, they allied themselves with Antigonus Gonatas of Macedonia against the Achaean league (*q.v.*), and besides becoming protectors of Elis and Messenia won several Arcadian cities. Their naval power extended to Cephalonia, to the Aegaean islands and even to the Hellespont. The league at its zenith had thus a truly imperial status.

Later in the century its power began to be sapped by Macedonia. To check King Demetrius (239–229) the Aetolians joined arms with the Achaeans. In 224 they held Heracleia Trachis against Antigonus Doson, but lost control of Boeotia and Phocis. Since 228 their Arcadian possessions had been abandoned to Sparta. At the same time a new enemy arose in the Illyrian pirate fleets, which outdid them in unscrupulousness and violence. The raids of two Aetolian chiefs in Achaean territory (220) led to a coalition between Achaea and Philip V. of Macedon, who assailed the invaders with great energy, driving them out of Peloponnesus and marching into Aetolia itself, where he surprised and sacked the federal capital Thermon. After buying peace by the cession of Acarnania (217) the league concluded a compact with Rome, in which both states agreed to plunder ruthlessly their common enemies (211). In the great war of their Roman allies against Philip the federal troops took a prominent part, their cavalry being largely responsible for the victory of Cynoscephalae (197). The Romans in return restored central Greece to the league, but by withholding its former Thessalian possessions excited its deep resentment. The Aetolians now invited Antiochus III. of Syria to European Greece, and so precipitated a conflict with Rome. But in the war they threw away their chances. In 192 they wasted themselves in an unsuccessful attempt to secure Sparta. In 191 they supported Antiochus badly, and by their slackness in the defence of Thermopylae made his position in Greece untenable. Having thus isolated themselves the Aetolians stood at bay behind their walls against the Romans, who refused all compromises, and, after the general surrender in 189, restricted the league to Aetolia proper and assumed control over its foreign relations. In 167 the country suffered severely from the intrigues of a philo-Roman party, which caused a series of judicial murders and the deportation of many patriots to Italy. By the time of Sulla, when the league is mentioned for the last time, its functions were purely nominal. The federal constitution closely resembled that of the Achaean league (*q.v.*), for which it doubtless served as a model. The general assembly, convoked every autumn at Thermon to elect officials, and at other places in special emergencies, shaped the league's general policy; it was nominally open to all freemen, though no doubt the Aetolian chieftains really controlled it. The council of deputies from the confederate cities undertook the routine of administration and jurisdiction. The *strategus* (general), aided by 30 *apocleti* (ministers), had complete control in the field and presided over the assembly, though with restricted advisory powers. The Aetolians also used the Amphictyonic synod for passing solemn enactments. The league's relation to outlying dependencies is obscure; many of these were probably mere protectorates or "allied states" and secured no representation. The federal executive was certainly much more efficient than that of the Achaeans, and its councils suffered less from disunion; but its generals and admirals, official or otherwise, enjoyed undue licence; hence the league deservedly gained an evil name for the numerous acts of lawlessness or violence which its troops committed. But as a champion of republican Greece against foreign enemies no other power of the age rendered equal services. After the first overthrow of the Byzantine empire Aetolia passed to a branch of the old imperial house (1205). In the 15th century it was held by Scanderbeg (*q.v.*) and by the Venetians, but Mahommed II. brought it definitely under Turkish rule. In the War of Independence the Aetolians by their stubborn defence, culminating in the sieges of Missolonghi (*q.v.*), formed the backbone of the rebellion. Northern Aetolia remains a desolate region, inhabited mainly by Vlach shepherds. The south-western plain, though rendered unhealthy by lagoons, and central Aetolia yield good crops of currants, vine, maize and tobacco, which are conveyed by railway from Agrinion and Anatolikon to the coast. The country, which forms part of the modern department of Acarnania and Aetolia, contains numerous fragments of ancient fortifications. It has contributed a notable proportion of distinguished men to modern Greece.

AUTHORITIES.—Strabo pp. 450 sqq.; Thucydides iii. 94-98; Diodorus xviii. 24. 5; Pausanias x. 20 sq.; Polybius and Livy *passim*; W. J. Woodhouse, *Aetolia* (Oxford, 1897); M. Dubois, *Les Ligues achéenne et étolienne* (Paris, 1885); E. A. Freeman, *Federal Government* (ed. 1893, London), ch. vi.; B. V. Head, *Historia Numorum* (Oxford, 1887), pp. 283-284; M. Holleaux in *Bulletin de Correspondance Hellénique* (1905, pp. 362-372); G. Sotiriades in 'Εφημερὶς 'Αρχαιολογική, (1900) pp. 163-212, (1903) pp. 73-94, and in *Bulletin de Correspondance Hellénique* (1907), pp. 139-184; C. Salvetti in *Studi di Storia Antica*, vol. ii. (Rome, 1893), pp. 270-320. (M. O. B. C.)

AFARS (DANAKIL), a tribe of African "Arabs" of Hamitic stock. They occupy the arid coast-lands between Abyssinia and the sea. They claim to be Arabs, but are more akin to the Galla and Somali. The tribe is roughly divisible into a pastoral and a coast-dwelling group. Their religion is chiefly fetich and tree-worship; many, nominally, profess Mahommedanism. They are distinguished by narrow straight noses, thin lips and small pointed chins; their cheekbones are not prominent. They are more scantily clothed than the Abyssinians or Galla, wearing, generally, nothing but a waist-cloth. Their women, when quite young, are pretty and graceful. Their huts are often tastefully decorated, the floors being spread with yellow mats, embroidered with red and violet designs. The Afars are divided into many sub-tribes, each having an hereditary sultan, whose power is, however, limited. They are desperate fighters and in 1875 successfully resisted an attempt to bring them under Egyptian rule. In 1883–1888, however, their most important sultan concluded treaties placing his country under Italian protection. The Afar region is now partly under Abyssinian and partly under Italian authority. The Afars are also found in considerable numbers in French Somaliland. They have a saying "Guns are only useful to frighten cowards." They were formerly redoubtable pirates, but the descendants of these corsairs are now fishermen, and are the only sailors in the Red Sea who hunt the dugong.

See Fr. Scazamucci and E. H. Giglioli, *Notizie sui Danakil* (1884); P. Paulitschke, *Ethnographie Nordost-Afrikas* (2 vols., Berlin, 1893–1896), and *Die geographische Erforschung der Adâl-Länder und Harârs in Ost-Afrika* (Leipzig, 1884).

AFER, DOMITIUS, a Roman orator and advocate, born at Nemausus (Nîmes) in Gallia Narbonensis, flourished in the reigns of Tiberius, Caligula, Claudius and Nero. His pupil Quintilian calls him the greatest orator he had ever known; but he disgraced his talents by acting as public informer against some of the most distinguished personages in Rome. He gained the favour of Tiberius by accusing Claudia Pulcra, the widow of Germanicus, of adultery and the use of magic arts against the emperor. Judicious flattery secured him the consulship under Caligula (39); and under Nero he was superintendent of the water supply. He died A.D. 60, according to Jerome, of over-eating. Quintilian quotes some of his witty sayings (*dicta*), collections of which were published, and mentions two books by him *On Witnesses*.

Quintilian, *Instit.* vi. 3. 42, viii. 5. 16, x. 1. 118, &c.; Tac. *Ann* iv. 52; Dio Cassius lix. 19, lx. 33; Pliny, *Epp.* viii. 18.

AFFECTION (Lat. *ad*, and *facere*, to do something to, *sc.* a person), literally, a mental state resulting generally from an external influence. It is popularly used of a relation between persons amounting to more than goodwill or friendship. By ethical writers the word has been used generally of distinct states of feeling, both lasting and spasmodic; some contrast it with "passion" as being free from the distinctively sensual element. More specifically the word has been restricted to emotional states which are in relation to persons. In the former sense, it is the Gr. πάθος, and as such it appears in Descartes and most of the early British ethical writers. On various grounds, however—*e.g.* that it does not involve anxiety or excitement, that it is comparatively inert and compatible with the entire absence of the sensuous element—it is generally and usefully distinguished from passion. In this narrower sense the word has played a great part in ethical systems, which have spoken of the social or parental "affections" as in some sense a part of moral obligation. For a consideration of these and similar problems, which depend ultimately on the degree in which the affections are regarded as voluntary, see H. Sidgwick, *Methods of Ethics*, pp. 345-349.

In psychology the terms "affection" and "affective" are of great importance. As all intellectual phenomena have by experimentalists been reduced to sensation, so all emotion has been and is regarded as reducible to simple mental affection, the element of which all emotional manifestations are ultimately composed. The nature of this element is a problem which has been provisionally, but not conclusively, solved by many psychologists; the method is necessarily experimental, and all experiments on feeling are peculiarly difficult. The solutions proposed are two. In the first, all affection phenomena are primarily divisible into those which are pleasurable and those which are the reverse. The main objections to this are that it does not explain the infinite variety of phenomena, and that it disregards the distinction which most philosophers admit between higher and lower pleasures. The second solution is that every sensation has its specific affective quality, though by reason of the poverty of language many of these have no name. W. Wundt, *Outlines of Psychology* (trans. C. H. Judd, Leipzig, 1897), maintains that we may group under three main affective directions, each with its negative, all the infinite varieties in question; these are (*a*) pleasure, or rather pleasantness, and the reverse, (*b*) tension and relaxation, (*c*) excitement and depression. These two views are antithetic and no solution has been discovered.

Two obvious methods of experiment have been tried. The first, introduced by A. Mosso, the Italian psychologist, consists in recording the physical phenomena which are observed to accompany modifications of the affective consciousness. Thus it is found that the action of the heart is accelerated by pleasant, and retarded by unpleasant, stimuli; again, changes of weight and volume are found to accompany modifications of affection—and so on. Apart altogether from the facts that this investigation is still in its infancy and that the conditions of experiment are insufficiently understood, its ultimate success is rendered highly problematical by the essential fact that real scientific results can be achieved only by data recorded in connexion with a perfectly normal subject; a conscious or interested subject introduces variable factors which are probably incalculable.

The second is Fechner's method; it consists of recording the changes in feeling-tone produced in a subject by bringing him in contact with a series of conditions, objects or stimuli graduated according to a scientific plan and presented singly in pairs or in groups. The result is a comparative table of likes and dislikes.

Mention should also be made of a third method which has hardly yet been tried, namely, that of endeavouring to isolate one of the three "directions" by the method of suggestion or even hypnotic trance observations.

For the subject of emotion in general see modern text-books of psychology, *e.g.* those of J. Sully, W. James, G. T. Fechner, O. Külpe; Angelo Mosso, *La Paura* (Milan, 1884, 1900; Eng. trans. E. Lough and F. Kiesow, Lond. 1896); E. B. Titchener, *Experimental Psychology* (1905); art. PSYCHOLOGY and works there quoted.

AFFIDAVIT (Med. Lat. for "he has declared upon oath," from *affidare*, *fides*, faith), a written statement sworn or affirmed to before some person who has authority to administer an oath or affirmation. Evidence is chiefly taken by means of affidavits in the Chancery Division of the High Court of Justice in England on a petition, summons or motion. Interlocutory proceedings before trial are conducted by affidavits, *e.g.* for discovery of documents, hence called *affidavit of documents*. Affidavits are sometimes necessary as certificates that certain formalities have been duly and legally performed (such as service of proceedings, &c.). They are extensively used in bankruptcy practice, in the administration of the revenue and in the inferior and county courts. In testamentary causes, all documents of any kind, such as wills, codicils, drafts or instructions of same must be filed in the form of affidavits (termed *affidavits of scripts*). In Scotland the testimony of witnesses by affidavit is almost unknown, except in a few non-contentious cases as *prima facie* evidence. In the rules of the Supreme Court (R.S.C. Ord. XXXVIII.) certain formal requirements are laid down for all affidavits and affirmations in causes or matters depending in the High Court. An affidavit must consist of title, body or statement and jurat. It must be written or printed on foolscap, bookwise, in the first person; give correctly the names of the parties to the action; and the description and true place of abode of the deponent. An affidavit is confined, except on interlocutory motions, to such facts as the witness is able of his own knowledge to prove. The signature of the deponent must be written opposite to the jurat, which must contain the place, date and time of swearing, and this signed by the officer or magistrate before whom the affidavit is sworn. An affidavit sworn on a Sunday is not invalid. Quakers, Moravians and Separatists were first privileged to make a solemn declaration or affirmation, and by the Common Law Procedure Act 1852 and other statutes all persons prevented by religious belief from taking an oath were allowed to affirm; and, finally, by the Oaths Act 1888, every person who objects to be sworn is allowed to affirm in all places and for all purposes where an oath is required by law. By an act of 1835 justices are permitted to take affidavits in any matter by declaration, and a person making a false affidavit in this way is liable to punishment. The same act prohibited justices of peace from administering oaths in any matter in which they had not jurisdiction as judges, except when an oath was specially authorized by statute, as in the bankruptcy law, and excepting criminal inquiries, parliamentary proceedings and instances where oaths are required to give validity to documents abroad. Scottish justices can act in England and *vice versa*. The Oaths Act 1888 and the Commissioner of Oaths Act 1889 consolidated all previous enactments relating to oaths and gave the lord chancellor power to appoint commissioners for oaths to take affidavits for all purposes (see OATH). Under the Debtors Act 1869 a plaintiff may file an affidavit for the arrest of a debtor (*affidavit to hold to bail*) when the debt amounts to £50 or upwards, where it can be shown that the debtor's absence from the kingdom would materially prejudice the prosecution of the action.

Affidavits may be made abroad before any British ambassador, envoy, minister, *chargé d'affaires*, secretary of embassy or legation, consul or consular agent.

In the United States affidavit has the same meaning as in England and its general uses are the same, but it is not substituted for oral evidence in court to anything like the extent to which that is done in the English courts of chancery. The statutes of each state designate the persons before whom affidavits may be made outside the state, and special commissioners are appointed for that purpose by each state. Affidavits made abroad must be made before such commissioners or persons so designated, who are usually diplomatic and consular officials, justices, notaries public or mayors. "Affidavit of documents" is not generally used in the United States; discovery is procured by motion.

AFFILIATION (from Lat. *ad-filiare*, to adopt as a son), in law, the procedure by which the paternity of a bastard child is determined, and the obligation of contributing to its support enforced. In England a number of statutes on the subject have been passed, the chief being the Bastardy Act of 1845, and the Bastardy Laws Amendment Acts of 1872 and 1873. The mother of a bastard may summon the putative father to petty sessions within twelve months of the birth (or at any later time if he is proved to have contributed to the child's support within twelve months after the birth), and the justices, after hearing evidence on both sides, may, if the mother's evidence be corroborated in some material particular, adjudge the man to be the putative father of the child, and order him to pay a sum not exceeding five shillings a week for its maintenance, together with a sum for expenses incidental to the birth, or the funeral expenses, if it has died before the date of order, and the costs of the proceedings. An order ceases to be valid after the child reaches the age of thirteen, but the justices may in the order direct the payments to be continued until the child is sixteen years of age. An appeal to quarter sessions is open to the defendant, and a further appeal on questions of law to the King's Bench by rule *nisi* or *certiorari*. Should the child afterwards become chargeable to the parish, the sum due by the father may be received by the parish officer. When a bastard child, whose mother has not obtained an order, becomes chargeable to the parish, the guardians may proceed against the putative father for a contribution. Any woman who is single, a widow, or a married woman living apart from her husband, may make an application for a summons, and it is immaterial where the child is begotten, provided it is born in England. An application for a summons may be made before the birth of the child, but in this case the statement of the mother must be in the form of a sworn deposition. The defendant must be over fourteen years of age. No agreement on the part of the woman to take a sum down in discharge of the liability of the father is a bar to the making of an affiliation order. In the case of twins it is usual to make separate applications and obtain separate summonses. The Summary Jurisdiction Act 1879 makes due provision for the enforcement of an order of affiliation. In the case of soldiers an affiliation order cannot be enforced in the usual way, but by the Army Act 1881, if an order has been made against a soldier of the regular forces, and a copy of such order be sent to the secretary of state, he may order a portion of the soldier's pay to be retained. There is no such special legislation with regard to sailors in the royal navy.

In the British colonies, and in the states of the United States (with the exception of California, Idaho, Missouri, Oregon, Texas and Utah), there is some procedure (usually termed *filiation*) akin to that described above, by means of which a mother can obtain a contribution to the support of her illegitimate child from the putative father. The amount ordered to be paid may subsequently be increased or diminished (1905; 94 N.Y. Supplt. 372). On the continent of Europe, however, the legislation of the various countries differs rather widely. France, Belgium, Holland, Italy, Russia, Servia and the canton of Geneva provide no means of inquiry into the paternity of an illegitimate child, and consequently all support of the child falls upon the mother; on the other hand, Germany, Austria, Norway, Sweden, Denmark and the majority of the Swiss cantons provide for an inquiry into the paternity of illegitimate children, and the law casts a certain amount of responsibility upon the father.

Affiliation, in France, is a term applied to a species of adoption by which the person adopted succeeds equally with other heirs to the acquired, but not to the inherited, property of the deceased. (See Adoption. Also Bastard; Poor Laws.)

Authorities.—Saunders, *Law and Practice of Orders of Affiliation*; Lushington, *Law of Affiliation and Bastardy*; Little, *Poor Law Statutes.* (T. A. I.)

AFFINITY (Lat. *affinitas*, relationship by marriage, from *affinis*, bordering on, related to; *finis*, border, boundary), in law, as distinguished from consanguinity (*q.v.*), the term applied to the relation which each party to a marriage, the husband and wife, bears to the kindred of the other. Affinity is usually described as of three kinds. (1) *Direct*: that relationship which subsists between the husband and his wife's relations by blood or between the wife and the husband's relations by blood. The marriage having made them one person, the blood relations of each are held as related by affinity in the same degree to the one spouse as by consanguinity to the other. But the relation is only with the married parties themselves, and does not bring those in affinity with them in affinity with each other; so a wife's sister has no affinity to her husband's brother. This is (2) *Secondary* affinity. (3) *Collateral* affinity is the relationship subsisting between the husband and the relations of his wife's relations.

The subject is chiefly important from the matrimonial prohibitions by which the canon law has restricted relations by affinity. Taking the table of degrees within which marriage is prohibited on account of consanguinity, the rule has been thus extended to affinity, so that wherever relationship to a man himself would be a bar to marriage, relationship to his deceased wife will be the same bar, and *vice versa* on the husband's decease.

Briefly, *direct* affinity is a bar to marriage. This rule has been founded chiefly on interpretations of the eighteenth chapter of Leviticus. Formerly by law in England, marriages within the degrees of affinity were not absolutely null, but they were liable to be annulled by ecclesiastical process during the lives of both parties; in other words, the incapacity was only a canonical, not a civil, disability. By the Marriage Act 1835 all marriages of this kind not disputed before the passing of the act were declared absolutely valid, while all subsequent to it were declared null. This rendered null in England, and not merely voidable, a marriage with a deceased wife's sister or niece. (See Consanguinity; Marriage.)

AFFINITY, CHEMICAL, the property or relation in virtue of which dissimilar substances are capable of entering into chemical combination with each other. (See Chemistry; Chemical Action; Valency.)

AFFIRMATION (from Lat. *affirmare*, to assert), the declaration that something is true; in logic, a positive judgment, the union of the subject and predicate of a proposition; particularly, in law, the solemn declaration allowed to those who conscientiously object to taking an oath. (See Oath.)

AFFRAY, in law, the fighting of two or more persons in a public place to the terror (*à l' effroi*) of the lieges. The offence is a misdemeanour at English common law, punishable by fine and imprisonment. A fight in private is an assault and battery, not an affray. As those engaged in an affray render themselves also liable to prosecution for Assault (*q.v.*), Unlawful Assembly (see Assembly, Unlawful), or Riot (*q.v.*), it is for one of these offences that they are usually charged. Any private person may, and constables and justices must, interfere to put a stop to an affray. In the United States the English common law as to affray applies, subject to certain modifications by the statutes of particular states (Bishop, *Amer. Crim. Law*, 8th ed., 1892, vol. i. § 535). The Indian Penal Code (sect. 159) adopts the English definition of affray, with the substitution of "actual disturbance of the peace" for "causing terror to the lieges." The Queensland Criminal Code of 1899 (sect. 72) defines affray as taking part in a fight in a public highway or taking part in a fight of such a nature as to alarm the public in any other place to which the public have access. This definition is taken from that in the English Criminal Code Bill of 1880, cl. 96. Under the Roman Dutch law in force in South Africa affray falls within the definition of *vis publica*.

AFFRE, DENIS AUGUSTE (1793–1848), archbishop of Paris, was born at St Rome, in the department of Tarn, on the 27th of September 1793. He was educated for the priesthood at St Sulpice, where in 1818 he became professor of dogmatic theology. After filling a number of ecclesiastical offices, he was elevated to the archbishopric of Paris in 1840. Though opposed to the government of Louis Philippe, he took no part in politics, but devoted himself to his pastoral work. His episcopate, however, is chiefly remembered owing to its tragic close. During the insurrection of June 1848 the archbishop was led to believe that by his personal interference peace might be restored between the soldiery and the insurgents. Accordingly, in spite of the warning of General Cavaignac, he mounted the barricade at the entrance to the Faubourg St Antoine, bearing a green branch as sign of peace. He had spoken only a few words, however, when the insurgents, hearing some shots, and fancying they were betrayed, opened fire upon the national guard, and the archbishop fell, struck by a stray bullet. He was removed to his palace, where he died on the 27th of June 1848. Next day the National Assembly issued a decree expressing their great sorrow on account of his death; and the public funeral on the 7th of July was one of the most striking spectacles of its kind. The archbishop wrote several treatises of considerable value, including an *Essai sur les hiéroglyphes égyptiens* (Paris, 1834), in which he showed that Champollion's system was insufficient to explain the hieroglyphics.

See Ricard, *Les grands évêques de l'église de France au XIXe siècle* (Lille, 1893); L. Alazard, *Denis-Auguste Affre, archevêque de Paris* (Paris, 1905).

AFFREIGHTMENT (from "freight," *q.v.*). *Contract of Affreightment* is the expression usually employed to describe the contract between a shipowner and some other person called the freighter, by which the shipowner agrees to carry goods of the freighter in his ship, or to give to the freighter the use of the whole or part of the cargo-carrying space of the ship for the carriage of his goods on a specified voyage or voyages or for a specified time; the freighter on his part agreeing to pay a specified price, called "freight," for the carriage of the goods or the use of the ship. A ship may be let like a house to some person who takes possession and control of it for a specified term. The person who hires a ship in this way occupies during the currency of his term the position of shipowner. The contract by which a ship is so let may be called a *charter-party*; but it is not, properly speaking, a contract of affreightment, and is mentioned here only because it is necessary to remember the distinction between a *charter-party* of this kind, which is sometimes called a demise of the ship, and a *charter-party* which is a form of contract of affreightment, as will hereinafter appear.

The law with regard to the contract of affreightment is, of course, a branch of the general law of contract. The rights and obligations of the shipowner and the freighter depend, as in the case of all parties to contracts, upon the terms of the agreement entered into between them. The law, however, interferes to some extent in regulating the effect to be given to contracts. Certain contracts are forbidden by the law, and being illegal are, therefore, incapable of enforcement. The most important example of illegality in the case of contracts of affreightment is when the contract involves trading with an enemy. The law interferes again with regard to the interpretation of the contract. The meaning to be given to the words of the contract, or, in other words, its construction, when a dispute arises about it, must be determined by the judge or court. The result is, that certain more or less common clauses in contracts of affreightment have come before the courts for construction, and the decisions in these cases are treated practically, though not perhaps quite logically, as rules of law determining the sense to be put upon certain forms of expression in common use in shipping contracts. A third way in which the law interferes is by laying down certain rules by which the rights of the parties are to be regulated in the absence of any express stipulation with regard to the matter dealt with by such rules. This is done either by statutory enactment, as by that part (Part VIII.) of the Merchant Shipping Act 1894 which deals with the liability of shipowners; or by established rules of the unwritten law, the "common law" as it is called, as, for instance, the rule that the common carrier is absolutely responsible for the safe delivery of the goods carried, unless it is prevented by the act of God or the king's enemies. These rules of law, whether common law or statute law, regulating the obligations of carriers of goods by sea, are of most importance in cases which are uncommon though not unknown at the present day, in which there is an affreightment without any written agreement of any kind. It will, therefore, be convenient to consider first cases of this kind where there is no express agreement, oral or written, except as to the freight and destination of the goods, and where, consequently, the rights and obligations of the parties as to all other terms of carriage depend wholly upon the rules of law, remembering always that these same rules apply when there is a written contract, except in so far as they are qualified or negatived by the terms of such contract.

Rules of law.

The rules of the common or ancient customary law of England with regard to the carriage of goods were no doubt first considered by the courts and established with regard to the carriage of goods by common carriers on land. These rules were applied to common carriers by water, and it may now be taken to be the general rule that shipowners who carry goods by sea are by the English law subject to the liabilities of common carriers. (See, as to the grounds and precise extent of this doctrine, the judgments in *Liver Alkali Company* v. *Johnson* (1874), L.R., 9 Ex. 338, and *Nugent* v. *Smith* (1876) 1 C.P.D. 423.) In practice goods are not often shipped without a written contract or acknowledgment of the terms upon which they are to be carried. For each separate consignment or parcel of goods shipped a *bill of lading* is almost invariably given, and when a whole cargo is agreed to be carried the terms are set out in a document called a *charter-party*, signed by or on behalf of the shipowner on the one part, and the shipper, who is called the *charterer*, on the other part. But at present we are considering the relations of shipowner and shipper independently of any express contract, as in a case when goods are shipped and received to be carried to the place to which the ship is bound for a certain freight, but without any further agreement as to the terms of carriage. In such a case the rights of the parties depend on the rules of law, or, which is much the same thing, upon the warranties or promises which though not expressed must, as the courts have held, be implied as arising from the relation between the parties as shipper and carrier. The obligations on the one side and the other may be defined shortly to be as follows:—The shipper must not ship goods of a nature or in a condition which he knows, or ought, if he used reasonable care, to know to be dangerous to the ship, or to other goods, unless the shipowner has notice of or has sufficient opportunity to observe their dangerous character. The shipper must be prepared, without notice from the shipowner, to take delivery of his goods with reasonable despatch on the arrival of the ship at the place of destination, being ready there to discharge in some usual discharging place. The shipper must pay the agreed freight, and will not be entitled to claim delivery until the freight has been paid. In other words, the shipowner has a *lien* on the goods carried for the freight payable in respect of the carriage. On the other hand, the obligation upon the shipowner is first and foremost to deliver safely at their destination the goods shipped, and this obligation is, by the common law, subject to this exception only that the shipowner is not liable for loss or damage caused by the act of God or the king's enemies; but by statute (Merchant Shipping Act 1894, Part VIII.) it is further qualified to this extent that the shipowner is not liable for loss, happening without his actual fault or privity, by fire on board the ship, or by the robbery or embezzlement of or making away with gold or silver or jewellery, the true nature and value of which have not been declared in writing at the time of shipment; and, further, the shipowner is not liable for damage to or loss of goods or merchandise beyond an aggregate amount, not exceeding eight pounds per ton for each ton of the ship's tonnage. The shipowner is bound by an implied undertaking, or, in other words, is made responsible by the law as if he had entered into an express undertaking: (1) that the ship is seaworthy; (2) that she shall proceed upon the voyage with reasonable despatch, and shall not deviate without necessity from the usual course of the voyage.

In default of express contract.

It is not our purpose in this article to discuss minute or doubtful questions; but in their general outline the obligations of shipper and shipowner, where no terms of carriage have been agreed, except as to the freight and destination of the goods, are such as have been described above. The importance of appreciating clearly this view of the relations of shipper and shipowner arises from the fact that these fundamental rules apply to all contracts of affreightment, whether by bill of lading, charter-party or otherwise, except in so far as they are modified or negatived by the express terms of the contract.

Bills of Lading.

The document signed by the master or agent for the shipowner, by which are acknowledged the shipment of a parcel of goods and the terms upon which it is to be carried, is called a Bill of Lading. Very many different forms of bills of lading are used. For the purpose of illustration the following form (from Mr Scrutton's book on *Charter-parties and Bills of Lading*) has been selected as a sample:—

> Shipped, in apparent good order and condition by   in and upon the good Vessel called the   now lying in the port of   and bound for   , with liberty to call at any ports in any order, to sail without Pilots, and to tow and assist Vessels in distress, and to deviate for the purpose of saving life or property; and to be delivered in the like good order and condition at the aforesaid port of   unto   or to his or their assigns, freight and all other conditions as per Charter Party. The act of God, perils of the sea, fire, barratry of the Master and Crew, enemies, pirates, and thieves, arrests, and restraints of princes, rulers, and people, collisions, stranding, and other accidents of navigation excepted, even when occasioned by negligence, default, or error in judgment of the Pilot, Master, Mariners, or other servants of the Shipowners.
>
> Ship not answerable for losses through explosion, bursting of boilers, breakage of shafts, or any latent defect in the machinery or hull, not resulting from want of due diligence by the Owners of the Ship, or any of them, or by the Ship's Husband or Manager.
>
> General Average payable according to York-Antwerp Rules.
>
> In Witness whereof, the Master or Agent of the said Ship hath affirmed to three Bills of Lading, all of this tenor and date, drawn as first, second and third, one of which Bills being accomplished, the others to stand void.
>
> Dated in   this   day of   188 .

The bill of lading is an acknowledgment of the shipment of goods in a named vessel for carriage to a specified destination on terms set forth in the document. It is usually signed by the master of the vessel, but very commonly by the agents of the shipowner or sometimes of the charterers of the vessel. A vessel may be employed by its owners to earn freight in various ways: (1) It may be placed, as it is said, on the berth as a general ship, to receive cargo from any shippers who may desire to send goods to the port, or one of the ports, to which the vessel is bound. The mate or chief officer usually superintends the loading, and, as goods are shipped, a *mate's receipt* is given as an acknowledgment of the shipment. The *mate's receipt* is afterwards exchanged for the *bill of lading*. In the case of a shipment by a general ship the bill of lading is the evidence and memorandum of the contract between the shipowner and the shipper. (2) A shipper may, however, require the whole cargo space of the vessel to carry, for example, a full cargo of grain. In such a case the vessel will be chartered by the shipowner to the shipper, and the contract will be the charter-party. Even in such a case a bill or bills of lading will usually be given to enable the shipper to deal more conveniently with the goods by way of sale or otherwise. By the ancient custom of merchants recognized and incorporated in the law, the bill of lading is a document of title, representing the goods themselves, by the transfer of which symbolical delivery of the goods may be made. But when a cargo is shipped under a charter-party, although bills of lading may be given to the charterer, it is the charter-party, and not the bills of lading, which constitutes the record of the contract between the parties—of *charter-parties* we shall treat below. (3) There is a third class of case which is a combination of the two with which we have dealt above. A vessel is very commonly chartered by her owner to a charterer who has no intention to ship and does not ship any cargo on his own account, but places the vessel on the berth to receive cargo from shippers who ship under bills of lading. The charterer receives the bill of lading freight and pays the charter-party freight, his object being of course to obtain a total bill of lading freight in excess of the chartered freight, and so make a profit. The master, although he usually remains the servant of the shipowner during the term of the charter-party, acts nevertheless under the directions and on behalf of the charterer in signing bills of lading. The legal effect of this situation is that shippers who ship goods under bills of lading without knowledge of the terms of the charter-party are entitled to look to the shipowner as the person responsible to them for the safe carriage of their goods. This right depends essentially on the fact that the master who signs the bills of lading, although in doing so he is acting for the charterer, remains nevertheless the servant of the shipowner, who is not allowed to deny as against third persons, who do not know the relations between the charterer and the shipowner, that his servant, the master of the ship, has the ordinary authority of a master to bind his owner by signing bills of lading.

The forms of bills of lading vary very much, and their clauses have been the subject of judicial consideration and decision in a vast number of reported cases. The essential particulars, or at all events those common to all bills of lading, may be stated as follows:

1. The name of the shipper.
2. The name of the ship.
3. The place of loading and destination of the ship.
4. A description of the goods shipped.
5. The place of delivery.
6. The persons to whom delivery is to be made.
7. The freight to be paid.
8. The excepted perils.
9. The shipowner's lien.

The description of (1) the shipper and (2) the ship calls for no remark. The (3) description of the voyage is important, because there is, as we have already explained, an implied undertaking by the shipowner in every contract of carriage not unnecessarily to deviate from the ordinary route of the voyage upon which the goods are received to be carried. The consequences of a deviation are serious, inasmuch as the shipowner is liable, not only for any loss or damage which the shipper suffers in consequence of the deviation, but for any loss of goods which occurs after the deviation, even though such loss is caused by one of the excepted perils. The only exception to this rule is that a deviation may be made to save life, but not to save property. It is, however, very usual to qualify the strictness of this implied undertaking by introducing in the bill of lading certain "liberties" to deviate, as, for example, in the form given above, "liberty to call at any ports in any order, to tow and assist vessels in distress, and to deviate for the purpose of saving life and property." The nature and extent of the liberty will depend on the words of the contract. The inclination of English courts has been to construe clauses giving a liberty to deviate somewhat strictly against the shipowner.

The (4) importance of the description of the goods shipped and their condition is obvious, as the contract is to deliver them as described and in the like good condition, subject, of course, to the exceptions. It must, moreover, be noted that, as against the master or person who has himself signed the bill of lading, the statement therein of the goods shipped is absolutely conclusive. But as against the shipowner, unless he has himself signed the bill of lading, the statement of the goods shipped is not conclusive. It is evidence as against him that the goods described were shipped, but he is allowed to rebut this evidence by proving, if he can, that the goods mentioned, or some of them, were not in fact shipped.

As to (5) the place of delivery, very serious questions frequently arise. Primarily, of course, the shipowner is bound to deliver at the place named. Should he be prevented by some obstacle or difficulty which is of a temporary nature, the vessel must wait, and delivery must be made as soon as possible. Where, however, the obstacle is permanent, or at all events such as must cause unreasonable delay, having regard to the nature of the adventure, the shipowner is excused from delivery at the place named in the bill of lading, provided the difficulty arises from an excepted peril, or in consequence of delivery at the place named being forbidden by the law of England, as may happen, for example, in the case of a declaration of war between Great Britain and the state in which the port named in the bill of lading is situate. A party to a contract cannot be held liable for breaking his contract if its performance has become illegal. There may be other cases in which, from the circumstances of the voyage and adventure, it must be inferred that the parties intended the performance of the contract to be conditional on the existence at the time of performance of a certain state of things, the non-existence of which would render performance impossible. For instance, if the port named in the bill of lading became permanently closed and inaccessible to shipping in consequence of an earthquake, it would probably be held that the continued existence of the place named as a port was an implied condition of the contract, and that the shipowner was excused. Where, however, the performance of the contract remains lawful, and is not excused by the express terms of the contract, or by some implied condition, the shipowner is liable for any loss or damage suffered by the shipper by reason of his goods not being delivered at the named place, even though such delivery has become impossible. There is another reason why the precise description of the place of delivery often becomes important. It is only on the arrival of the ship at the place described as the place of delivery that the obligation of the consignee of the goods to take delivery commences. Delay involves considerable loss and expense to the shipowner. The shipper or consignee is not responsible for any delay which occurs before the ship has arrived at the place of delivery described in the bill of lading.

(6) The goods may be deliverable by the terms of the bill of lading to a named consignee, and to him only, but more usually they are made deliverable to the "order or assigns" of the named consignee or of the shipper. If the goods are made deliverable to order or assigns the bill of lading is a negotiable instrument, or, in other words, the right to the goods, and the rights and liabilities under the contract contained in the bill of lading, may be transferred by indorsement and delivery of the document. When an indorsement has once been made by the shipper or consignee writing his name and nothing more on the back of the bill of lading, the rights in and under it may be transferred from hand to hand by mere delivery. A bill of lading so indorsed is said to be indorsed "in blank." But the shipper or consignee may restrict the negotiability of the bill of lading by indorsing it not "in blank," but with a direction requiring delivery to be made to a particular person or indorsee, or to his order. This is called an indorsement "in full." When an indorsement has been made "in full" to a named indorsee or order, such indorsee must again indorse "in blank" or "in full" to effect a new transfer of the rights in the bill of lading.

(7) The amount or rate of *freight* payable is stated in the bill of lading, either expressly, or, not uncommonly when the freight under the bill of lading is the same as under the charter-party, by reference to the charter-party. A common form of such reference is "freight and other conditions, as per charter-party." It may here be mentioned that this form of words does not incorporate in the contract under the bill of lading all the terms and conditions of the charter-party, but only those which apply to the person who is to take delivery, and relate to matters *ejusdem generis*, or similar to the payment of freight, such as demurrage and the like. The conditions of the charter-party thus incorporated do not include, for instance, the exceptions in the charter-party so as to add them to the exceptions in the bill of lading. Freight, unless it is otherwise provided by the contract, is payable only on delivery of the goods at their destination. If the voyage is interrupted and its completion becomes impossible, the shipowner cannot claim payment of freight even *pro rata itineris*. He loses his freight altogether. This is so even when the completion of the voyage is prevented by causes for which the shipowner is not responsible, such as the act of God or the king's enemies, or perils which are within the express exceptions in the bill of lading. When the voyage is interrupted by accident, and indeed in any case, the goods may, by agreement between the shipowner and the consignee, be delivered at some place short of their destination upon payment of a freight *pro rata*; that is to say, proportional to the length of voyage accomplished, and such an agreement may be implied in certain circumstances from the conduct of the consignee in taking delivery before they arrive at their destination. In all such cases it will be a question of fact whether the goods were in fact delivered upon the terms, express or implied, that freight *pro rata* should be paid. As a rule such an agreement would not be implied where the shipowner is unable or unwilling to forward the goods to their destination, and the owner of the goods, therefore, has no option but to take delivery where offered.

When the ship is disabled and cannot proceed, or she is prevented by some obstacle from proceeding to the place of delivery named in the bill of lading, and the shipowner is unwilling or unable to forward the goods by another ship, even though he may be excused for his failure to carry the goods to their destination, he is not entitled to be paid any part of the freight; and the consignee is entitled to have the goods delivered to him either at the place where the vessel has taken refuge in her disabled condition, or, if the obstacle arises without disablement of the vessel, at the place which is nearest and most reasonably convenient at the time and in the circumstances when the further prosecution of the voyage has to be abandoned. On the other hand, after the goods have been shipped, so long as the shipowner is ready and willing to carry the goods to their destination, or, if the ship is disabled, to forward them to their destination by some other ship without unreasonable delay, the owner of the goods cannot require the goods to be delivered to him at any place short of their destination without payment of the full freight. Sometimes the freight, either wholly or in part, is made payable *in advance*. If freight payable in advance has become due, even though the ship is lost before it is paid, it must, in the absence of some special provision to the contrary, still be paid, and freight already paid in advance does not become repayable because the goods do not reach their destination. If, however, goods upon which freight has been paid in advance are lost, and the shipowner is liable for their loss, the amount of freight paid in advance must be taken into account in assessing the damage recoverable from the shipowner.

(8) There is no part of the bill of lading which is of greater practical importance or which demands more careful consideration by shipowner and shipper alike than that which sets forth the excepted perils: those perils, or in other words causes of loss, for which the shipowner is to be exempt from liability. By the common law, as we have seen, the exemption of the carrier, apart from express contract, extended only to loss by the act of God or the king's enemies. The expression "act of God" requires a word of explanation. It will be sufficient to say that it is not synonymous with *force majeure*; but it includes every loss by *force majeure* in which human agency, by act or negligence, has had no part. The list of excepted perils varies much in different forms of bills of lading. In the older forms it usually included perils of the seas, robbers and pirates, restraint of princes and rulers, fire and barratry (that is, wilful wrongdoing) of the master and crew. The list, however, has grown in modern times, and is still growing; the tendency being to exempt the shipowner from liability for all loss which does not arise from his own personal default, or from the negligence of his managers or agents in failing to provide a vessel seaworthy and fit for the voyage at its commencement. It is important to point out in this connexion that there are two duties which the shipowner is always presumed to undertake, and which are assumed to be unaffected and unqualified by the exceptions, unless a contrary intention is very clearly expressed by the terms of the contract. In the first place, he undertakes absolutely that the ship in which the goods are shipped is fit at the commencement of the voyage for the service to be performed. If during the voyage loss arises even from dangers of the seas or other excepted peril which would not have occurred if the vessel had been seaworthy and fit for the voyage at its commencement, the shipowner is not protected by the exceptions, and is liable for the loss. In the second place, there is an implied undertaking by the shipowner that all reasonable care will be taken by himself, his servants and agents, safely to carry and deliver at their destination the goods received by him for carriage. Should loss or damage occur during the voyage, though the direct cause of such loss or damage be perils of the seas or other excepted peril, still the shipowner cannot claim exemption under the exceptions, if the shipper can prove that the loss or damage

would not have occurred but for the negligence of the master or crew, or other servants of the shipowner. The shipowner, in other words, is bound, with his servants, to use all reasonable care to prevent loss by excepted perils and by any other cause.

Express stipulations.

It must not be supposed that even these primary obligations, which are introduced into every contract of affreightment not by words but by implication, may not be excluded by the express terms of the contract. It has now become common form to stipulate that the shipowner shall not be liable for any loss arising from the negligence of his servants, or that he shall not be liable for loss by the excepted perils even when brought about by the negligence of his servants. And with regard to seaworthiness, it is not uncommon for the shipowner to stipulate that he shall not be responsible for loss arising even from the unseaworthiness of the ship on sailing, provided that due care has been taken by the owner and his agents and servants to make the ship seaworthy at the commencement of the voyage. There is indeed no rule of English law which prevents a shipowner from exempting himself by the terms of the bill of lading from liability for damage and loss of every kind, whether arising from unseaworthiness or any other cause whatsoever. In such a case the goods are carried at their owner's risk, and if he desires protection he must obtain it by insurance. In this respect the law of England permits greater freedom of contract than is allowed by the law of some other states. The owners, agents and masters of vessels loading in the United States of America are forbidden by an act of Congress, commonly called the Harter Act, passed in the year 1893, to insert in their contracts of affreightment any clause exempting the shipowner from liability for the negligence of his servants; but it is at the same time enacted that, provided all reasonable skill and care has been exercised by the shipowner to make the vessel seaworthy and fit for the voyage at its commencement, the shipowner shall not be liable for any loss caused by the negligence of the master or crew in the navigation of the vessel, or by perils of the sea or certain other causes set forth in the act. It is now very usual to insert in the bills of lading of British vessels loading in the United States a reference to the Harter Act, incorporating its provisions so as to make them terms and conditions of the bill of lading.

The difficulty of construing the terms of bills of lading with regard to the excepted perils, often expressed in obscure and inexact language, has given rise to much litigation, the results of which are recorded in the law reports. Where such difficulties arise the question must be, What is the true and natural meaning of the language used by the parties? This question is not governed by the general rules which we have endeavoured to explain; but the words of the contract must always be considered with reference to these rules, which are founded upon the well-established customs of merchants recognized and formulated by the courts of law.

(9) The bill of lading sometimes contains a clause as to the shipowner's *lien*. Without any express provision for it the shipowner has by the common law a lien for freight. If it is desired to give the shipowner a lien for *demurrage* (see below) or other charges, it must be expressly provided for. The *lien* is the right of the shipowner to retain the goods carried until payment has been made of the freight or the demurrage, or other charge for which a lien has been given. The lien may be waived, and is lost by delivery of the goods, or by any dealing with the consignee which is inconsistent with a right of the shipowner to retain possession of the goods until payment has been made. The shipowner may preserve his lien by landing the goods and retaining them in his own warehouse, or by storing them in a public warehouse, subject to the conditions required by the Merchant Shipping Act 1894.

Charter-parties.

Charter-parties are, as we have already explained, either for a voyage or for a period of time. (1) A charter-party for a voyage is a formal agreement made between the owner of the vessel and the charterers by which it is agreed that the vessel "being tight, staunch and strong, and every way fitted for the voyage," shall load at a certain named place a full cargo either of goods of a specified description or of general merchandise, and being so loaded shall proceed with all possible despatch either to a specified place or to a place to be named at a specified port of call, and there deliver the cargo to the charterers or their assigns. There are clauses which provide for the amount of freight to be paid and the manner and time of payment; for the time, usually described as *lay days*, to be allowed for loading and discharging, and for the *demurrage* to be paid if the vessel is detained beyond the lay days; usually also a clause requiring "the cargo to be brought to and taken from alongside at merchant's risk and expense"; a clause that the master shall sign bills of lading for the cargo shipped either at the same rate of freight as is payable under the charter-party or very commonly at any rate of freight (but in this case with a stipulation that, if the total bill of lading freight is less than the total freight payable under the charter-party, the difference is to be paid by the charterers to the master before the sailing of the vessel); and there is usually what is called the *cesser clause*, by which the charterer's liability under the charter-party is to cease on shipment of the cargo, the shipowner taking a lien on the cargo for freight, dead freight and demurrage. The charter-party is made subject to exceptions similar to those which are found in bills of lading. There are also usually clauses providing for the commissions to be paid to the brokers on signing the charter-party, the "address" commission to be paid to the agents for the vessel at the port of discharge, and other matters of detail. The clauses in charter-parties vary, of course, indefinitely, but the above is probably a sufficient outline of the ordinary form of a charter-party for a voyage.

What has been said with regard to bills of lading as to the voyage, the place of delivery, the exceptions and excepted perils, and the liability of the shipowner and his lien applies equally to charter-parties. It may be desirable to add a few words on *demurrage, dead freight*, and on the *cesser clause*.

Demurrage is, properly speaking, a fixed sum per day or per hour agreed to be paid by the charterer for any time during which the vessel is detained in loading or discharging over and above the time allowed, which is, as we have said, usually described as the *lay days*. Sometimes the number of days during which the vessel may be kept on demurrage at the agreed rate is fixed by the charter-party. If no demurrage is provided for by the charter-party, and the vessel is kept loading or discharging beyond the lay days, the shipowner is entitled to claim damages in respect of the loss which he has suffered by the detention of his ship; or, if the vessel is detained beyond the fixed number of demurrage days, damages for detention will be recoverable. Sometimes there is no time fixed by the charter-party for loading or discharging. The obligation in such cases is to load or discharge with all despatch that is possible and reasonable in the circumstances; and if the loading or discharging is not done with such reasonable despatch, the shipowner will be entitled to claim damages for detention of his ship. The rate of demurrage (if any) will generally be accepted as the measure of the damages for detention, but is not necessarily the true measure. When the claim is for detention and not demurrage the actual loss is recoverable, which may be more or may be less than the agreed rate of demurrage. The contract usually provides that Sundays and holidays shall be excepted in counting the lay days, but unless expressly stipulated this exception does not apply to the computation of the period of detention after the lay days have expired.

Dead freight is the name given to the amount of freight lost, and therefore recoverable by the shipowner from the charterer as damages if a full and complete cargo is not loaded in accordance with the terms of the charter-party.

The *cesser clause* has come into common use because very frequently the charterers are not personally interested in the cargo shipped. They may be agents merely, or they may have chartered the vessel as a speculation to make a profit upon the bill of lading freight. The effect of the clause is that when the charterers have shipped a full cargo they have fulfilled all their obligations, the shipowner discharging them from all further liability and taking instead a lien on the cargo for payment of all freight, demurrage or dead freight that may be payable to him. It has become an established rule for the construction of the *cesser clause* that, if the language used will permit it, the cesser of liability is assumed to be co-extensive only with the lien given to the shipowner; or, in other words, the charterers are released from those liabilities only for which a lien is given to the shipowner. The shipowner is further secured by the stipulation already referred to, that if the total freight payable under the bills of lading is less than the full chartered freight the difference shall be paid to the shipowner before the vessel sails. A difficulty which sometimes arises, notwithstanding these precautions, is that although an ample lien is given by the charter-party, the terms of the bills of lading may be insufficient to preserve the same extensive lien as against the holder of the bills of lading. The shippers under the bills of lading, if they are not the charterers, are not liable for the chartered freight, but only for the bill of lading freight; and unless the bill of lading expressly reserves it, they are not subject to a lien for the chartered freight. The master may guard against this difficulty by refusing to sign bills of lading which do not preserve the shipowner's lien for his full chartered freight. But he is often put into a difficulty by a somewhat improvident clause in the charter-party requiring him to sign bills of lading *as presented*. See *Kruger* v. *Moel Tryvan*, 1907 A. C. 272.

(2) A time charter-party is a contract between the shipowner and charterers, by which the shipowner agrees to let and the

charterers to hire the vessel for a specified term for employment, either generally in any lawful trade or upon voyages within certain limits. A place is usually named at which the vessel is to be re-delivered to the owners at the end of the term, and the freight is payable until such re-delivery; the owner almost always pays the wages of the master and crew, and the charterers provide coals and pay port charges; the freight is usually fixed at a certain rate per gross register ton per month, and made payable monthly in advance, and provision is made for suspension of hire in certain cases if the vessel is disabled; the master, though he usually is and remains the servant of the owner, is required to obey the orders of the charterers as regards the employment of the vessel, they agreeing to indemnify the owners from all liability to which they may be exposed by the master signing bills of lading or otherwise complying with the orders of the charterers; and the contract is made subject to exceptions similar to those in bills of lading and voyage charter-parties. This is the general outline of the ordinary form of a time charter-party, but the forms and their clauses vary, of course, very much, according to the circumstances of each case.

It is apparent that under a time charter-party the shipowner to a large extent parts with the control of his ship, which is employed within certain limits according to the wish and directions, and for the purposes and profit of, the charterers. But, as we have already explained at the beginning of this article, the shipowner continues in possession of his vessel by his servant the master, who remains responsible to his owner for the safety and proper navigation of the ship. The result of this, as has been already pointed out, is that the holder of a bill of lading signed by the master, if he has taken the bill of lading without knowledge of the terms of the time charter-party, may hold the owner responsible for the due performance of the contract signed by the master in the ordinary course of his duties, and within his ostensible authority as servant of the shipowner, although in fact in signing the bill of lading the master was acting as agent for and at the direction of the time charterer, and not the shipowner. In the language of the ordinary time charter-party the ship is *let* to the charterers; but there is no true demise, because, as we have pointed out, the vessel remains in the possession of the shipowner, the charterer enjoying the advantages and control of its employment. Where the possession of a ship is given up to a hirer, who appoints his own master and crew, different considerations apply; but though the instrument by which the ship is let may be called a charter-party, it is not truly a contract of affreightment.

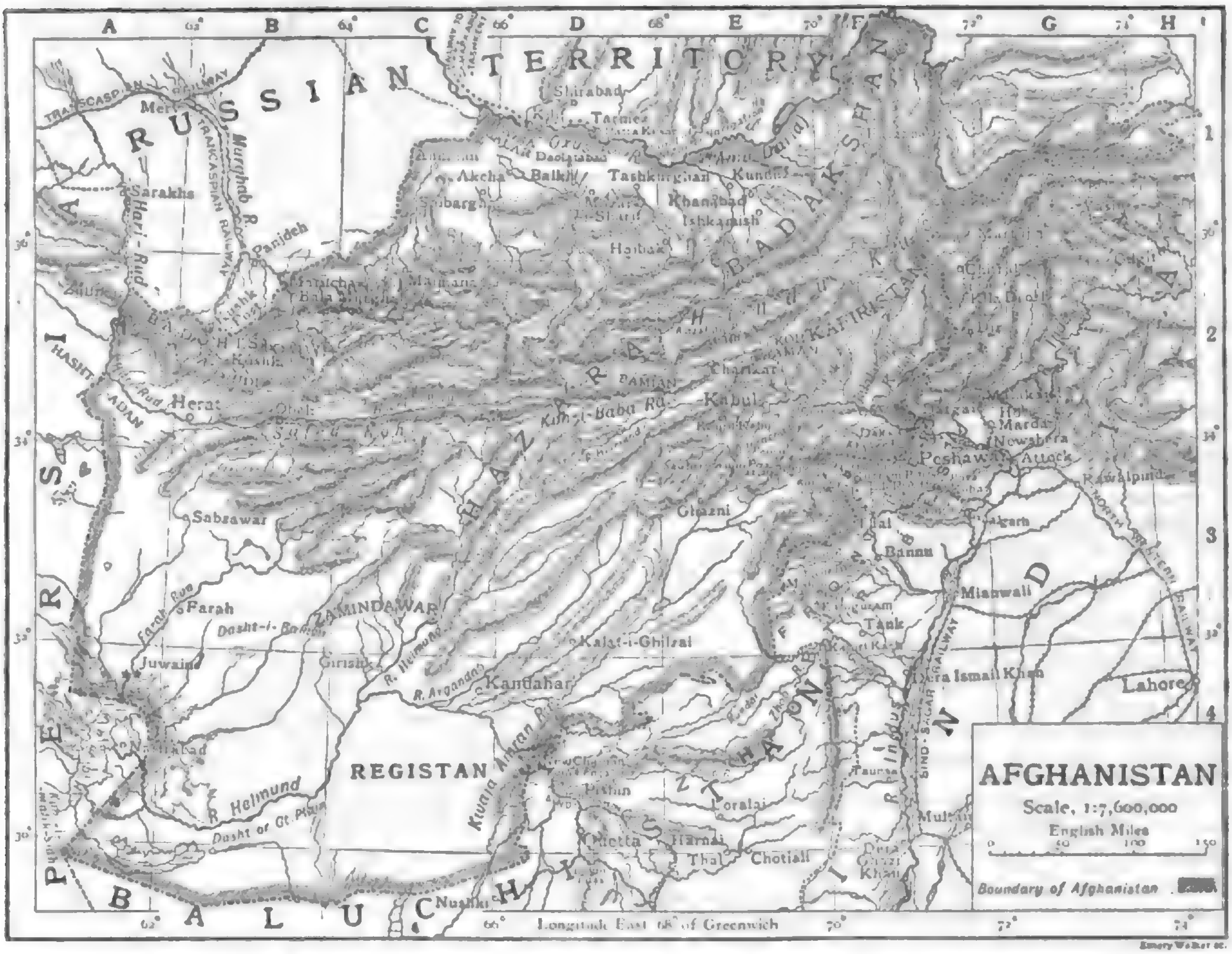
Customary rights.

There are certain rights and obligations arising out of the relationship of shipowner and cargo-owner in circumstances of extraordinary peril or urgency in the course of a voyage, which, though not strictly contractual, are well established by the customs of merchants and recognized by the law. It is obvious that, when a ship carrying a cargo is in the course of a voyage, the master to some extent represents the owners of both ship and cargo. In cases of emergency it may be necessary that the master should, without waiting for authority or instructions, incur expense or make sacrifices as agent not only of his employer, the shipowner, but also of the cargo-owner. Ship and cargo may be in peril, and it may be necessary for the safety of both to put into a port of refuge. There it may be necessary to repair the ship, and to land and warehouse, and afterwards re-ship the cargo. For these purposes the master will be obliged to incur expense, of which some part, such as the cost of repairing the ship, will be for the benefit of the shipowner; part, such as the warehousing expenses, will be for the benefit of the cargo-owner; and part, such as the port charges incurred in order to enter the port of refuge, are for the common benefit and safety of ship and cargo. Again, in a storm at sea, it may be necessary for the safety of ship and cargo to cut away a mast or to jettison, that is to say, throw overboard part of the cargo. In such a case the master, acting for the shipowner or cargo-owner, as the case may be, makes a sacrifice of part of the ship or part of the cargo, in either case for the purpose of saving ship and cargo from a danger common to both. Voluntary sacrifices so made and extraordinary expenses incurred for the common safety are called general average (see AVERAGE) sacrifices and expenses, and are made good to the person who has made the sacrifice or incurred the expense by a general average contribution, which is recoverable from the owners of the property saved in proportion to its value, or, in other words, each contributes rateably according to the benefit received. The law regulating the rights of the parties with regard to such contribution is called the law of General Average. It must, however, be remembered that the owner of the cargo is entitled under the contract of affreightment to the ordinary service of the ship and crew for the safe carriage of the cargo to its destination, and the shipowner is bound to pay all ordinary expenses incurred for the purpose of the voyage. He must also bear all losses arising from damage to the ship by accidents. But when extraordinary expense has been incurred by the shipowner for the safety of the cargo, he can recover such expense from the owner of the cargo as a *special charge* on cargo; or when an extraordinary expense has been incurred or a voluntary sacrifice made by the shipowner to save the ship and cargo from a peril common to both, he may require the owner of cargo to contribute in *general average* to make good the loss.

See Carver, *Carriage by Sea* (London, 1905); Scrutton, *Charter-parties and Bills of Lading* (London, 1904). (W.)

AFGHANISTAN, a country of Central Asia. Estimated area 245,000 sq. m. (including Badakshan and Kafiristan). Pop. about 5,000,000. It is bounded on the N. by Russian Turkestan, on the W. by Persia, and on the E. and S. by Kashmir and the independent tribes of the North-West Frontier of India and Baluchistan. The chief importance of Afghanistan in modern days is due to its position as a "buffer state" intervening between the two great empires of Asiatic Russia and British India. During the last quarter of the 19th century our knowledge of the country was greatly increased, and its boundaries on the N., E. and S. were strictly delimited. The second Afghan war of 1878–80 afforded an opportunity for the extension of wide geographical surveys on a scientific basis. The Russian-Afghan Boundary Commission of 1884–1886 resulted in the delimitation and mapping of the northern frontier. The Durand agreement of 1893 led to the partition of the Pathan tribes on the southern and eastern frontiers. The Pamir Commission of 1895 settled its north-eastern border. Finally the Perso-Baluch Commission of 1904–1905 defined its western face.

Beginning with the Persian border at Zulfikar on the Hari Rud river, the boundary between Afghanistan and Russia follows a line roughly parallel to the course of the Paropamisus, and about 35 m. to the north of it, till it strikes the Kushk river in Jamshidi territory at a point which was once known as Chahil Dukteran, but is now the Russian post Kushkinski, and the terminus of a branch railway from Merv. Kushkinski is about 20 m. below the old Jamshidi settlement of Kushk, which is the capital of Badghis. The settlement and the post originally called Kushk must not be confused together. From Kushkinski the boundary runs north-east, crossing the Murghab river near Maruchak (which is an Afghan fortress), and thence passes north-east through the hills of the Chul, and the undulating deserts of the Aleli Turkmans, to the Oxus, leaving the valleys of Charshamba and of Andkhui (to which it runs approximately parallel) within Afghan limits. These valleys denote the limits of cultivation in this direction. Throughout all this region the boundary is generally of an artificial character, marked by pillars, but it is here and there indicated by natural features forming local lines of water-parting or water-course. The boundary meets the Oxus at Khamiab at the western extremity of the cultivated district of Khwaja Salar, and from that point to the eastern end of Lake Victoria in the Pamirs the main channel of the Oxus river forms the northern limits of Afghanistan. (See OXUS.) Eastwards from Lake Victoria the frontier line was determined by the Pamir Boundary Commission of 1895. A part of the little Pamir is included in Afghan territory, but the boundary crosses this Pamir before the great bend northwards of the Aksu takes place, and, passing over a series of crags and untraversable mountain ridges, is lost on the Chinese frontier in the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REGISTAN
ZAMINDAWAR
BADAKSHAN
KAFIRISTAN
HAZARA
Kuh-i-Baba Ra.
Safed Koh
Dasht-i-Bakwa
Dasht or Gt. Plain
R. Helmund
R. Argandab
Hari Rud
Murghab R.
TRANSCASPIAN RAILWAY
SIND-SAGAR RAILWAY
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30° 32° 34° 36°

Emery Walker sc.

snowfields of Sarikol. Bending back westwards upon itself, the line of Afghan frontier now follows the water-parting of the Hindu Kush; and as the Hindu Kush absolutely overhangs the Oxus nearly opposite Ishkashim, it follows that, at this point, Afghanistan is about 10 m. wide. Thus a small and highly elevated portion of the state extends eastwards from its extreme north-eastern corner, and is attached to the great Afghan quadrilateral by the thin link of the Panja valley. These narrow limits (called Wakhan) include the lofty spurs of the northern flank of the Hindu Kush, an impassable barrier at this point, where the glacial passes reach 19,000 ft. in altitude, and the enclosing peaks 24,000 ft. The backbone or main water-divide of the Hindu Kush continues to form the boundary between Afghanistan and those semi-independent native states which fringe Kashmir in this mountain region, until it reaches Kafiristan. From near the Dorah pass (14,800 ft.), which connects Chitral with the Panja (or Oxus) river, a long, straight, snow-clad spur reaches southwards, which divides the Kafiristan valley of Bashgol from that of Chitral, and this continues to denote the eastern limits of Afghanistan till it nearly touches the Chitral river opposite the village of Arnawai, 45 m. south of Chitral. Here the Bashgol and Chitral valleys unite and the boundary passes to the water-divide east of the Chitral river, after crossing it by a spur which leaves the insignificant Arnawai valley to the north; along this water-divide it extends to a point nearly opposite the quaint old town of Pashat in the Kunar valley (the Chitral river has become the Kunar in its course southwards), and then stretches away in an uneven and undefined line, dividing certain sections of the Mohmands from each other by hypothetical landmarks, till it strikes the Kabul river near Palosi. Thence following a course nearly due south, it reaches Landi Kotal. From the abutment of the Hindu Kush on the Sarikol in the Pamir regions to Landi Kotal, and throughout its eastern and southern limits, the boundary of Afghanistan touches districts which were brought under British political control with the formation of the North-West Frontier Provinces of India in 1901. From the neighbourhood of Landi Kotal the boundary is carried to the Safed Koh overlooking the Afridi Tirah, and then, rounding off the cultivated portions of the Kurram valley below the Peiwar, it crosses the Kaitu and passes to the upper reaches of the Tochi. Crossing these again, it is continued on the west of Waziristan, finally striking the Gomal river at Domandi. South of the Gomal it separates the interests of Afghanistan from those of Baluchistan, which here adjoins the North-West Frontier Province. From Domandi (the junction of the Kundar river with the Gomal) the Afghan boundary marches with that of Baluchistan. (See BALUCHISTAN.) It is carried to the south-west on a line which is largely defined by the channels of the Kundar and the Kadanai to a point beyond the Sind-Peshin terminal station of New Chaman, west of the Khojak range, and then drops southward to Shorawak and Nushki. From Nushki it crosses the Helmund desert, touching the crest of a well-defined mountain watershed for a great part of the way, and, leaving Chagai to Baluchistan, it strikes nearly west to the Persian frontier, and joins it on the Koh-i-Malik Siah mountain, south of Seistan. Two points of this part of the Afghan boundary are notable. It leaves some of the most fanatical of the Durani Afghan people on the Baluch side of the frontier in the Toba district, north of the Quetta–Chaman line of railway; and it passes 50 m. south of the Helmund river.

enclosing within Afghanistan the only approach to Seistan from India which is available during the seasons of Helmund overflow. Between Afghanistan and Persia the boundary was defined by Sir F. Goldsmid's Commission in 1872 from the Malik-Siah-Koh to the Helmund Lagoons, and rectified by the Commission under Sir Henry MacMahon in 1903–1905. Beyond these lagoons to Hashtadan it is still indefinite. The eastern limits of Hashtadan had been previously fixed as far north as the Hari Rud river at Toman Agha. From this point to Zulfikar the Hari Rud is itself the boundary.

Afghan provinces.

Within the limits of this boundary Afghanistan comprises four main provinces, Northern Afghanistan or Kabul, Southern Afghanistan or Kandahar, Herat and Afghan Turkestan, together with the minor dependencies of the Ghilzai and Hazara Highlands, Ghazni, Jalalabad and Kafiristan. All these are described in separate articles. The kingdom of Kabul is the historic Afghanistan; the link which unites it to Kandahar, Herat and the other outlying provinces having been frequently broken and again restored by amirs of sufficient strength and capability. The Herat province is largely Persian, while Afghan Turkestan is chiefly Usbeg; and in neither is the sentiment of loyalty to the central government very strong. The bond is geographical and political rather than racial. The geographical divisions of the country are created by the basins of its chief rivers, the Kabul, the Helmund, the Hari Rud and the Oxus. The Kabul river drains Northern Afghanistan, the Hari Rud the province of Herat, and the Oxus that of Afghan Turkestan. Afghanistan is largely a country of mountains and deserts; but there are wide tracts of highly irrigated and most productive country where fruit is grown in such abundance as to become an important item in the export trade. The Afghans are expert agriculturists and make profitable use of all the natural sources of water-supply. As practical irrigation engineers they are only rivalled by the Chinese.

Mountain systems.

The dominant mountain system of Afghanistan is the Hindu Kush, and that extension westwards of its water-divide which is indicated by the Koh-i-Baba to the north-west of Kabul, and by the Firozkhoi plateau (Karjistan), which merges still farther to the west by gentle gradients into the Paropamisus, and which may be traced across the Hari Rud to Mashad.

The culminating peaks of the Koh-i-Baba overlooking the sources of the Hari Rud, the Helmund, the Kunduz and the Kabul very nearly reach 17,000 ft. in height (Shah Fuladi, the highest, is 16,870), and from them to the south-west long spurs divide the upper tributaries of the Helmund, and separate its basin from that of the Farah Rud. These spurs retain a considerable altitude, for they are marked by peaks exceeding 11,000 ft. They sweep in a broad band of roughly parallel ranges to the south-west, preserving their general direction till they abut on the Great Registan desert to the west of Kandahar, where they terminate in a series of detached and broken anticlinals whose sides are swept by a sea of encroaching sand. The long, straight, level-backed ridges which divide the Argandab, the Tarnak and Arghastan valleys, and flank the route from Kandahar to Ghazni, determining the direction of that route, are outliers of this system, which geographically includes the Khojak, or Kwaja Amran, range in Baluchistan.

North of the main water-parting of Afghanistan the broad synclinal plateau into which the Hindu Kush is merged is traversed by the gorges of the Saighan, Bamian and Kamard tributaries of the Kunduz, and farther to the west by the Band-i-Amir or Balkh river. Between the debouchment of the Upper Murghab from the Firozkhoi uplands into the comparatively low level of the valley above Bala Murghab, extending eastwards in a nearly straight line to the upper sources of the Shibarghan stream, the Band-i-Turkestan range forms the northern ridge between the plateau and the sand formations of the Chul. It is a level, straight-backed line of sombre mountain ridge, from the crest of which, as from a wall, the extraordinary configuration of that immense loess deposit called the Chul can be seen stretching away northwards to the Oxus—ridge upon ridge, wave upon wave, like a vast yellow-grey sea of storm-twisted billows. The Band-i-Turkestan anticlinal may be traced eastwards of the Balkh-ab (the Band-i-Amir) within the folds of the Kara Koh to the Kunduz, and beyond; but the Kara Koh does not mark the northern wall of the great plateau nor overlook the sands of the Oxus plain, as does the Band-i-Turkestan. Here there intervenes a second wide synclinal plateau, of which the northern edge is defined by the flat outlines of the Elburz to the south of Mazar-i-Sharif, and immediately at the foot of this range lie the alluvial plains of Mazar and Tashkurghan. Opposite Tashkurghan the Oxus plain narrows to a short 25 m. On the south this great band of roughly undulating central plateau is bounded by the Koh-i-Baba, to the west of Kabul, and by the Hindu Kush to the north and north-east of that city. Thus the main routes from Kabul to Afghan Turkestan must cross either one or other of these ranges, and must traverse one or other of the terrific defiles which have been carved out of them by the upper tributaries of the rivers running northwards towards the Oxus. Probably in no country in the world are there gathered together within comparatively narrow limits so many clean-cut waterways, measuring thousands of feet in depth, affording such a stupendous system of narrow roadways through the hills.

After the Hindu Kush and the Turkestan mountains, that range which divides Ningrahar (or the valley of Jalalabad) from Kurram and the Afridi Tirah, and is called Safed Koh (also the name of the range south of the Hari Rud), is the most important, as it is the most impressive, in Afghanistan.

The highest peak of the Safed Koh, Sikaram, is 15,600 ft. above sea-level. From this central dominating peak it falls gently towards the west, and gradually subsides in long spurs, reaching to within a few miles of Kabul and barring the road from Kabul to Ghazni. At a point which is not far east of the Kabul meridian an offshoot is directed southwards, which becomes the water-parting between the Kurram and the Logar at Shutargardan, and can be traced to a connexion with the great watershed of the frontier dividing the Indus basin from that of the Helmund. This main watershed retains its high altitude far to the south. There are peaks measuring over 12,000 ft. on the divide between the Tochi and the Ghazni plains.

Geology.

So far as we know at present the geological history of Afghanistan differs widely from that of India. When, somewhere at the commencement of the Cretaceous period, the peninsula of India was connected by land with Madagascar and Southern Africa, all Afghanistan, Baluchistan and Persia formed part of an area which was not continuously below sea-level, but exhibited alternations of land and sea. The end of the Cretaceous period saw the beginning of a series of great earth movements ushered in by volcanic eruptions on a scale such as the earth has never since witnessed, which resulted in the upheaval of the Himalayas by a process of crushing and folding of the sedimentary rocks till marine fossils were forced to an altitude of 20,000 ft. above the sea. It was not till the Tertiary age, and even late in that age, that much of the land area of Afghanistan was raised above the sea-level. Then the ocean gradually retired into the great Central Asian depressions.

Everywhere there have been great and constant changes of level since that period, and the process of flexure and the formation of anticlinals traversing the northern districts of Afghanistan is a process which is still in action. So rapid has been the land elevation of Central Afghanistan that the erosive action of rivers has not been able to keep pace with that of upheaval; and the result all through Afghanistan (but specially marked in the great central highlands between Kabul and Herat) is the formation of those immensely deep gorges and defiles which are locally known as *daras*. One of these, in the Astarab, to the south-east of Maimana, is but 30 yds. wide, and is enclosed between perpendicular limestone cliffs 1500 ft. high. C. L. Griesbach considers that the general outline of the land configuration has remained much the same since Pliocene times, and that the force which brought about the wrinkling of the older deposits still continues to add fold on fold. The highlands which shut off the Turkestan provinces from Southern Afghanistan have afforded the best opportunities for geological investigation, and as might be expected from their geographical position, the general result of the examination of exposed sections leads to the identification of geological affinity with Himalayan, Indian and Persian regions. The general configuration of the Turkestan highlands has been already indicated.

Against the last great fold which terminates this mountain area northwards are ranged the Tertiaries and recent deposits. North of Maimana they form low undulating loess hills, in which most of the Band-i-Turkestan drainage is lost. This wide-spreading loess area, formed partly of wind-blown sand and partly of detritus from the mountains, is known as Chul, and merges into the great plains south of the Oxus river, a great part of which is covered with modern aerial deposits. Beneath this Chul formation the older beds of the outer and Turkestan ranges dip and pass to an irregular outcrop near the banks of the Oxus. Between the Oxus and the hills there has already been formed a rise or flexure in the ground, which extends more or less parallel to the northern edge of the hills, and, shutting in the cultivated area of the plains, arrests all tributaries seeking to effect a junction with the Oxus from the south, and leads to the formation of marshes and swamps. This appears to be the beginning of a new anticlinal which has altered the levels of the Balkh plain, and is indicative of those elevating processes which may have been effective within historic times in changing the climate and the agricultural prospects of this part of Central Asia. The Oxus itself is steadily encroaching on its right banks and depositing detritus on the left.

No fresh discoveries of minerals likely to be of high economic value to Afghanistan have been made of late years. Such as are known and worked at present have been worked from very ancient times, and their capacity is not likely to develop greatly under the Kabul government. The most important feature in this connexion which was noted by the geologist of the Russo-Afghan Commission is the existence of vast coal beds in northern Afghanistan. In 1903 some coal mines were discovered in the Jagdalak districts.

There are no glaciers now to be found in Afghan Turkestan; but evidences of their recent existence are abundant. The great boulder bed terraces in some of the valleys of the northern slopes of the Ferozkhoi plateau are probably of glacial origin. In the mountains west of Kabul glaciers have retired, leaving the moraines perfectly undisturbed. They are probably contemporary with the older alluvia. (T. H. H.*)

Rocks.

The oldest rocks which have yet been identified[1] in Afghanistan occur along the axis of the main watershed, and have been referred to the Carboniferous. At Robat-i-Pai near Herat, for example, there is a dark *Productus* limestone which seems to be identical with the *Productus* limestone of the Central Himalayas. These beds are conformably succeeded, along the Central Asian watershed, by a continuous series of strata which apparently represent the Permian, Trias and Jurassic of Europe. They consist of marine beds alternating with freshwater and littoral deposits, together with plant beds and coal-seams of considerable thickness. The lowest beds of this series, which from their position may belong either to the Permian or to the upper part of the Carboniferous, have yielded no recognizable fossils; but they include a conglomerate which closely resembles the boulder bed near the base of the Talchir series in India. The Upper Trias has been definitely identified by the occurrence of *Halobia* and other fossils; while in the higher beds of the series marine forms belonging to the middle and upper Jurassic have been found.

The plant beds occur at several horizons, and among the remains which have been found in them are several forms which occur also in the Gondwana beds of India. There can be no doubt that the series as a whole is the equivalent of the Gondwana system, and when the country has been more closely examined the association of marine fossils with Gondwana plants will be of the greatest value in determining the precise homotaxis of the Indian deposits.

The Jurassic beds are followed, generally with perfect conformity, by the Cretaceous, which covers a large part of Afghan Turkestan and probably forms the greater part of the ranges which run south and south-west from the principal watershed. The lowest beds consist of red grits which contain Neocomian fossils, while the middle and upper Cretaceous consist chiefly of limestone and chalk. The entire system may be represented in the west, but in the Herat province and in Afghan Turkestan the middle Cretaceous seems to be absent, and it is probable that, as in other regions, the upper Cretaceous covers a much wider area than the lower beds. Tertiary and recent deposits are widely spread, filling most of the valleys and covering the plains of the Helmund. Eocene beds have not yet been proved to exist; but this is probably owing to the imperfect knowledge of the country, for the formation is known in Persia, Baluchistan and the Suliman Hills. The lower part of the Miocene is marine in Herat and Afghan Turkestan; but the upper Miocene is usually of freshwater or estuarine origin. In Afghanistan, as in other regions near the great Eurasian system of folds, the Miocene includes extensive deposits of gypsum and salt. It was during this period that the forces which finally raised the country above the level of the sea began to take effect. The Pliocene consists entirely of freshwater and terrestrial deposits, which were probably laid down at the foot of the rising hills and on the floors of the intervening valleys. As the elevation continued, they were sometimes involved in the folding to which the mountains owe their origin. During this period the gradual desiccation of the country continued, and wind-blown deposits, such as the loess, began to make their appearance.

Although volcanic cones are known both in Persia and in Baluchistan, none have yet been described in Afghanistan itself. There is, however, ample evidence that at several distinct geological periods the region has been the seat of great volcanic activity. According to C. L. Griesbach, basic volcanic rocks are interbedded with the lowest part of the plant-bearing series, and enormous outbursts took place during the Neocomian period. But the most important igneous masses are the great intrusions of syenitic granite and of basic rock which penetrate the Cretaceous beds. These are probably of Eocene or of late Cretaceous age. (P. La.)

Roads and passes.

Omitting the group of northern routes to India from Central Asia, which pass between Kashmir and Afghanistan through the defiles of Chitral and of the Indus (see HINDU KUSH), the highways of Afghanistan may be classed under two heads: (1) Foreign trade routes, and (2) Internal communications.

(1) Of the many routes which cross the frontiers of Afghanistan the most important commercially are those which connect the Oxus regions and the Central Asian khanates with Kabul, and those which lead from Kabul, Ghazni and Kandahar to the plains of India.

Kabul is linked with Afghan Turkestan and Badakshan by three main lines of communication across the Koh-i-Baba and the Hindu Kush. One of these routes follows the Balkh river to its head from Tashkurghan, and then, preserving a high general level of 8000 to 9000 ft., it passes over the water-divides separating the upper tributaries of the Kunduz river, and drops into the valley formed by another tributary at Bamian. From Bamian it passes over the central mountain chain to Kabul either by the well-known passes of Irak (marking the water-divide of the Koh-i-Baba) and of Unai (marking the summit of the Sanglakh, a branch of the Hindu Kush), or else, turning eastwards, it crosses into the Ghorband valley by the Shibar, a pass which is considerably lower than the Irak and is very seldom snowbound. From the foot of the Unai pass it follows the Kabul river, and from the foot of the Shibar it follows the circuitous route which is offered by the drainage of the Ghorband valley to Charikar, and thence southwards to Kabul. The main points on this route are Haibak, Bajgah and Bamian. It is full of awkward grades and minor passes, but it does not maintain a high level generally, no pass (if the Shibar route be adopted) much exceeding 10,000 ft. That this has for centuries been regarded as the main route northward from Kabul, the Buddhist relics of Bamian and Haibak bear silent witness; but it may be doubted whether Abdur Rahman's talent for roadmaking has not opened out better alternative lines. One of his roads connects Haibak with the Ghorband valley by the Chahardar pass across the Hindu Kush. The pass is high (nearly 14,000 ft.), but the road is excellently well laid out, and the route, which, south of Haibak, traverses a corner of the Ghori and Baghlan districts of Badakshan, is more direct. A third route also passes through Badakshan, and connects Kunduz with Charikar by the Khawák pass and Panjshir river. The latter joins the Ghorband close to Charikar. The Khawák (11,600 ft.) is not a high pass; the grades are easy and the snowfall usually light. This high road is stated (on Afghan authority) to be kept open for khafila traffic all the year round by the employment of forced labour for clearing snow. It is a recently developed route and one of great importance to Kabul, both strategically and commercially.

Routes that pass through the mountain barriers of the frontier between Peshawar and the Gomal occur at intervals along the western border, and in the northern section of the Indian frontier they are all well marked. The Khyber, Kurram and Tochi are the best known, inasmuch as all these lines of advance into Afghanistan are held by British troops or Indian levies. But the Bara valley route into the heart of the Afridi Tirah is not to be altogether overlooked, although it is not a trade route of any importance. Between Kabul and Jalalabad there are two roads, one by the Lataband pass, and the other and more difficult by the Khurd-Kabul and Jagdalak passes, the latter being the scene of the massacre of a British brigade in 1842. Between Jalalabad and Peshawar is the Khyber pass (*q.v.*). The Khyber was not in ancient times the main route of advance from Kabul to Peshawar. From Kabul the old route followed the Kabul river through the valley of Laghman (or Lamghan, as the Afghans call it) over a gentle water-parting into the Kunar valley, leaving Ningrahar and Jalalabad to the south. From the Kunar it crossed into Bajour by one of several open and comparatively easy passes, and from Bajour descended into India either by the Malakand or some other contiguous frontier gateway to the plains of Peshawar.

The Kurram route involves the Peiwar and Shutargardan passes (8600 and 10,800 ft. respectively) across the southern extensions of the Safed Koh range, and has never been a great trade route, however suitable as an alternative military line of advance.

Trade does not extend largely between Afghanistan and India by the Tochi route, being locally confined to the valley and the districts at its head, yet this is the shortest and most direct route between Ghazni and the frontier, and in the palmy days of Ghazni raiding was the road by which the great robber Mahmud occasionally descended on to the Indus plains. Traces of his raiding and roadmaking are still visible, but it is certain that he made use of the more direct route to Peshawar far more frequently than he did of the Tochi. The exact nature of the connexion between the head of the Tochi and the Ghazni plain is still unknown to us.

The Gomal is the great central trade route between Afghanistan and India; and the position, which is held by a tribal post at Wana, will do much to ensure its continued popularity. The Gomal involves no passes of any great difficulty, although it is impossible to follow the actual course of the river on account of the narrow defiles which have been cut through the recent conglomerate beds which flank the plains of the Indus. It has been carefully surveyed for a possible railway alignment; and an excellent road now connects

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[1] We owe our knowledge of the geology of Afghanistan almost entirely to the observations of C. L. Griesbach, and a summary of his researches will be found in *Records of the Geological Survey of India*, vol. xx. (1887), pp. 93-103, with map.

Tank (at its foot) with the Zhob line of communications to Quetta, and with Wana on the southern flank of Waziristan. The Gomal route is of immense importance, both as a commercial and strategic line, and in both particulars is of far greater significance than either the Kurram or the Tochi.

(2) Of the interior lines of communication, those which connect the great cities of Afghanistan, Herat, Kabul and Kandahar, are obviously the most important. Between Kabul and Herat there is no "royal" road, the existing route passing over the frequently snowbound wastes that lie below the southern flank of the great Koh-i-Baba into the upper valleys of the Hari Rud tributaries. It is a waste, elevated, desolate region that the route traverses, and the road itself is only open at certain seasons of the year. Between Kabul and Kandahar exists the well-known and oft-traversed route by Ghazni and Kalat-i-Ghilzai. There is but one insignificant water-parting—or kotal—a little to the north of Ghazni; and the road, although unmade, may be considered equal to any road of its length in Europe for military purposes. Between Kandahar and Herat there is the recognized trade route which crosses the Helmund at Girishk and passes through Farah and Sabzawar. It includes about 360 miles of easy road, with spaces where water is scarce. There is not a pass of any great importance, nor a river of any great difficulty, to be encountered from end to end, but the route is flanked on the north between Kandahar and Girishk by the Zamindawar hills, containing the most truculent and fanatical clans of all the Southern Afghan tribes. Little need be said of the 65 m. of route between Kandahar and the Baluchistan frontier at New Chaman. It is on the whole a route across open plains and hard, stony "dasht"—a route which would offer no great difficulties to that railway extension from Chaman which has so long been contemplated. A very considerable trade now passes along this route to India, in spite of almost prohibitive imposts; but the trade does not follow the railway from New Chaman to the eastern foot of the Khojak. Long strings of camels may still be seen from the train windows patiently treading their slow way over the Khojak pass to Kila Abdullah, whilst the train alongside them rapidly twists through the mountain tunnel into the Peshin valley.

Climate.

The variety of climate is immense, as might be expected. Taking the highlands of the country as a whole, there is no great difference between the mean temperature of Afghanistan and that of the lower Himalayas. Each may be placed at a point between 50° and 60° F. But the remarkable feature of Afghan climate (as also of that of Baluchistan) is its extreme range of temperature within limited periods. The least daily range in the north is during the cold weather, the greatest in the hot. For seven months of the year (from May to November) this range exceeds 30° F. daily. Waves of intense cold occur, lasting for several days, and one may have to endure a cold of 12° below zero, rising to a maximum of 17° below freezing-point. On the other hand the summer temperature is exceedingly high, especially in the Oxus regions, where a shade maximum of 110° to 120° is not uncommon. At Kabul, and over all the northern part of the country to the descent at Gandamak, winter is rigorous, but especially so on the high Arachosian plateau. In Kabul the snow lies for two or three months; the people seldom leave their houses, and sleep close to stoves. At Ghazni the snow has been known to lie long beyond the vernal equinox; the thermometer sinks to 10° and 15° below zero (Fahr.); and tradition relates the entire destruction of the population of Ghazni by snowstorms more than once.

At Jalalabad the winter and the climate generally assume an Indian character. The summer heat is great everywhere in Afghanistan, but most of all in the districts bordering on the Indus, especially Sewi, on the lower Helmund and in Seistan. All over Kandahar province the summer heat is intense, and the simoon is not unknown. The hot season throughout this part of the country is rendered more trying by frequent dust storms and fiery winds; whilst the bare rocky ridges that traverse the country, absorbing heat by day and radiating it by night, render the summer nights most oppressive. At Kabul the summer sun has great power, though the heat is tempered occasionally by cool breezes from the Hindu Kush, and the nights are usually cool. At Kandahar snow seldom falls on the plains or lower hills; when it does, it melts at once.

At Herat, though 800 ft. lower than Kandahar, the summer climate is more temperate; and, in fact, the climate altogether is far from disagreeable. From May to September the wind blows from the N.W. with great violence, and this extends across the country to Kandahar. The winter is tolerably mild; snow melts as it falls, and even on the mountains does not lie long. Three years out of four at Herat it does not freeze hard enough for the people to store ice; yet it was not very far from Herat, and could not have been at a greatly higher level (at Kafir Kala, near Kassan) that, in 1750, Ahmad Shah's army, retreating from Persia, is said to have lost 18,000 men from cold in a single night. In the northern Herat districts, too, records of the coldest month (February) show the mean minimum as 17° F., and the maximum 38°. The eastern reaches of the Hari Rud river are frozen hard in the winter, rapids and all, and the people travel on it as on a road.

The summer rains that accompany the S.W. monsoon in India, beating along the southern slopes of the Himalaya, travel up the Kabul valley as far as Laghman, though they are more clearly felt in Bajour and Panjkora, under the high spurs of the Hindu Kush, and in the eastern branches of Safed Koh. Rain also falls at this season at the head of Kurram valley. South of this the Suliman mountains may be taken as the western limit of the monsoon's action. It is quite unfelt in the rest of Afghanistan, in which, as in all the west of Asia, the winter rains are the most considerable. The spring rain, though less copious, is more important to agriculture than the winter rain, unless where the latter falls in the form of snow. In the absence of monsoon influences there are steadier weather indications than in India. The north-west blizzards which occur in winter and spring are the most noticeable feature, and their influence is clearly felt on the Indian frontier. The cold is then intense and the force of the wind cyclonic. Speaking generally, the Afghanistan climate is a dry one. The sun shines with splendour for three-fourths of the year, and the nights are even more clear than the days. Marked characteristics are the great differences of summer and winter temperature and of day and night temperature, as well as the extent to which change of climate can be attained by slight change of place. As the emperor Baber said of Kabul, at one day's journey from it you may find a place where snow never falls, and at two hours' journey a place where snow almost never melts!

The Afghans vaunt the salubrity and charm of some local climates, as of the Toba hills above the Kakar country, and of some of the high valleys of the Safed Koh.

The people have by no means that immunity from disease which the bright, dry character of the climate and the fine physical aspect of a large proportion of them might lead us to expect. Intermittent and remittent fevers are very prevalent; bowel complaints are common, and often fatal in the autumn. The universal custom of sleeping on the house-top in summer promotes rheumatic and neuralgic affections; and in the Koh Daman of Kabul, which the natives regard as having the finest of climates, the mortality from fever and bowel complaint, between July and October, is great, the immoderate use of fruit predisposing to such ailments.

Population.

The term Afghan really applies to one section only of the mixed conglomeration of nationalities which forms the people of Afghanistan, but this is the dominant section known as the Durani. The Ghilzai (who is almost as powerful as the Durani) claims to be of Turkish origin; the Hazaras, the Chahar-Aimak, Tajiks, Uzbegs, Kafirs and others are more or less subject races. Popularly any inhabitant of Afghanistan is known as Afghan on the Indian frontier without distinction of origin or language; but the language division between the Parsiwan (or Persian-speaking Afghan) and the Pathan is a very distinct one. The predominance of the Afghan in Afghanistan dates from the middle of the 18th century, when Ahmad Shah carved out Afghanistan from the previous conquests of Nadir Shah and called it the Durani empire.

The Durani Afghans claim to be Ben-i-Israel, and insist on their descent from the tribes who were carried away captive from Palestine to Media by Nebuchadrezzar. Yet they also claim to be Pukhtun (or Pathan) in common with all other Pushtu-speaking tribes, whom they do not admit to be Afghan. The bond of affinity between the various peoples who compose the Pathan community is simply the bond of a common language.

All of them recognize a common code or unwritten law called Pukhtunwali, which appears to be similar in general character to the old Hebraic law, though modified by Mahommedan ordinances, and strangely similar in certain particulars to Rajput custom. Besides their division into clans and tribes, the whole Afghan people may be divided into dwellers in tents and dwellers in houses; and this division is apparently not coincident with tribal divisions, for of several of the great clans at least a part is nomad and a part settled. Such, *e.g.*, is the case with the Durani and with the Ghilzai.

The settled Afghans form the village communities, and in part the population of the few towns. Their chief occupation is with the soil. They form the core of the nation and the main part of the army. Nearly all own the land on which they live, and which they cultivate with their own hands or by hired labour. Roundly speaking, agriculture and soldiering are their sole occupations. No Afghan will pursue a handicraft or keep a shop, though the Ghilzai Povindahs engage largely in travelling trade and transport of goods. As a race the Afghans are very handsome and athletic, often with fair complexion and flowing beard, generally black or brown, sometimes, though rarely, red; the features highly aquiline. The hair is shaved off from the forehead to the top of the head, the remainder at the sides being allowed to fall in large curls over the shoulders. Their step is full of resolution; their bearing proud and apt to be rough.

The women have handsome features of Jewish cast (the last trait often true also of the men); fair complexions, sometimes rosy, though usually a pale sallow; hair braided and plaited behind in two long tresses terminating in silken tassels. They are rigidly secluded, but intrigue is frequent.

The Afghans, inured to bloodshed from childhood, are familiar with death, and audacious in attack, but easily discouraged by failure; excessively turbulent and unsubmissive to law or discipline; apparently frank and affable in manner, especially when they hope to gain some object, but capable of the grossest brutality when that hope ceases. They are unscrupulous in perjury, treacherous, vain and insatiable, passionate in vindictiveness, which they will satisfy at the cost of their own lives and in the most cruel manner. Nowhere is crime committed on such trifling grounds, or with such general impunity, though when it is punished the punishment is atrocious. Among themselves the Afghans are quarrelsome, intriguing and distrustful; estrangements and affrays are of constant occurrence; the traveller conceals and misrepresents the time and direction of his journey. The Afghan is by breed and nature a bird of prey. If from habit and tradition he respects a stranger within his threshold, he yet considers it legitimate to warn a neighbour of the prey that is afoot, or even to overtake and plunder his guest after he has quitted his roof. The repression of crime and the demand of taxation he regards alike as tyranny. The Afghans are eternally boasting of their lineage, their independence and their prowess. They look on the Afghans as the first of nations, and each man looks on himself as the equal of any Afghan.

They are capable of enduring great privation, and make excellent soldiers under British discipline, though there are but few in the Indian army. Sobriety and hardiness characterize the bulk of the people, though the higher classes are too often stained with deep and degrading debauchery. The first impression made by the Afghan is favourable. The European, especially if he come from India, is charmed by their apparently frank, open-hearted, hospitable and manly manners; but the charm is not of long duration, and he finds that the Afghan is as cruel and crafty as he is independent. No trustworthy statistics exist showing either present numbers or fluctuations in the population of Aghanistan. Within the amir's dominions there are probably from four to five millions of people, and of these the vast majority are agriculturists.

The cultivators, including landowners, tenants, hired labourers and slaves, represent the working population of the country, and as industrious and successful agriculturists they are unsurpassed in Asia. They have carried the art of irrigation to great perfection, and they utilize every acre of profitable soil. Certain Ghilzai clans are specially famous for their skill in the construction of the karez or underground water-channel.

Religion.

The religion of the country throughout is Mahommedan. Next to Turkey, Afghanistan is the most powerful Mahommedan kingdom in existence. The vast majority of Afghans are of the Sunni sect; but there are, in their midst, such powerful communities of Shiahs as the Hazaras of the central districts, the Kizilbashes of Kabul and the Turis of the Kurram border, nor is there between them that bitterness of sectarian animosity which is so marked a feature in India. The Kafirs of the mountainous region of Kafiristan alone are non-Mahommedan. They are sunk in a paganism which seems to embrace some faint reflexion of Greek mythology, Zoroastrian principles and the tenets of Buddhism, originally gathered, no doubt, from the varied elements of their mixed extraction. Those contiguous Afghan tribes, who have not so long ago been converted to the faith of Islam, are naturally the most fanatical and the most virulent upholders of the faith around them. In and about the centre of civilization at Kabul, instances of Ghazism are comparatively rare. In the western provinces about Kandahar (amongst the Durani Afghans—the people who claim to be Beni-Israel), and especially in Zamindawar, the spirit of fanaticism runs high, and every other Afghan is a possible Ghazi—a man who has devoted his life to the extinction of other creeds.

Language and literature.

Persian is the vernacular of a large part of the non-Afghan population, and is familiar to all educated Afghans; it is the language of the court and of literature. Pushtu, however, is the prevailing language, though it does not seem to be spoken in Herat, or, roughly speaking, west of the Helmund. Turki is spoken in Afghan Turkestan. There is a respectable amount of Afghan literature. The oldest work in Pushtu is a history of the conquest of Swat by Shaikh Mali, a chief of the Yusafzais, and leader in the conquest (A.D. 1413–24). In 1494 Kaju Khan became chief of the same clan; during his rule Buner and Panjkora were completely conquered, and he wrote a history of the events. In the reign of Akbar, Bayazid Ansari, called Pir-i-Roshan, "the Saint of Light," the founder of an heretical sect, wrote in Pushtu; as did his chief antagonist, a famous Afghan saint called Akhund Darweza. The literature is richest in poetry. Abdur Rahman (17th century) is the best known poet. Another very popular poet is Khushal Khan, the warlike chief of the Khattaks in the time of Aurangzeb. Many other members of his family were poets also. Ahmad Shah, the founder of the monarchy, likewise wrote poetry. Ballads are numerous.

Education.

Education is confined to most elementary principles in Afghanistan. Of schools or colleges for the purposes of a higher education befitted to the sons of noblemen and the more wealthy merchants there are absolutely none; but the village school is an ever-present and very open spectacle to the passer-by. Here the younger boys are collected and instructed in the rudiments of reading, writing and religious creed by the village mullah, or priest, who thereby acquires an early influence over the Afghan mind. The method of teaching is confined to that wearisome system of loud-voiced repetition which is so annoying a feature in Indian schools; and the Koran is, of course, the text-book in all forms of education. Every Afghan gentleman can read and speak Persian, but beyond this acquirement education seems to be limited to the physical development of the youth by instruction in horsemanship and feats of skill. Such advanced education as exists in Afghanistan is centred in the priests and physicians; but the ignorance of both is extreme.

Constitution and laws.

The government of Afghanistan is an absolute monarchy under the amir, and succession to the throne is hereditary. There are five chief political divisions in the country—namely, Kabul, Turkestan, Herat, Kandahar and Badakshan, each of which is ruled by a "naib" or governor, who is directly responsible to the amir. Under the governors of provinces the nobles and kazis (or district judges) dispense justice much in the feudal fashion. There are three classes of chiefs who form the council or durbar of the king. These are the sirdars, the khans and the mullahs. The sirdars are hereditary nobles, the khans are representatives of the people, and the mullahs of Mahommedan religion. The khan is elected by the clan or tribe. The clannish attachment of the Afghans is rather to the community than to the chief. These three classes of representatives are divided into two assemblies, the Durbar Shahi or royal assembly, and the Kharwanin Mulkhi or commons. The mullahs take their place in one or the other according to their individual rank. The executive officials of the amir have a selected body, called the Khilwat, which acts as a cabinet council, but no member can give advice to the crown without being asked to do so, or beyond the jurisdiction of his own department. The amir, in addition to being chief executive officer, is chief judge and supreme court of appeal. Any one has the right to appeal to the amir for trial, and the great amirs, Dost Mahommed and Abdur Rahman, were accessible at all times to the petitions of their subjects. Next to the amir comes the court of the kazi, the chief centre of justice, and beneath the kazi comes the kotwal, who performs, as in India, the ordinary functions of a magistrate. In large provincial towns there is a punchait, or council, for the trial of commercial cases. There are government departments for the administration of revenue, customs, post-office, military affairs, &c. The general law administered in all the courts of Afghanistan is that of Islam and of the customs of the country, with developments introduced by the Amir Abdur Rahman.

Defence.

The Afghan army probably numbers 50,000 regulars distributed between the military centres of Herat, Kandahar, Kabul, Mazar-i-Sharif, Jalalabad and Asmar, with detachments at frontier outposts on the side of India. Abdur Rahman claimed that he could put 100,000 men into the field within a week for the defence of Herat. In 1896 he introduced a system of semi-enforced service whereby one man in every eight between the ages of sixteen and seventy takes his turn at military training. In this way he calculated that he could have raised 1,000,000 men armed with modern weapons, but his chief difficulty would be money and transport. The pay of the army is apt to be irregular. The amir's factories at Kabul for arms and ammunition are said to turn out about 20,000 cartridges and 15 rifles daily, with 2 guns per week; but the arms thus produced are very heterogeneous, and the different varieties of cartridge used would cause endless complications. The two chief fastnesses of Northern Afghanistan are Herat and Dehdadi near Balkh. The latter fort took twelve years to build, and commands all the roads leading from the Oxus into Afghan Turkestan. It is armed with naval quick-firing guns, Krupp, Hotchkiss, Nordenfeld and Maxim. The chief cantonment for the same district is at Mazar-i-Sharif, 12 m. from Balkh.

Finance.

Financially, Afghanistan has never, since it first became a kingdom, been able to pay for its own government, public works and army. There appears to be no inherent reason why this should be so. Whilst it can never (in the absence of any great mineral wealth) develop into a wealthy country, it can at least support its own population; and it would, but for the short-sighted trade policy of Abdur Rahman, certainly have risen to a position of respectable solvency. Its revenues (about which no trustworthy information is available) are subject to great fluctuations, and probably never exceed the value of one million sterling per annum. They fell in Shere Ali's time to £700,000. The original subsidy to the amir from the Indian government was fixed at 12 lakhs of rupees (£80,000) per annum, but in 1893, in connexion with the boundary settlement, it was increased to £120,000.

Minerals.

Few minerals are wrought in Afghanistan, though Abdur Rahman claims in his autobiography that the country is rich in mines. Some small quantity of gold is taken from the streams in Laghman and the adjoining districts. Famous silver mines were formerly worked near the head of the Panjshir valley in Hindu Kush. Kabul is chiefly supplied with iron from the Permuli (or Farmuli) district, between the Upper Kurram and Gomal, where it is said to be abundant. Iron ore is most abundant near the passes leading to Bamian, and in other parts of Hindu Kush. Copper ore from various parts of Afghanistan has been seen, but it is nowhere worked. Lead is found in Upper Bangash (Kurram district), and in the Shinwari country (also among the branches of Safed Koh), and in the Kakar country. There are reported to be rich lead mines near Herat scarcely worked. Lead, with antimony, is found near the Arghand-ab, 32 m. north-west of Ghazni, and in the Ghorband valley, north of Kabul. Most of the lead used, however, comes from the Hazara country, where the ore is described as being gathered on the surface. An ancient mine of great extent and elaborate character exists at Feringal, in the Ghorband valley. Antimony is obtained in considerable quantities at Shah-Maksud, about 30 m. north of Kandahar. Sulphur is said to be found at Herat, dug from the soil in small fragments, but the chief supply comes from the Hazara country and from Pirkisri, on the confines of Seistan, where there would seem to be a crater, or fumarole. Sal-ammoniac is brought from the same place. Gypsum is found in large quantities in the plain of Kandahar, being dug out in fragile coralline masses from near the surface. Coal (perhaps lignite) is said to be found in Zurmat (between the Upper Kurram and the Gomal) and near Ghazni. Nitre abounds in the soil over all the south-west of Afghanistan, and often affects the water of the karez or subterranean canals.

Vegetation.

The characteristic distribution of vegetation on the mountains of Afghanistan is worthy of attention. The great mass of it is confined to the main ranges and their immediate off-shoots, whilst on the more distant and terminal prolongations it is almost entirely absent; in fact, these are naked rock and stone.

Take, for example, the Safed Koh. On the alpine range itself and its immediate branches, at a height of 6000 to 10,000 ft., we have abundant growth of large forest trees, among which conifers are the most noble and prominent, such as *Cedrus Deodara*, *Abies excelsa*, *Pinus longifolia*, *P. Pinaster*, *P. Pinea* (the edible pine) and the larch. We have also the yew, the hazel, juniper, walnut, wild peach and almond. Growing under the shade of these are several varieties of rose, honeysuckle, currant, gooseberry, hawthorn, rhododendron and a luxuriant herbage, among which the ranunculus family is important for frequency and number of genera. The lemon and wild vine are also here met with, but are more common on the northern mountains. The walnut and oak (evergreen, holly-leaved and kermes) descend to the secondary heights, where they become mixed with alder, ash, khinjak, *Arbor-vitae*, juniper, with species of *Astragalus*, &c. Here also are *Indigoferae* and dwarf laburnum.

Lower again, and down to 3000 ft. we have wild olive, species of rock-rose, wild privet, acacias and mimosas, barberry and *Zizyphus*; and in the eastern ramifications of the chain, *Chamaerops humilis* (which is applied to a variety of useful purposes), *Bignonia* or trumpet flower, sissu, *Salvadora persica*, verbena, acanthus, varieties of *Gesnerae*.

The lowest terminal ridges, especially towards the west, are, as has been said, naked in aspect. Their scanty vegetation is almost wholly herbal; shrubs are only occasional; trees almost non-existent. Labiate, composite and umbelliferous plants are most common. Ferns and mosses are almost confined to the higher ranges.

In the low brushwood scattered over portions of the dreary plains of the Kandahar table-lands, we find leguminous thorny plants of the papilionaceous sub-order, such as camel-thorn (*Hedysarum Alhagi*), *Astragalus* in several varieties, spiny rest-harrow (*Ononis spinosa*), the fibrous roots of which often serve as a tooth-brush; plants of the sub-order *Mimosae*, as the sensitive mimosa; a plant of the rue family, called by the natives *lipåd;* the common wormwood; also certain orchids, and several species of *Salsola*. The rue and wormwood are in general use as domestic medicines—the former for rheumatism and neuralgia; the latter in fever, debility and dyspepsia, as well as for a vermifuge. The *lipåd*, owing to its heavy nauseous odour, is believed to keep off evil spirits. In some places, occupying the sides and hollows of ravines, are found the rose bay (*Nerium Oleander*), called in Persian *khar-zarah*, or ass-bane, the wild laburnum and various *Indigoferae*.

In cultivated districts the chief trees seen are mulberry, willow, poplar, ash, and occasionally the plane; but these are due to man's planting.

Uncultivated products of value.

One of the most important of these is the gum-resin of *Narthex asafetida*, which grows abundantly in the high and dry plains of Western Afghanistan, especially between Kandahar and Herat. The depot for it is Kandahar, whence it finds its way to India, where it is much used as a condiment. It is not so used in Afghanistan, but the Seistan people eat the green stalks of the plant preserved in brine. The collection of the gum-resin is almost entirrly in the hands of the Kakar clan of Afghans.

In the highlands of Kabul edible rhubarb is an important local luxury. The plants grow wild in the mountains. The bleached rhubarb, which has a very delicate flavour, is altered by covering the young leaves, as they sprout from the soil, with loose stones or an empty jar. The leaf-stalks are gathered by the neighbouring hill people, and carried down for sale. Bleached and unbleached rhubarb are both largely consumed, both raw and cooked.

The walnut and edible pine-nut are both wild growths, which are exported.

The *sanjît* (*Elaeagnus orientalis*), common on the banks of watercourses, furnishes an edible fruit. An orchis found in the mountain yields the dried tuber which affords the nutritious mucilage called *salep*; a good deal of this goes to India.

Pistacia khinjak affords a mastic. The fruit, mixed with its resin, is used for food by the Achakzais in Southern Afghanistan. The true pistachio is found only on the northern frontier; the nuts are imported from Badakshan and Kunduz.

Mushrooms and other fungi are largely used as food, especially by the Hindus of the towns, to whom they supply a substitute for meat.

Manna, of at least two kinds, is sold in the bazaars. One, called *turanjbîn*, appears to exude, in small round tears, from the camel-thorn, and also from the dwarf tamarisk; the other, *sir-kasht*, in large grains and irregular masses or cakes with bits of twig imbedded, is obtained from a tree which the natives call *siah chob* (black wood), thought by Bellew to be a *Fraxinus* or *Ornus*.

Agriculture.

In most parts of the country there are two harvests, as generally in India. One of these, called by the Afghans *bahârak*, or the spring crop, is sown in the end of autumn and reaped in summer. It consists of wheat, barley and a variety of lentils. The other, called *pâisah* or *tîrmâi*, the autumnal, is sown in the end of spring, and reaped in autumn. It consists of rice, varieties of millet and sorghum, of maize, *Phaseolus Mungo*, tobacco, beet, turnips, &c. The loftier regions have but one harvest.

Wheat is the staple food over the greater part of the country. Rice is not largely distributed. In much of the eastern mountainous country *bâjra* (*Holcus spicatus*) is the chief grain. Most English and Indian garden-stuffs are cultivated; turnips in some places very largely, as cattle food.

The growth of melons, water-melons and other cucurbitaceous plants is reckoned very important, especially near towns; and this crop counts for a distinct harvest.

Sugar-cane is grown only in the rich plains; and though cotton is grown in the warmer tracts, most of the cotton cloth is imported.

Madder is an important item of the spring crop in Ghazni and Kandahar districts, and generally over the west, and supplies the Indian demand. It is said to be very profitable, though it takes three years to mature. Saffron is grown and exported. The castor-oil plant is everywhere common, and furnishes most of the oil of the country. Tobacco is grown very generally; that of Kandahar has much repute, and is exported to India and Bokhara. Two crops of leaves are taken.

Lucerne and a trefoil called *shaftal* form important fodder crops in the western parts of the country, and, when irrigated, are said to afford ten or twelve cuttings in the season. The *komal* (*Prangos pabularia*) is abundant in the hill country of Ghazni, and is said to extend through the Hazara country to Herat. It is stored for winter use, and forms an excellent fodder. Others are derived from the *Holcus sorghum*, and from two kinds of panick. It is common to cut down the green wheat and barley before the ear forms, for fodder, and the repetition of this, with barley at least, is said not to injure the grain crop. Bellew gives the following statement of the manner in which the soil is sometimes worked in the Kandahar district:—Barley is sown in November; in March and April it is twice cut for fodder; in June the grain is reaped, the ground is ploughed and manured and sown with tobacco, which yields two cuttings. The ground is then prepared for carrots and turnips, which are gathered in November or December.

Of great moment are the fruit crops. All European fruits are produced profusely, in many varieties and of excellent quality. Fresh or preserved, they form a principal food of a large class of the people, and the dry fruit is largely exported. In the valleys of Kabul mulberries are dried, and packed in skins for winter use. This mulberry cake is often reduced to flour, and used as such, forming in some valleys the main food of the people.

Grapes are grown very extensively, and the varieties are very numerous. The vines are sometimes trained on trellises, but most frequently over ridges of earth 8 or 10 ft. high. The principal part of the garden lands in villages round Kandahar is vineyard, and the produce must be enormous.

Open canals are usual in the Kabul valley, and in eastern Afghanistan generally; but over all the western parts of the country much use is made of the *kares*, which is a subterranean aqueduct uniting the waters of several springs, and conducting their combined volume to the surface at a lower level.

Fauna.

As regards vertebrate zoology, Afghanistan lies on the frontier of three regions, viz. the *Eurasian*, the *Ethiopian* (to which region Baluchistan seems to belong) and the *Indo-Malayan*. Hence it naturally partakes somewhat of the forms of each, but is in the main *Eurasian*.

Felidae.—*F. catus*, *F. chaus* (both Eurasian); *F. caracal* (Eur., Ind., Eth.), about Kandahar; a small leopard, stated to be found almost all over the country, perhaps rather the cheetah (*F. jubatus*, Ind. and Eth.); *F. pardus*, the common leopard (Eth. and Ind.). The tiger exists in Afghan Turkestan.

Canidae.—The jackal (*C. aureus*, Eur., Ind., Eth.) abounds on the Helmund and Argand-ab, and probably elsewhere. Wolves (*C. Bengalensis*) are formidable in the wilder tracts, and assemble in troops on the snow, destroying cattle and sometimes attacking single horsemen. The hyena (*H. striata*, Africa to India) is common. These do not hunt in packs, but will sometimes singly attack a bullock; they and the wolves make havoc among sheep. A favourite feat of the boldest of the young men of southern Afghanistan is to enter the hyena's den, single-handed, muffle and tie him. There are wild dogs, according to Elphinstone and Conolly. The small Indian fox (*Vulpes Bengalensis*) is found; also *V. flavescens*, common to India and Persia, the skin of which is much used as a fur.

Mustelidae.—Species of mungoose (*Herpestes*), species of otter, *Mustela erminea*, and two ferrets, one of them with tortoise-shell marks, tamed by the Afghans to keep down vermin; a marten (*M. flavigula*, Indian).

Bears are two: a black one, probably *Ursus torquatus*; and one of a dirty yellow, *U. Isabellinus*, both Himalayan species.

Ruminants.—*Capra aegagrus* and *C. megaceros*; a wild sheep (*Ovis cycloceros* or *Vignei*); *Gazella subgutturosa*—these are often netted in batches when they descend to drink at a stream; *G. dorcas* perhaps; *Cervus Wallichii*, the Indian barasingha, and probably some other Indian deer, in the north-eastern mountains.

The wild hog (*Sus scrofa*) is found on the lower Helmund. The wild ass, *Gorkhar* of Persia (*Equus onager*), is frequent on the sandy tracts in the south-west.

The Himalayan varieties of the markhor and ibex are abundant in Kafiristan.

Talpidae.—A mole, probably *Talpa Europaea*; *Sorex Indicus*; *Erinaceus collaris* (Indian), and *Er. auritus* (Eurasian).

Bats believed to be *Phyllorhinus cineraceus* (Punjab species), *Scotophilus Bellii* (W. India), *Vesp. auritus* and *V. barbastellus*, both found from England to India.

Rodentia.—A squirrel (*Sciurus Syriacus*?); *Mus Indicus* and *M. Gerbellinus*; a jerboa (*Dipus telum*?); *Alactaga Bactriana*; *Gerbillus Indicus*, and *G. erythrinus* (Persian and Indian); *Lagomys Nepalensis*, a Central Asian species. A hare, probably *L. ruficaudatus*.

BIRDS.—The largest list of Afghan birds that we know of is given by Captain Hutton in the *J. As. Soc. Bengal*, vol. xvi. pp. 775 seq.; but it is confessedly far from complete. Of 124 species in that list, 95 are pronounced to be Eurasian, 17 Indian, 10 both Eurasian and Indian, 1 (*Turtur risorius*) Eur., Ind. and Eth.; and 1 only, *Carpodacus* (*Bucanetes*) *crassirostris*, peculiar to the country. Afghanistan appears to be, during the breeding season, the retreat of a variety of Indian and some African (desert) forms, whilst in winter the *avifauna* becomes overwhelmingly Eurasian.

REPTILES.—The following particulars are from Gray:—Lizards—*Pseudopus gracilis* (Eur.), *Argyrophis Horsfieldii*, *Salea Horsfieldii*, *Calotes Maria*, *C. versicolor*, *C. minor*, *C. Emma*, *Phrynocephalus Tickelii*—all Indian forms. A tortoise (*Testudo Horsfieldii*) appears to be peculiar to Kabul. There are apparently no salamanders or tailed Amphibia. The frogs are partly Eurasian, partly Indian; and the same may be said of the fish, but they are as yet most imperfectly known.

The camel is of a more robust and compact breed than the tall beast used in India, and is more carefully tended. The two-humped Bactrian camel is commonly used in the Oxus regions, but is seldom seen near the Indian frontier.

Horses form a staple export to India. The best of these, however, are reserved for the Afghan cavalry. Those exported to India are usually bred in Maimana and other places in Afghan

Turkestan. The indigenous horse is the *yabu*, a stout, heavy-shouldered animal, of about 14 hands high, used chiefly for burden, but also for riding. It gets over incredible distances at an ambling shuffle, but is unfit for fast work and cannot stand excessive heat. The breed of horses was much improved under the amir Abdur Rahman, who took much interest in it. Generally, colts are sold and worked too young.

The cows of Kandahar and Seistan give very large quantities of milk. They seem to be of the humped variety, but with the hump evanescent. Dairy produce is important in Afghan diet, especially the pressed and dried curd called *krût* (an article and name perhaps introduced by the Mongols).

There are two varieties of sheep, both having the fat tail. One bears a white fleece, the other a russet or black one. Much of the white wool is exported to Persia, and now largely to Europe by Bombay. Flocks of sheep are the main wealth of the nomad population, and mutton is the chief animal food of the nation. In autumn large numbers are slaughtered, their carcases cut up, rubbed with salt and dried in the sun. The same is done with beef and camel's flesh.

The goats, generally black or parti-coloured, seem to be a degenerate variety of the shawl-goat.

The climate is found to be favourable to dog-breeding. Pointers are bred in the Kohistan of Kabul and above Jalalabad—large, heavy, slow-hunting, but fine-nosed and staunch; very like the old double-nosed Spanish pointer. There are greyhounds also, but inferior in speed to second-rate English dogs.

Trade and commerce.

The manufactures of the country have not developed much during recent years. Poshtins (sheepskin clothing) and the many varieties of camel and goat's hair-cloth which, under the name of "barak," "karak," &c., are manufactured in the northern districts, are still the chief local products of that part of Afghanistan. Herat and Kandahar are famous for their silks, although a large proportion of the manufactured silk found on the Herat market, as well as many of the felts, carpets and embroideries, are brought from the Central Asian khanates. The district of Herat produces many of the smaller sorts of carpets ("*galichas*" or prayer-carpets), of excellent design and colour, the little town of Adraskand being especially famous for this industry; but they are not to be compared with the best products of eastern Persia or of the Turkman districts about Panjdeh.

The nomadic Afghan tribes of the west are chiefly pastoral, and the wool of the southern Herat and Kandahar provinces is famous for its quality. In this direction, the late boundary settlements have undoubtedly led to a considerable development of local resources. A large quantity of wool, together with silk, dried fruit, madder and asafetida, finds its way to India by the Kandahar route.

It is impossible to give accurate trade statistics, there being no trustworthy system of registration. The value of the imports from Kabul to India in 1892–1893 was estimated at 221,000 Rx (or tens of rupees). In 1899 it was little over 217,000 Rx, the period of lowest intermediate depression being in 1897. These imports include horses, cattle, fruits, grain, wool, silk, hides, tobacco, drugs and provisions (ghi, &c.). All this trade emanates from Kabul, there being no transit trade with Bokhara owing to the heavy dues levied by the amir. The value of the exports from India to Kabul also shows great fluctuation. In the year 1892–1893 it was registered at nearly 611,000 Rx. In 1894–1895 it had sunk to 274,000 Rx, and in 1899 it figured at 294,600 Rx. The chief items are cotton goods, sugar and tea. In 1898–1899 the imports from Kandahar to India were valued at 330,000 Rx, and the exports from India to Kandahar at about 264,000 Rx. Three-fourths of the exports consist of cotton goods, and three-eighths of the imports were raw wool. The balance of the imports was chiefly made up of dried fruits. Comparison with trade statistics of previous years on this side Afghanistan is difficult, owing to the inclusion of a large section of Baluchistan and Persia within the official "Kandahar" returns; but it does not appear that the value of the western Afghanistan trade is much on the increase. The opening up of the route between Quetta and Seistan has doubtless affected a trade which was already seriously hampered by restrictions. In the year after the mission of Sir Louis Dane to Kabul in 1005 it was authoritatively stated that the trade between Afghanistan and India had nearly doubled in value.

Antiquities.

The basin of the Kabul river especially abounds in remains of the period when Buddhism flourished. Bamian is famous for its wall-cut figures, and at Haibak (on the route between Tashkurghan and Kabul) there are some most interesting Buddhist remains. In the Koh-Daman, north of Kabul, are the sites of several ancient cities, the greatest of which, called Beghram, has furnished coins in scores of thousands, and has been supposed to represent Alexander's Nicaea. Nearer Kabul, and especially on the hills some miles south of the city, are numerous topes. In the valley of Jalalabad are many remains of the same character.

In the valley of the Tarnak are the ruins of a great city (Ulan Robat) supposed to be the ancient Arachosia. About Girishk, on the Helmund, are extensive mounds and other traces of buildings; and the remains of several great cities exist in the plain of Seistan, as at Pulki, Peshawaran and Lakh, relics of ancient Drangiana. An ancient stone vessel preserved in a mosque at Kandahar is almost certainly the same that was treasured at Peshawar in the 5th century as the begging pot of Sakya-Muni. In architectural relics of a later date than the Graeco-Buddhist period Afghanistan is remarkably deficient. Of the city of Ghazni, the vast capital of Mahmud and his race, no substantial relics survive, except the tomb of Mahmud and two remarkable brick minarets. A vast and fruitful harvest of coins has been gathered in Afghanistan and the adjoining regions.

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(T. H. H.*)

HISTORY

The Afghan chroniclers call their people *Beni-Israil* (Arab. for Children of Israel), and claim descent from King Saul (whom they call by the Mahommedan corruption *Tâlût*) through a son whom they ascribe to him, called Jeremiah, who again had a son called Afghâna. The numerous stock of Afghâna were removed by Nebuchadrezzar, and found their way to the mountains of Ghor and Feroza (east and north of Herat). Only nine years after Mahommed's announcement of his mission they heard of the new prophet, and sent to Medina a deputation headed by a wise and holy man called Kais, to make inquiry. The deputation became zealous converts, and on their return converted their countrymen. From Kais and his three sons the whole of the genuine Afghans claim descent.

This story is repeated in great and varying detail in sundry books by Afghans, the oldest of which appears to be of the 16th century; nor do we know that any trace of the legend is found of older date. In the version given by Major Raverty (Introd. to *Afghan Grammar*), Afghanah is settled by King Solomon himself *in the Sulimani mountains*; there is nothing about Nebuchadrezzar or Ghor. The historian Ferishta says he had read that the Afghans were descended from Copts of the race of Pharaoh. And one of the Afghan histories, quoted by Mr Bellew, relates "a current tradition" that, previous to the time of Kais, *Bilo* the father of the Biluchis, *Uzbak* (evidently the father of the Usbegs) and *Afghana* were considered as brethren. As Mahommed Usbeg Khan, the *eponymus* of the medley of Tatar tribes called Usbegs, reigned in the 14th century A.D., this gives some possible light on the value of these so-called traditions.

We have analogous stories in the literature of almost all nations that derive their religion or their civilization from a foreign source. To say nothing of the *Book of Mormon*, a considerable number of persons have been found to propagate the doctrine that the English people are descended from the tribes of Israel. But the Hebrew ancestry of the Afghans is more worthy at least of consideration, for a respectable number of intelligent officers, well acquainted with the Afghans, have been strong in their belief of it; and though the customs alleged in proof will not bear the stress laid on them, undoubtedly a prevailing type of the Afghan physiognomy has a character strongly Jewish. This characteristic is certainly a remarkable one; but it is shared, to a considerable extent, by the Kashmiris (a circumstance which led Bernier to speculate on the Kashmiris representing the lost tribes of Israel), and, we believe, by the Tajik people of Badakshan.

Relations with the Greeks.—In the time of Darius Hystaspes (500 B.C.) we find the region now called Afghanistan embraced in the Achaemenian satrapies, and various parts of it occupied by *Sarangians* (in Seistan), *Arians* (in Herat), *Sattagydians* (supposed in highlands of upper Helmund and the plateau of Ghazni), *Dadicae* (suggested to be Tajiks), *Aparytae* (mountaineers, perhaps of Safed Koh, where lay the *Paryetae* of Ptolemy), *Gandarii* (in Lower Kabul basin) and *Paktyes*, on or near the Indus. In the last name it has been plausibly suggested that we have the *Pukhtun*, as the eastern Afghans pronounce their name. Indeed, *Pusht*, *Pasht* or *Pakht* would seem to be the oldest name of the country of the Afghans in their traditions.

The *Ariana* of Strabo corresponds generally with the existing dominions of Kabul, but overpasses their limits on the west and south.

About 310 B.C. Seleucus is said by Strabo to have given to the Indian Sandrocottus (Chandragupta), in consequence of a marriage-contract, some part of the country west of the Indus occupied by an Indian population, and no doubt embracing a part of the Kabul basin. Some sixty years later occurred the establishment of an independent Greek dynasty in Bactria. (See Bactria, Media, Eucratides, Menander of India, Euthydemus, and Persia, *Ancient History*.) Of the details of their history and extent of their dominion in different reigns we know almost nothing, and conjecture is often dependent on such vague data as are afforded by the collation of the localities in which the coins of independent princes have been found. But their power extended certainly over the Kabul basin, and probably, at times, over the whole of Afghanistan. The ancient architecture of Kashmir, the tope of Manikyala in the Punjab, and many sculptures found in the Peshawar valley, show unmistakable Greek influence. Demetrius (*c.* 190 B.C.) is supposed to have reigned in Arachosia after being expelled from Bactria, much as, at a later date, Baber reigned in Kabul after his expulsion from Samarkand. Eucratides (181 B.C.) is alleged by Justin to have warred in India. With his coins, found abundantly in the Kabul basin, commences the use of an Arianian inscription, in addition to the Greek, supposed to imply the transfer of rule to the south of the mountains, over a people whom the Greek dynasty sought to conciliate. Under Heliocles (147 B.C.?), the Parthians, who had already encroached on Ariana, pressed their conquests into India. Menander (126 B.C.) invaded India at least to the Jumna, and perhaps also to the Indus delta. The coinage of a succeeding king, Hermaeus, indicates a barbaric irruption. There is a general correspondence between classical and Chinese accounts of the time when Bactria was overrun by Scythian invaders. The chief nation among these, called by the Chinese *Yue-Chi*, about 126 B.C. established themselves in Sogdiana and on the Oxus in five hordes. Near the Christian era the chief of one of these, which was called Kushan, subdued the rest, and extended his conquests over the countries south of the Hindu Kush, including Sind as well as Afghanistan, thus establishing a great dominion, of which we hear from Greek writers as Indo-Scythia. (See Yue-Chi.)

Buddhism had already acquired influence over the people of the Kabul basin, and some of the barbaric invaders adopted that system. Its traces are extensive, especially in the plains of Jalalabad and Peshawar, but also in the vicinity of Kabul.

Various barbaric dynasties succeeded each other. A notable monarch was Kanishka (see India, *History*) or Kanerkes, whose date is variously fixed at from 58 B.C. to A.D. 125, and whose power extended over the upper Oxus basin, Kabul, Peshawar, Kashmir and probably far into India. His name and legends still filled the land, or at least the Buddhist portion of it, 600 years later, when the Chinese pilgrim, Hsüan Tsang, travelled in India; they had even reached the great Mahommedan philosopher, traveller and geographer, Abū-r-Raihān Muhammad al-Bīrūnī (see Bīrūnī), in the 11th century; and they are still celebrated in the Mongol versions of Buddhist ecclesiastical story.

Turkoman Dynasties.—In the time of Hsüan Tsang (A.D. 630–645) there were both Indian and Turk princes in the Kabul valley, and in the succeeding centuries both these races seem to have predominated in succession. The first Mahommedan attempts at the conquest of Kabul were unsuccessful, though Seistan and Arachosia were permanently held from an early date. It was not till the end of the 10th century that a Hindu prince ceased to reign in Kabul, and it fell into the hands of the Turk Sabuktagin, who had established his capital at Ghazni. There, too, reigned his famous son Mahmud, and a series of descendants, till the middle of the 12th century, rendering the city one of the most splendid in Asia. We then have a powerful dynasty, commonly believed to have been of Afghan race; and if so, the first. But the historians give them a legendary descent from Zohak, which is no Afghan genealogy. The founder of the dynasty was Alauddin, chief of Ghor, whose vengeance for the cruel death of his brother at the hands of Bahram the Ghaznevide was wreaked in devastating the great city. His nephew, Shahabuddin Mahommed, repeatedly invaded India, conquering as far as Benares. His empire in India indeed—ruled by his freedmen who after his death became independent—may be regarded as the origin of that great Mahommedan monarchy which endured nominally till 1857. For a brief period the Afghan countries were subject to the king of Khwarizm, and it was here chiefly that occurred the gallant attempts of Jalaluddin of Khwarizm to withstand the progress of Jenghiz Khan.

A passage in Ferishta seems to imply that the Afghans in the Sulimani mountains were already known by that name in the first century of the Hegira, but it is uncertain how far this may be built on. The name *Afghans* is very distinctly mentioned in 'Utbi's *History of Sultan Mahmud*, written about A.D. 1030, coupled with that of the *Khiljis*. It also appears frequently in connexion with the history of India in the 13th and 14th centuries. The successive dynasties of Delhi are generally called *Pathan*, but were really so only in part. Of the *Khiljis* (1288–1321) we have already spoken. The Tughlaks (1321–1421) were originally Tatars of the Karauna tribe. The Lodis (1450–1526) were pure Pathans. For a century and more after the Mongol invasion the whole of the Afghan countries were under Mongol rule; but in the middle of the 14th century a native dynasty sprang up in western Afghanistan, that of the *Kurts*, which extended its rule over Ghor, Herat and Kandahar. The history of the Afghan countries under the Mongols is obscure; but that régime must have left its mark upon the country, if we judge from the occurrence of frequent Mongol names of places, and even of Mongol expressions adopted into familiar language.

The Mogul Dynasty.—All these countries were included in Timur's conquests, and Kabul at least had remained in the possession of one of his descendants till 1501, only three years before it fell into the hands of another and more illustrious one, Sultan Baber. It was not till 1522 that Baber succeeded in permanently wresting Kandahar from the Arghuns, a family of Mongol descent, who had long held it. From the time of his conquest of Hindustan (victory at Panipat, April 21, 1526), Kabul and Kandahar may be regarded as part of the empire of Delhi under the (so-called) Mogul dynasty which Baber founded. Kabul so continued till the invasion of Nadir Shah (1738). Kandahar often changed hands between the Moguls and the rising Safavis (or Sufis) of Persia. Under the latter it had remained from 1642 till 1708, when in the reign of Husain, the last of them, the Ghilzais, provoked by the oppressive Persian governor Shahnawaz Khan (a Georgian prince of the Bagratid house), revolted under Mir Wais, and expelled the Persians. Mir Wais was acknowledged sovereign of Kandahar, and eventually defeated the Persian armies sent against him, but did not long survive (*d.* 1715).

Mahmud, the son of Mir Wais, a man of great courage and energy, carried out a project of his father's, the conquest of Persia itself. After a long siege, Shah Husain came forth from Ispahan with all his court, and surrendered the sword and diadem of the Sufis into the hands of the Ghilzai (October 1722). Two years later Mahmud died mad, and a few years saw the end of Ghilzai rule in Persia.

The Durani Dynasty.—In 1737-38 Nadir Shah both recovered Kandahar and took Kabul. But he gained the goodwill of the Afghans, and enrolled many in his army. Among these was a noble young soldier, Ahmad Khan, of the Saddozai family of the Abdali clan, who after the assassination of Nadir (1747) was chosen by the Afghan chiefs at Kandahar to be their leader, and assumed kingly authority over the eastern part of Nadir's empire, with the style of *Dur-i-Durān*, "Pearl of the Age," bestowing that of *Durani* upon his clan, the Abdalis. With Ahmad Shah, Afghanistan, as such, first took a place among the kingdoms of the earth, and the Durani dynasty, which he founded, still occupies its throne. During the twenty-six years of his reign he carried his warlike expeditions far and wide. Westward they extended nearly to the shores of the Caspian; eastward he repeatedly entered India as a conqueror. At his great battle of Panipat (January 6, 1761), with vastly inferior numbers, he inflicted on the Mahrattas, then at the zenith of their power, a tremendous defeat, almost annihilating their vast army; but the success had for him no important result. Having long suffered from a terrible disease, he died in 1773, bequeathing to his son Timur a dominion which embraced not only Afghanistan to its utmost limits, but the Punjab, Kashmir and Turkestan to the Oxus, with Sind, Baluchistan and Khorasan as tributary governments.

Timur transferred his residence from Kandahar to Kabul, and continued during a reign of twenty years to stave off the anarchy which followed close on his death. He left twenty-three sons, of whom the fifth, Zaman Mirza, by help of Payindah Khan, head of the Barakzai family of the Abdalis, succeeded in grasping the royal power. For many years barbarous wars raged between the brothers, during which Zaman Shah, Shuja-ul-Mulk and Mahmud successively held the throne. The last owed success to Payindah's son, Fatteh Khan (known as the "Afghan Warwick"), a man of masterly ability in war and politics, the eldest of twenty-one brothers, a family of notable intelligence and force of character, and many of these he placed over the provinces. Fatteh Khan, however, excited the king's jealously by his powerful position, and provoked the malignity of the king's son, Kamran, by a gross outrage on the Saddozai family. He was accordingly seized, blinded and afterwards murdered with prolonged torture, the brutal Kamran striking the first blow.

The Barakzai brothers united to avenge Fatteh Khan. The Saddozais were driven from Kabul, Ghazni and Kandahar, and with difficulty reached Herat (1818). Herat remained thus till Kamran's death (1842), and after that was held by his able and wicked minister Yar Mahommed. The rest of the country was divided among the Barakzais—Dost Mahommed, the ablest, getting Kabul. Peshawar and the right bank of the Indus fell to the Sikhs after their victory at Nowshera in 1823. The last Afghan hold of the Punjab had been lost long before—Kashmir in 1819; Sind had cast off all allegiance since 1808; the Turkestan provinces had been practically independent since the death of Timur Shah.

The First Afghan War, 1838–42.—In 1809, in consequence of the intrigues of Napoleon in Persia, the Hon. Mountstuart Elphinstone had been sent as envoy to Shah Shuja, then in power, and had been well received by him at Peshawar. This was the first time the Afghans made any acquaintance with Englishmen. Lieut. Alex. Burnes (afterwards Sir Alex. Burnes) visited Kabul on his way to Bokhara in 1832. In 1837 the Persian siege of Herat and the proceedings of Russia created uneasiness, and Burnes was sent by the governor-general as resident to the amir's court at Kabul. But the terms which the Dost sought were not conceded by the government, and the rash resolution was taken of re-establishing Shah Shuja, long a refugee in British territory. Ranjit Singh, king of the Punjab, bound himself to co-operate, but eventually declined to let the expedition cross his territories.

The war began in March 1838, when the "Army of the Indus," amounting to 21,000 men, assembled in Upper Sind and advanced through the Bolan Pass under the command of Sir John Keane. There was hardship, but scarcely any opposition. Kohandil Khan of Kandahar fled to Persia. That city was occupied in April 1839, and Shah Shuja was crowned in his grandfather's mosque. Ghazni was reached 21st July; a gate of the city was blown open by the engineers (the match was fired by Lieut., afterwards Sir Henry, Durand), and the place was taken by storm. Dost Mahommed, finding his troops deserting, passed the Hindu Kush, and Shah Shuja entered the capital (August 7). The war was thought at an end, and Sir John Keane (made a peer) returned to India with a considerable part of the force, leaving behind 8000 men, besides the Shah's force, with Sir W. Macnaghten as envoy, and Sir A. Burnes as his colleague.

During the two following years Shah Shuja and his allies remained in possession of Kabul and Kandahar. The British outposts extended to Saighan, in the Oxus basin, and to Mullah Khan, in the plain of Seistan. Dost Mahommed surrendered (November 3, 1840) and was sent to India, where he was honourably treated. From the beginning, insurrection against the new government had been rife. The political authorities were overconfident, and neglected warnings. On the 2nd of November 1841 the revolt broke out violently at Kabul, with the massacre of Burnes and other officers. The position of the British camp, its communications with the citadel and the location of the stores were the worst possible; and the general (Elphinstone) was shattered in constitution. Disaster after disaster occurred, not without misconduct. At a conference (December 23) with the Dost's son, Akbar Khan, who had taken the lead of the Afghans, Sir W. Macnaghten was murdered by that chief's own hand. On the 6th of January 1842, after a convention to evacuate the country had been signed, the British garrison, still numbering 4500 soldiers (of whom 690 were Europeans), with some 12,000 followers, marched out of the camp. The winter was severe, the troops demoralised, the march a mass of confusion and massacre, and the force was finally overwhelmed in the Jagdalak pass between Kabul and Jalalabad.

On the 13th the last survivors mustered at Gandamak only twenty muskets. Of those who left Kabul, only Dr Brydon reached Jalalabad, wounded and half dead. Ninety-five prisoners were afterwards recovered. The garrison of Ghazni had already been forced to surrender (December 10). But General Nott held Kandahar with a stern hand, and General Sale, who had reached Jalalabad from Kabul at the beginning of the outbreak, maintained that important point gallantly.

To avenge these disasters and recover the prisoners preparations were made in India on a fitting scale; but it was the 16th of April 1842 before General Pollock could relieve Jalalabad, after forcing the Khyber Pass. After a long halt there he advanced (August 20), and gaining rapid successes, occupied Kabul (September 15), where Nott, after retaking and dismantling Ghazni, joined him two days later. The prisoners were happily recovered from Bamian. The citadel and central bazaar of Kabul were destroyed, and the army finally evacuated Afghanistan, December 1842.

This ill-planned and hazardous enterprise was fraught with the elements of inevitable failure. A ruler imposed upon a free people by foreign arms is always unpopular; he is unable to stand alone; and his foreign auxiliaries soon find themselves obliged to choose between remaining to uphold his power, or retiring with the probability that it will fall after their departure. The leading chiefs of Afghanistan perceived that the maintenance of Shah Shuja's rule by British troops would soon be fatal to their own power and position in the country, and probably to their national independence. They were insatiable in their demands for office and emolument, and when they discovered that the shah, acting by the advice of the British envoy, was levying from among their tribesmen regiments to be directly under his control, they took care that the plan should fail. Without a regular revenue no effective administration could be organized; but the attempt to raise taxes showed that it might raise the people, so that for both men and money the shah's government was still obliged to rely principally upon British aid. All these circumstances combined to render the new régime weak and unpopular, since there was no force at the ruler's command except foreign troops to put down disorder or to protect those who submitted, while the discontented nobles fomented disaffection and the inbred hatred of strangers in race and religion among the general Afghan population.

British and Russian Relations.—It has been said that the declared object of this policy had been to maintain the independence and integrity of Afghanistan, to secure the friendly alliance of its ruler, and thus to interpose a great barrier of mountainous country between the expanding power of Russia in Central Asia and the British dominion in India. After 1849, when the annexation of the Punjab had carried the Indian north-western frontier up to the skirts of the Afghan highlands, the corresponding advance of the Russians south-eastward along the Oxus river became of closer interest to the British, particularly when, in 1856, the Persians again attempted to take possession of Herat. Dost Mahommed now became the British ally, but on his death in 1863 the kingdom fell back into civil war, until his son, Shere Ali, had won his way to undisputed rulership in 1868. In the same year Bokhara became a dependency of Russia. To the British government an attitude of non-intervention in Afghan affairs appeared in this situation to be no longer possible. The meeting between the amir Shere Ali and the viceroy of India (Lord Mayo) at Umballa in 1869 drew nearer the relations between the two governments; the amir consolidated and began to centralize his power; and the establishment of a strong, friendly and united Afghanistan became again the keynote of British policy beyond the north-western frontier of India.

When, therefore, the conquest of Khiva in 1873 by the Russians, and their gradual approach towards the amir's northern border, had seriously alarmed Shere Ali, he applied for support to the British; and his disappointment at his failure to obtain distinct pledges of material assistance, and at Great Britain's refusal to endorse all his claims in a dispute with Persia over Seistan, so far estranged him from the British connexion that he began to entertain amicable overtures from the Russian authorities at Tashkend. In 1869 the Russian government had assured Lord Clarendon that they regarded Afghanistan as completely outside the sphere of their influence; and in 1872 the boundary line of Afghanistan on the north-west had been settled between England and Russia so far eastward as Lake Victoria.

Nevertheless the correspondence between Kabul and Tashkend continued, and as the Russians were now extending their dominion over all the region beyond Afghanistan on the north-west, the British government determined, in 1876, once more to undertake active measures for securing their political ascendancy in that country. But the amir, whose feelings of resentment had by no means abated, was now leaning toward Russia, though he mainly desired to hold the balance between two equally formidable rivals. The result of overtures made to him from India was that in 1877, when Lord Lytton, acting under direct instructions from Her Majesty's ministry, proposed to Shere Ali a treaty of alliance, Shere Ali showed himself very little disposed to welcome the offer; and upon his refusal to admit a British agent into Afghanistan the negotiations finally broke down.

Second Afghan War, 1878–80.—In the course of the following year (1878) the Russian government, to counteract the interference of England with their advance upon Constantinople, sent an envoy to Kabul empowered to make a treaty with the amir. It was immediately notified to him from India that a British mission would be deputed to his capital, but he demurred to receiving it; and when the British envoy was turned back on the Afghan frontier hostilities were proclaimed by the viceroy in November 1878, and the second Afghan War began. Sir Donald Stewart's force, marching up through Baluchistan by the Bolan Pass, entered Kandahar with little or no resistance; while another army passed through the Khyber Pass and took up positions at Jalalabad and other places on the direct road to Kabul. Another force under Sir Frederick Roberts marched up to the high passes leading out of Kurram into the interior of Afghanistan, defeated the amir's troops at the Peiwar Kotal, and seized the Shutargardan Pass which commands a direct route to Kabul through the Logar valley. The amir Shere Ali fled from his capital into the northern province, where he died at Mazar-i-Sharif in February 1879. In the course of the next six months there was much desultory skirmishing between the tribes and the British troops, who defeated various attempts to dislodge them from the positions that had been taken up; but the sphere of British military operations was not materially extended. It was seen that the farther they advanced the more difficult would become their eventual retirement; and the problem was to find a successor to Shere Ali who could and would make terms with the British government.

In the meantime Yakub Khan, one of Shere Ali's sons, had announced to Major Cavagnari, the political agent at the headquarters of the British army, that he had succeeded his father at Kabul. The negotiations that followed ended in the conclusion of the treaty of Gandamak in May 1879, by which Yakub Khan was recognized as amir; certain outlying tracts of Afghanistan were transferred to the British government; the amir placed in its hands the entire control of his foreign relations, receiving in return a guarantee against foreign aggression; and the establishment of a British envoy at Kabul was at last conceded. By this convention the complete success of the British political and military operations seemed to have been attained; for whereas Shere Ali had made a treaty of alliance with, and had received an embassy from Russia, his son had now made an exclusive treaty with the British government, and had agreed that a British envoy should reside permanently at his court. Yet it was just this final concession, the chief and original object of British policy, that proved speedily fatal to the whole settlement. For in September the envoy, Sir Louis Cavagnari, with his staff and escort, was massacred at Kabul, and the entire fabric of a friendly alliance went to pieces. A fresh expedition was instantly despatched across the Shutargardan Pass under Sir Frederick Roberts, who defeated the Afghans at Charasia near Kabul, and entered the city in October. Yakub Khan, who had surrendered, was sent to India; and the British army remained in military occupation of the district round Kabul until in December (1870) its communications with India were interrupted, and its position at the capital placed in serious jeopardy, by a general rising of the tribes. After they had been repulsed and put down, not without some hard fighting, Sir Donald Stewart, who had not quitted Kandahar, brought a force up by Ghazni to Kabul, overcoming some resistance on his way, and assumed the supreme command. Nevertheless the political situation was still embarrassing, for as the whole country beyond the range of British effective military control was masterless, it was undesirable to withdraw the troops before a government could be reconstructed which could stand without foreign support, and with which diplomatic relations of some kind might be arranged. The general position and prospect of political affairs in Afghanistan bore, indeed, an instructive resemblance to the situation just forty years earlier, in 1840, with the important differences that the Punjab and Sind had since become British, and that communications between Kabul and India were this time secure.

Reign of Abdur Rahman.—Abdur Rahman, the son of the late amir Shere Ali's elder brother, had fought against Shere Ali in the war for succession to Dost Mahommed, had been driven beyond the Oxus, and had lived for ten years in exile with the Russians. In March 1880 he came back across the river, and began to establish himself in the northern province of Afghanistan. The viceroy of India, Lord Lytton, on hearing of his reappearance, instructed the political authorities at Kabul to communicate with him. By skilful negotiations a meeting was arranged, and after pressing in vain for a treaty he was induced to assume charge of the country upon his recognition by the British as amir, with the understanding that he should have no relations with other foreign powers, and with a formal assurance from the viceroy of protection from foreign aggression, so long as he should unreservedly follow the advice of the British government in regard to his external affairs. The province of Kandahar was severed from the Kabul dominion; and the sirdar Shere Ali Khan, a member of the Barakzai family, was installed by the British representative as its independent ruler.

For the second time in the course of this war a conclusive settlement of Afghan affairs seemed now to have been attained; and again, as in 1879, it was immediately dissolved. In July 1880, a few days after the proclamation of Abdur Rahman as amir at Kabul, came news that Ayub Khan, Shere Ali's younger son, who had been holding Herat since his father's death, had marched upon Kandahar, had utterly defeated at Maiwand a British force that went out from Kandahar to oppose him, and was besieging that city. Sir Frederick Roberts at once set out from Kabul with 10,000 men to its relief, reached Kandahar after a rapid march of 313 miles, attacked and routed Ayub Khan's army on the 1st of September, and restored British authority in southern Afghanistan. As the British ministry had resolved to evacuate Kandahar, the sirdar Shere Ali Khan, who saw that he could not stand alone, resigned and withdrew to India, and the amir Abdur Rahman was invited to take possession of the province. But when Ayub Khan, who had meanwhile retreated to Herat, heard that the British forces had retired, early in 1881, to India, he mustered a fresh army and again approached Kandahar. In June the fort of Girishk, on the Helmund, was seized by his adherents; the amir's troops were defeated some days later in an engagement, and Ayub Khan took possession of Kandahar at the end of July. The amir Abdur Rahman, whose movements had hitherto been slow and uncertain, now acted with vigour and decision. He marched rapidly from Kabul at the head of a force, with which he encountered Ayub Khan under the walls of Kandahar, and routed his army on 22nd September, taking all his guns and equipage. Ayub Khan fled toward Herat, but as the place had meanwhile been occupied by one of the amir's generals he took refuge in Persia. By this victory Abdur Rahman's rulership was established.

In 1884 it was determined to resume the demarcation, by a joint commission of British and Russian officers, of the northern boundary of Afghanistan. The work went on with much difficulty and contention, until in March 1885, when the amir was at Rawalpindi for a conference with the viceroy of India, Lord Dufferin, the news came that at Panjdeh, a disputed place on the boundary held by the Afghans, the Russians had attacked and driven out with some loss the amir's troops. For the moment the consequences seemed likely to be serious; but the affair was arranged diplomatically, and the demarcation proceeded up to a point near the Oxus river, beyond which the commission were unable to settle an agreement.

During the ten years following his accession in 1880 Abdur Rahman employed himself in extending and consolidating his dominion over the whole country. Some local revolts among the tribes were rigorously suppressed; and two attempts to upset his rulership—the first by Ayub Khan, who entered Afghanistan from Persia, the second and more dangerous one by Ishak Khan, the amir's cousin, who rebelled against him in Afghan Turkestan—were defeated. By 1891 the amir had enforced his supreme authority throughout Afghanistan more completely than any of his predecessors. In 1895 the amir's troops entered Kafiristan, a wild mountainous tract on the north-east, inhabited by a peculiar race that had hitherto defied all efforts to subjugate them, but were now gradually reduced to submission. Meanwhile the delimitation of the northern frontier, up to the point where it meets Chinese territory on the east, was completed and fixed by arrangements between the governments of Russia and Great Britain; and the eastern border of the Afghan territory, towards India, was also mapped out and partially laid down, in accordance with a convention between the two governments. The amir not only received a large annual subsidy of money from the British government, but he also obtained considerable supplies of war material; and he, moreover, availed himself very freely of facilities that were given him for the importation at his own cost of arms through India. With these resources, and with the advantage of an assurance from the British government that he would be aided against foreign aggression, he was able to establish an absolute military despotism inside his kingdom, by breaking down the power of the warlike tribes which held in check, up to his time, the personal autocracy of the Kabul rulers, and by organizing a regular army well furnished with European rifles and artillery. Taxation of all kinds was heavily increased, and systematically collected. The result was that whereas in former times the forces of an Afghan ruler consisted mainly of a militia, furnished by the chiefs of tribes who held land on condition of military service, and who stoutly resisted any attempt to commute this service for money payment, the amir had at his command a large standing army, and disposed of a substantial revenue paid direct to his treasury. Abdur Rahman executed or exiled all those whose political influence he saw reason to fear, or of whose disaffection he had the slightest suspicion; his administration was severe and his punishments were cruel; but undoubtedly he put down disorder, stopped the petty tyranny of local chiefs and brought violent crime under some effective control in the districts. Travelling by the high roads during his reign was comparatively safe; although it must be added that the excessive exactions of dues and customs very seriously damaged the external trade. In short, Abdur Rahman's reign produced an important political revolution, or reformation, in Afghanistan, which rose from the condition of a country distracted by chronic civil wars, under rulers whose authority depended upon their power to hold down or conciliate fierce and semi-independent tribes in the outlying parts of the dominion, to the rank of a formidable military state governed autocratically. He established, for the first time in the history of the Afghan kingdom, a powerfully centralized administration strong enough to maintain order and to enforce obedience over all the country which he had united under his dominion, supported by a force sufficiently armed and disciplined to put down attempts at resistance or revolt. His policy, consistently maintained, was to permit no kind of foreign interference, on any pretext, with the interior concerns or the economical conditions of his country. From the British government he accepted supplies of arms and subsidies of money; but he would make no concessions in return, and all projects of a strategical or commercial nature, such as railways and telegraphs, proposed either for the defence or the development of his possessions, seem to have been regarded by the amir with extreme distrust, as methods of what has been called pacific penetration—so that on these points he was immovable. It was probably due to the strength and solidity of the executive administration organized, during his lifetime, by Abdur Rahman that, for the first time in the records of the dynasty founded by Ahmad Shah in the latter part of the 18th century, his death was not followed by disputes over the succession or by civil war.

Succession of Habibullah.—The amir Abdur Rahman died on the 1st of October 1901; and two days later his eldest son, Habibullah, formally announced his accession to the rulership. He was recognized with acclamation by the army, by the religious bodies, by the principal tribal chiefs and by all classes of the people as their lawful sovereign; while a deputation of Indian Mahommedans was despatched to Kabul from India to convey the condolences and congratulations of the viceroy. The amir's first measures were designed to enhance his popularity and to improve his internal administration, particularly with regard to the relations of his government with the tribes, and to the system introduced by the late amir of compulsory military service, whereby each tribe was required to supply a proportionate number of recruits. With this object a council of state for tribal affairs was established; and it was arranged that a representative of each tribe should be associated with the provincial governors for the adjudication of tribal cases.

In the important matter of foreign relations Habibullah showed a determination to adopt the policy of his father, to whom the British government had given an assurance of aid to repel foreign aggression, on the condition that the amir should follow the advice of that government in regard to external affairs. This condition was loyally observed by the new amir, who referred to India all communications of an official kind received from the Russian authorities in the provinces bordering on Afghanistan. But toward the various questions left pending between the governments of India and Afghanistan the new amir maintained also his father's attitude. He gave no indications of a disposition to continue the discussion of them, or to entertain proposals for extending or altering his relations with the Indian government. An invitation from the viceroy to meet him in India, with the hope that these points might be settled in conference, was put aside by dilatory excuses, until at last the project was abandoned, and finally the amir agreed to receive at Kabul a diplomatic mission. The mission, whose chief was Sir Louis Dane, foreign secretary to the Indian government, reached Kabul early in December 1904, and remained there four months in negotiation with the amir personally and with his representatives. It was found impossible, after many interviews, to obtain from Habibullah his consent to any addition to or variation of the terms of the assurance given by the British government in 1880, with which he professed himself entirely satisfied, so that the treaty finally settled in March 1905 went no further than a formal confirmation of all engagements previously concluded with the amir's predecessor. It was felt in British circles at the time that a very considerable concession to Habibullah's independence of attitude was displayed in the fact that he was styled in the treaty "His Majesty"; but, in the circumstances, it seems to have been thought diplomatic to accede to the amir's determination to insist on this matter of style. But the rebuff showed that it was desirable in the interests both of the British government and of Afghanistan that an opportunity should be made for enabling the amir to have personal acquaintance with the highest Indian authorities. A further step, calculated to strengthen the relations of amity between the two governments, was taken when it was arranged that the amir should pay a visit to the viceroy, Lord Minto, in India, in January 1907; and this visit took place with great cordiality and success.

The Anglo-Russian Convention, signed on the 31st of August 1907, contained the following important declarations with regard to Afghanistan. Great Britain disclaimed any intention of altering the political status or (subject to the observance of the treaty of 1905) of interfering in the administration or annexing any territory of Afghanistan, and engaged to use her influence there in no manner threatening to Russia. Russia, on her part, recognized Afghanistan as outside her sphere of influence.

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AFGHAN TURKESTAN, the most northern province of Afghanistan. It is bounded on the E. by Badakshan, on the N. by the Oxus river, on the N.W. and W. by Russia and the Hari Rud river, and on the S. by the Hindu Kush, the Koh-i-Baba and the northern watershed of the Hari Rud basin. Its northern frontier was decided by the Anglo-Russian agreement of 1873, and delimited by the Russo-Afghan boundary commission of 1885, which gave rise to the Panjdeh incident. The whole territory, from the junction of the Kokcha river with the Oxus on the north-east to the province of Herat on the south-west, is some 500 m. in length, with an average width from the Russian frontier to the Hindu Kush of 114 m. It thus comprises about 57,000 sq. m. or roughly two-ninths of the kingdom of Afghanistan. Except in the river valleys it is a poor territory, rough and mountainous towards the south, but subsiding into undulating wastes and pasture-lands towards the Turkman desert, and the Oxus riverain which is highly cultivated. The population, which is mostly agricultural, settled in and around its towns and villages, is estimated at 750,000. The province includes the khanates of Kunduz, Tashkurgan, Balkh with Akcha; the western khanates of Saripul, Shibarghan, Andkhui and Maimana, sometimes classed together as the Chahar Villayet, or "Four Domains"; and such parts of the Hazara tribes as lie north of the Hindu Kush and its prolongation. The principal town is Mazar-i-Sharif, which in modern times has supplanted the ancient city of Balkh; and Takhtapul, near Mazar, is the chief Afghan cantonment north of the Hindu Kush.

Ethnically and historically Afghan Turkestan is more connected with Bokhara than with Kabul, of which government it has been a dependency only since the time of Dost Mahommed. The bulk of the people of the cities are of Persian and Uzbeg stock, but interspersed with them are Mongol Hazaras and Hindus with Turkoman tribes in the Oxus plains. Over these races the Afghans rule as conquerors and there is no bond of racial unity between them. Ancient Balkh or Bactriana was a province of the Achaemenian empire, and probably was occupied in great measure by a race of Iranian blood. About 250 B.C. Diodotus (Theodotus), governor of Bactria under the Seleucidae, declared his independence, and commenced the history of the Greco-Bactrian dynasties, which succumbed to Parthian and nomadic movements about 126 B.C. After this came a Buddhist era which has left its traces in the gigantic sculptures at Bamian and the rock-cut topes of Haibak. The district was devastated by Jenghiz Khan, and has never since fully recovered its prosperity. For about a century it belonged to the Delhi empire, and then fell into Uzbeg hands. In the 18th century it formed part of the dominion of Ahmad Khan Durani, and so remained under his son Timur. But under the fratricidal wars of Timur's sons the separate khanates fell back under the independent rule of various Uzbeg chiefs. At the beginning of the 19th century they belonged to Bokhara; but under the great amir Dost Mahommed the Afghans recovered Balkh and Tashkurgan in 1850, Akcha and the four western khanates in 1855, and Kunduz in 1859. The sovereignty over Andkhui, Shibarghan, Saripul and Maimana was in dispute between Bokhara and Kabul until settled by the Anglo-Russian agreement of 1873 in favour of the Afghan claim. Under the strong rule of Abdur Rahman these outlying territories were closely welded to Kabul; but after the accession of Habibullah the bonds once more relaxed. (T. H. H.*)

AFIUM-KARA-HISSAR (*afium*, opium), the popular name of Kara-hissar Sahib, a city of Asiatic Turkey, in the vilayet of Brusa, nearly 200 m. E. of Smyrna, and 50 m. S.S.E. of Kutaiah. Pop. 18,000 (Moslems, 13,000; Christians, 5000). Called Nicopolis by Leo III. after his victory over the Arabs in 740, its name was changed by the Seljuk Turks to Kara-hissar. It stands partly on level ground, partly on a declivity, and above it rises a precipitous trachytic rock (400 ft.) on the summit of which are the ruins of an ancient castle. From its situation on the route of the caravans between Smyrna and western Asia on the one hand, and Armenia, Georgia, &c., on the other, the city became a place of extensive trade, and its bazaars are well stocked with the merchandise of both Europe and the East. Opium in large quantities is produced in its vicinity and forms the staple article of its commerce; and there are, besides, manufactures of black felts, carpets, arms and saddlery. Afium contains several mosques (one of them a very handsome building), and is the seat of an Armenian bishop. The town is connected by railway with Smyrna, Konia, Angora and Constantinople.

See V. Cuinet, *Turquie d'Asie* (Paris, 1894), vol. iv.

A FORTIORI (Lat. "from a stronger [reason]"), a term used of an argument which justifies a statement not itself specifically demonstrated by reference to a proved conclusion which includes it; thus, if A is proved less than B, and is known to be greater than C, it follows *a fortiori* that C is less than B without further proof. The argument is frequently based merely on a comparison of probabilities (cf. Matt. vi. 30), when it constitutes an appeal to common sense.

AFRANIUS, LUCIUS, Roman general, lived in the times of the Sertorian (79–72), third Mithradatic (74–61) and Civil Wars. Of humble origin (Cic. *ad Att.* i. 16. 20), from his early years he was a devoted adherent of Pompey. In 60, chiefly by Pompey's support, he was raised to the consulship, but in performing the duties of that office he showed an utter incapacity to manage civil affairs. In the following year, while governor of Cisalpine Gaul, he obtained the honour of a triumph, and on the allotment of Spain to Pompey (55), Afranius and Marcus Petreius were sent to take charge of the government. On the rupture between Caesar and Pompey they were compelled, after a short campaign in which they were at first successful, to surrender to Caesar at Ilerda (49), and were dismissed on promising not to serve again in the war. Afranius, regardless of his promise, joined Pompey at Dyrrhachium, and at the battle of Pharsalus (48) had charge of Pompey's camp. On the defeat of Pompey, Afranius, despairing of pardon from Caesar, went to Africa, and was present at the disastrous battle of Thapsus (46). Escaping from the field with a strong body of cavalry, he was afterwards taken prisoner, along with Faustus Sulla, by the troops of Sittius, and handed over to Caesar, whose veterans rose in tumult and put them to death.

See Hirtius, *Bell. Afric.* 95; Plutarch, *Pompey*; Dio Cassius xxxvii., xli.-xliii.; Caesar, *B.C.* i. 37-87; Appian. *B.C.* ii.; for the history of the period, articles on CAESAR and POMPEY.

AFRANIUS, LUCIUS, Roman comic poet, flourished about 94 B.C. His comedies chiefly dealt with everyday subjects from Roman middle-class life, and he himself tells us that he borrowed freely from Menander and others. His style was vigorous and correct; his moral tone that of the period.

Horace, *Epp.* ii. 1. 57; Cicero, *Brutus*, 45, *de Fin.* i. 3; Quintilian x. 1. 100; fragments, about 400 lines, in Ribbeck, *Scaenicae Romanorum Poesis Fragmenta*, ii. (1898).

AFRICA, the name of a continent representing the largest of the three great southward projections from the main mass of the earth's surface. It includes within its remarkably regular outline an area, according to the most recent computations, of 11,262,000 sq. m., excluding the islands.[1] Separated from Europe by the Mediterranean Sea, it is joined to Asia at its N.E. extremity by the Isthmus of Suez, 80 m. wide. From the most northerly point, Ras ben Sakka, a little west of Cape Blanc, in 37° 21′ N., to the most southerly point, Cape Agulhas, 34° 51′ 15″ S., is a distance approximately of 5000 m.; from Cape Verde, 17° 33′ 22″ W., the westernmost point, to Ras Hafun, 51° 27′ 52″ E., the most easterly projection, is a distance (also approximately) of 4600 m. The length of coast-line is 16,100 m. and the absence of deep indentations of the shore is shown by the fact that Europe, which covers only 3,760,000 sq. m., has a coast-line of 19,800 m.

I. PHYSICAL GEOGRAPHY

The main structural lines of the continent show both the east-to-west direction characteristic, at least in the eastern hemisphere, of the more northern parts of the world, and the north-to-south direction seen in the southern peninsulas. Africa is thus composed of two segments at right angles, the northern running from east to west, the southern from north to south, the subordinate lines corresponding in the main to these two directions.

Main Orographical Features.—The mean elevation of the continent approximates closely to 2000 ft., which is roughly the elevation of both North and South America, but is considerably less than that of Asia (3117 ft.). In contrast with the other continents it is marked by the comparatively small area both of very high and of very low ground, lands under 600 ft. occupying an unusually small part of the surface; while not only are the highest elevations inferior to those of Asia and South America, but the area of land over 10,000 ft. is also quite insignificant, being represented almost entirely by individual peaks and mountain ranges. Moderately elevated tablelands are thus the characteristic feature of the continent, though the surface of these is broken by higher peaks and ridges. (So prevalent are these isolated peaks and ridges that a special term [*Inselberglandschaft*] has been adopted in Germany to describe this kind of country, which is thought to be in great part the result of wind action.) As a general rule, the higher tablelands lie to the east and south, while a progressive diminution in altitude towards the west and north is observable. Apart from the lowlands and the Atlas range, the continent may be divided into two regions of higher and lower plateaus, the dividing line (somewhat concave to the north-west) running from the middle of the Red Sea to about 6° S. on the west coast. We thus obtain the following four main divisions of the continent:—(1) The coast plains—often fringed seawards by mangrove swamps—never stretching far from the coast, except on the lower courses of streams. Recent alluvial flats are found chiefly in the delta of the more important rivers. Elsewhere the coast lowlands merely form the lowest steps of the system of terraces which constitutes the ascent to the inner plateaus. (2) The Atlas range, which, orographically, is distinct from the rest of the continent, being unconnected with any other area of high ground, and separated from the rest of the continent on the south by a depressed and desert area (the Sahara), in places below sea-level. (3) The high southern and eastern plateaus, rarely falling below 2000 ft., and having a mean elevation of about 3500 ft. (4) The north and west African plains, bordered and traversed by bands of higher ground, but generally below 2000 ft. This division includes the great desert of the Sahara.

The third and fourth divisions may be again subdivided. Thus the high plateaus include:—(*a*) The South African plateau as far as about 12° S., bounded east, west and south by bands of high ground which fall steeply to the coasts. On this account South Africa has a general resemblance to an inverted saucer. Due south the plateau rim is formed by three parallel steps with level ground between them. The largest of these level areas, the Great Karroo, is a dry, barren region, and a large tract of the plateau proper is of a still more arid character and is known as the Kalahari Desert. The South African plateau is connected towards the north-east with (*b*) the East African plateau, with probably a slightly greater average elevation, and marked by some distinct features. It is formed by a widening out of the eastern axis of high ground, which becomes subdivided into a number of zones running north and south and consisting in turn of ranges, tablelands and depressions. The most striking feature is the existence of two great lines of depression, due largely to the subsidence of whole segments of the earth's crust, the lowest parts of which are occupied by vast lakes. Towards the south the two lines converge and give place to one great valley (occupied by Lake Nyasa), the southern part of which is less distinctly due to rifting and subsidence than the rest of the system. Farther north the western depression, sometimes known as the Central African trough or Albertine rift-valley, is occupied for more than half its length by water, forming the four lakes of Tanganyika, Kivu, Albert Edward and Albert, the first-named over 400 m. long and the longest freshwater lake in the world. Associated with these great valleys are a number of volcanic peaks, the greatest of which occur on a meridional line east of the eastern trough. The eastern depression, known as the East African trough or rift-valley, contains much smaller lakes, many of them brackish and without outlet, the only one comparable to those of the western trough being Lake Rudolf or Basso Norok. At no great distance east

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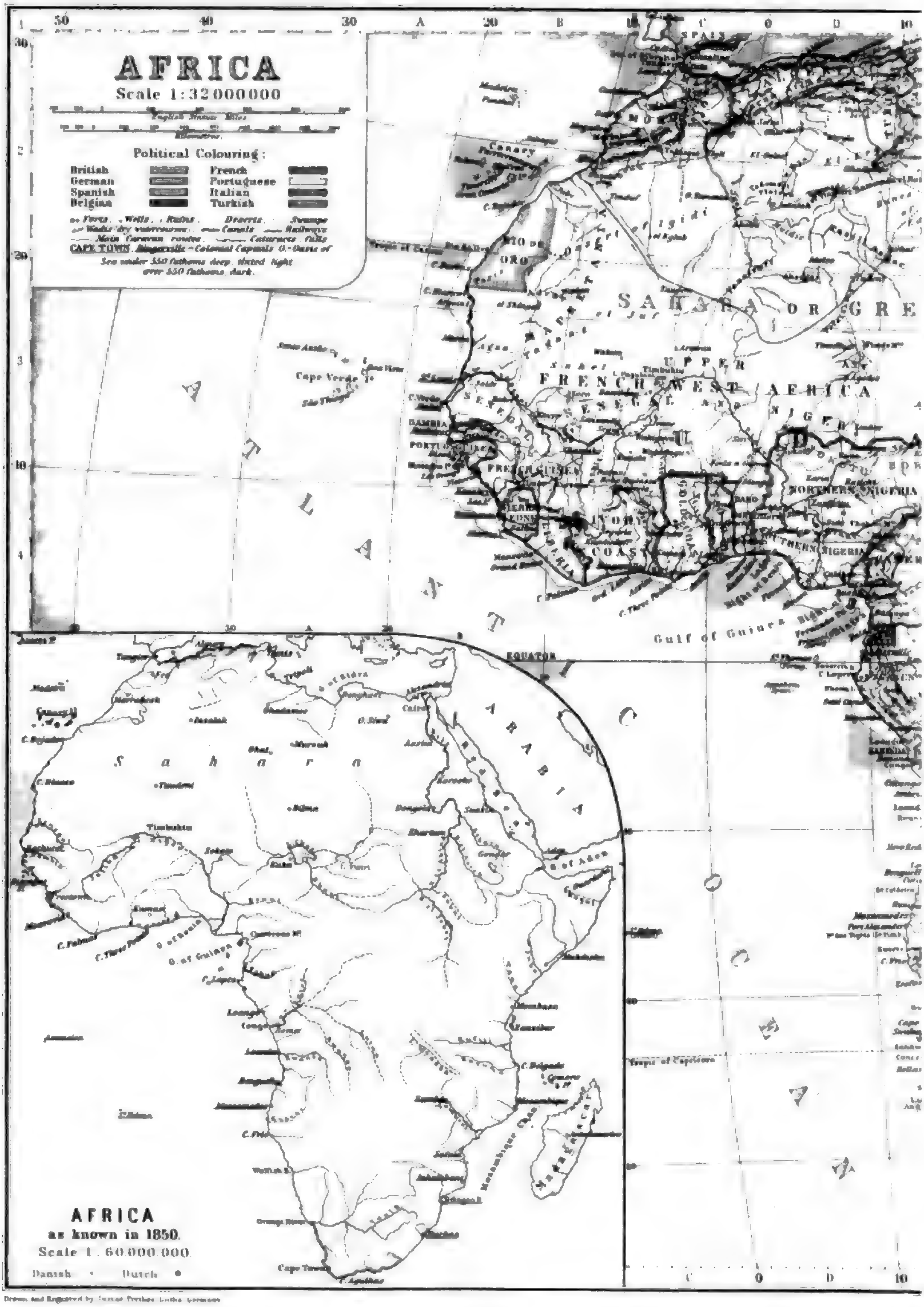
[1] With the islands, 11,498,000 sq. m.


AFRICA
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Belgian
French
Portuguese
Italian
Turkish
Forts. Wells. Ruins. Deserts. Swamps
Wadis (dry watercourses). Canals. Railways
Main Caravan routes. Cataracts. Falls
CAPE TOWN. Bingerville = Colonial Capitals. O. = Oasis of
Sea under 550 fathoms deep, tinted light, over 550 fathoms dark.
SPAIN
Madeira
Canary Is.
RIO DE ORO
SAHARA OR GRE
Cape Verde
UPPER
FRENCH WEST AFRICA
SENEGAL
NIGER
GAMBIA
PORTUGUESE
FRENCH GUINEA
SIERRA LEONE
LIBERIA
IVORY COAST
GOLD COAST
DAHOMEY
NORTHERN NIGERIA
SOUTHERN NIGERIA
Timbuktu
C. Three Points
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Bight of Benin
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Tropic of Capricorn
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Murzuk
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Sokoto
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C. Bojador
C. Blanco
C. Palmas
C. Three Points
G. of Guinea
Cameroon Mt.
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Benguella
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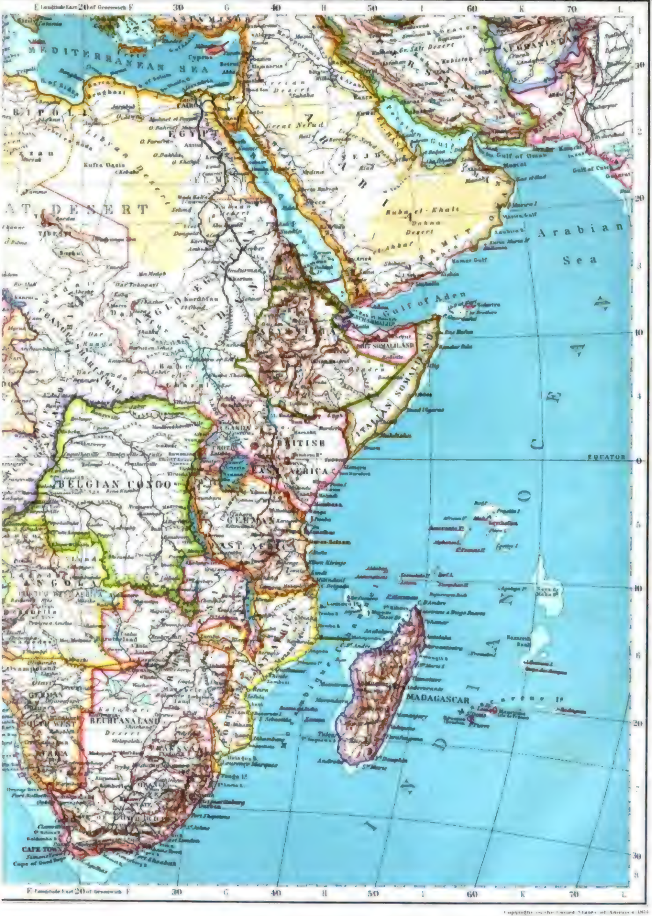
C. Frio
Walfish B.
Orange River
Cape Town
C. Agulhas
Natal
Delagoa B.
Mozambique Chan.
MADAGASCAR
Zanzibar
Mombasa
Magadoxo
Ascension
St. Helena

Drawn and Engraved by Justus Perthes, Gotha, Germany.


Longitude East 20 of Greenwich
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TRIPOLI
EGYPT
CAIRO
Libyan Desert
Kufra Oasis
Great Nefud
Persian Gulf
Gulf of Oman
Muscat
ARABIA
NEJD
AFGHANISTAN
Rub al-Khali
Dahna Desert
Red Sea
Gulf of Aden
Sokotra
ANGLO-EGYPTIAN SUDAN
Kordofan
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ITALIAN SOMALILAND
FR. SOMALILAND
Arabian Sea
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UGANDA
EQUATOR
BELGIAN CONGO
GERMAN EAST AFRICA
Seychelles
Amirante Is.
Dar-es-Salaam
Zanzibar
ANGOLA
PORTUGUESE WEST AFRICA
Comoro Is.
Mozambique
MADAGASCAR
Mauritius
Réunion
Mascarene Is.
GERMAN SOUTH WEST AFRICA
BECHUANALAND
Kalahari Desert
Lourenço Marques
Durban
Port Elizabeth
CAPE TOWN
Cape of Good Hope
INDIAN OCEAN
AT. DESERT
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of this rift-valley are Kilimanjaro—with its two peaks Kibo and Mawenzi, the former 19,321 ft., and the culminating point of the whole continent—and Kenya (17,007 ft.). Hardly less important is the Ruwenzori range (over 16,600 ft.), which lies east of the western trough. Other volcanic peaks rise from the floor of the valleys, some of the Kirunga (Mfumbiro) group, north of Lake Kivu, being still partially active. (*c*) The third division of the higher region of Africa is formed by the Abyssinian highlands, a rugged mass of mountains forming the largest continuous area of its altitude in the whole continent, little of its surface falling below 5000 ft., while the summits reach heights of 15,000 to 16,000 ft. This block of country lies just west of the line of the great East African trough, the northern continuation of which passes along its eastern escarpment as it runs up to join the Red Sea. There is, however, in the centre a circular basin occupied by Lake Tsana.

Both in the east and west of the continent the bordering highlands are continued as strips of plateau parallel to the coast, the Abyssinian mountains being continued northwards along the Red Sea coast by a series of ridges reaching in places a height of 7000 ft. In the west the zone of high land is broader but somewhat lower. The most mountainous districts lie inland from the head of the Gulf of Guinea (Adamawa, &c.), where heights of 6000 to 8000 ft. are reached. Exactly at the head of the gulf the great peak of the Cameroon, on a line of volcanic action continued by the islands to the south-west, has a height of 13,370 ft., while Clarence Peak, in Fernando Po, the first of the line of islands, rises to over 9000. Towards the extreme west the Futa Jallon highlands form an important diverging point of rivers, but beyond this, as far as the Atlas chain, the elevated rim of the continent is almost wanting.

The area between the east and west coast highlands, which north of 17° N. is mainly desert, is divided into separate basins by other bands of high ground, one of which runs nearly centrally through North Africa in a line corresponding roughly with the curved axis of the continent as a whole. The best marked of the basins so formed (the Congo basin) occupies a circular area bisected by the equator, once probably the site of an inland sea. The arid region, the Sahara—the largest desert in the world, covering 3,500,000 sq. m.—extends from the Atlantic to the Red Sea. Though generally of slight elevation it contains mountain ranges with peaks rising to 8000 ft. Bordered N.W. by the Atlas range, to the N.E. a rocky plateau separates it from the Mediterranean; this plateau gives place at the extreme east to the delta of the Nile. That river (see below) pierces the desert without modifying its character. The Atlas range, the north-westerly part of the continent, between its seaward and landward heights encloses elevated steppes in places 100 m. broad. From the inner slopes of the plateau numerous wadis take a direction towards the Sahara. The greater part of that now desert region is, indeed, furrowed by old water-channels.

The following table gives the approximate altitudes of the chief mountains and lakes of the continent:—

Mountains.	Ft.	Lakes.	Ft.
Rungwe (Nyasa)	10,400	Chad	850[1]
Drakensberg	11,700[1]	Leopold II	1100
Lereko or Sattima (Aberdare Range)	13,214[2]	Rudolf	1250
		Nyasa	1645[2]
Cameroon	13,370	Albert Nyanza	2028[1]
Elgon	14,152[2]	Tanganyika	2624[2]
		Ngami	2950
Karissimbi (Mfumbiro)	14,683[2]	Mweru	3000
Meru	14,955[2]	Albert Edward	3004[2]
Tagharat (Atlas)	15,000[1]	Bangweulu.	3700
Simen Mountains, Abyssinia	15,160[1]	Victoria Nyanza	3720[2]
		Abai	4200
Ruwenzori	16,619[2]	Kivu	4829[2]
Kenya	17,007[2]	Tsana	5690
Kilimanjaro	19,321[2]	Naivasha	6135[2]

The Hydrographic Systems.—From the outer margin of the African plateaus a large number of streams run to the sea with comparatively short courses, while the larger rivers flow for long distances on the interior highlands before breaking through the outer ranges. The main drainage of the continent is to the north and west, or towards the basin of the Atlantic Ocean. The high lake plateau of East Africa contains the head-waters of the Nile and Congo: the former the longest, the latter the largest river of the continent. The upper Nile receives its chief supplies from the mountainous region adjoining the Central African trough in the neighbourhood of the equator. Thence streams pour east to the Victoria Nyanza, the largest African lake (covering over 26,000 sq. m.), and west and north to the Albert Edward and Albert Nyanzas, to the latter of which the effluents of the other two lakes add their waters. Issuing from it the Nile flows north, and between 7° and 10° N. traverses a vast marshy level during which its course is liable to blocking by floating vegetation. After receiving the Bahr-el-Ghazal from the west and the Sobat, Blue Nile and Atbara from the Abyssinian highlands (the chief gathering ground of the flood-water), it crosses the great desert and enters the Mediterranean by a vast delta. The most remote head-stream of the Congo is the Chambezi, which flows south-west into the marshy Lake Bangweulu. From this lake issues the Congo, known in its upper course by various names. Flowing first south, it afterwards turns north through Lake Mweru and descends to the forest-clad basin of west equatorial Africa. Traversing this in a majestic northward curve and receiving vast supplies of water from many great tributaries, it finally turns south-west and cuts a way to the Atlantic Ocean through the western highlands. North of the Congo basin and separated from it by a broad undulation of the surface is the basin of Lake Chad—a flat-shored, shallow lake filled principally by the Shari coming from the south-east. West of this is the basin of the Niger, the third river of Africa, which, though flowing to the Atlantic, has its principal source in the far west, and reverses the direction of flow exhibited by the Nile and Congo. An important branch, however—the Benue—comes from the south-east. These four river-basins occupy the greater part of the lower plateaus of North and West Africa, the remainder consisting of arid regions watered only by intermittent streams which do not reach the sea. Of the remaining rivers of the Atlantic basin the Orange, in the extreme south, brings the drainage from the Drakensberg on the opposite side of the continent, while the Kunene, Kwanza, Ogowé and Sanaga drain the west coast highlands of the southern limb; the Volta, Komoe, Bandama, Gambia and Senegal the highlands of the western limb. North of the Senegal for over 1000 m. of coast the arid region reaches to the Atlantic. Farther north are the streams, with comparatively short courses, which reach the Atlantic and Mediterranean from the Atlas mountains.

Of the rivers flowing to the Indian Ocean the only one draining any large part of the interior plateaus is the Zambezi, whose western branches rise in the west coast highlands. The main stream has its rise in 11° 21′ 3″ S. 24° 22′ E. at an elevation of 5000 ft. It flows west and south for a considerable distance before turning to the east. All the largest tributaries, including the Shiré, the outflow of Lake Nyasa, flow down the southern slopes of the band of high ground which stretches across the continent in 10° to 12° S. In the south-west the Zambezi system interlaces with that of the Taukhe (or Tioghe), from which it at times receives surplus water. The rest of the water of the Taukhe, known in its middle course as the Okavango, is lost in a system of swamps and saltpans which formerly centred in Lake Ngami, now dried up. Farther south the Limpopo drains a portion of the interior plateau but breaks through the bounding highlands on the side of the continent nearest its source. The Rovuma, Rufiji, Tana, Juba and Webi Shebeli principally drain the outer slopes of the East African highlands, the last named losing itself in the sands in close proximity to the sea. Another large stream, the Hawash, rising in the Abyssinian mountains, is lost in a saline depression near the Gulf of Aden. Lastly, between the basins of the Atlantic and Indian Oceans there is an area of inland drainage along the centre of the East African plateau, directed chiefly into the lakes in the great rift-valley. The largest river is the Omo, which, fed by the rains of the Abyssinian highlands, carries down a large body of water into Lake Rudolf. The rivers of Africa are generally obstructed either by bars at their mouths or by cataracts at no great distance up-stream. But when these obstacles have been overcome the rivers and lakes afford a network of navigable waters of vast extent.

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[1] Estimated.

[2] See the calculations of Capt. T. T. Behrens, *Geog. Journal*, vol. xxix. (1907).

The calculation of the areas of African drainage systems, made by Dr A. Bludau (*Petermanns Mitteilungen*, 43, 1897, pp. 184-186) gives the following general results:—

Basin of the Atlantic	4,070,000 sq. m.
„ „ Mediterranean	1,680,000 „
„ „ Indian Ocean	2,086,000 „
Inland drainage area	3,452,000 „

The areas of individual river-basins are:—

Congo	(length over 3000 m.)	1,425,000 sq. m.
Nile	(„ fully 4000 m.)	1,082,000[1] „
Niger	(„ about 2600 m.)	808,000[2] „
Zambezi	(„ „ 2000 m.)	513,500 „
Lake Chad		394,000 „
Orange	(length about 1300 m.)	370,500[2] „
„	(actual drainage area)	172,500 „

The area of the Congo basin is greater than that of any other river except the Amazon, while the African inland drainage area is greater than that of any continent but Asia, in which the corresponding area is 4,900,000 sq. m.

The principal African lakes have been mentioned in the description of the East African plateau, but some of the phenomena connected with them may be spoken of more particularly here. As a rule the lakes which occupy portions of the great rift-valleys have steep sides and are very deep. This is the case with the two largest of the type, Tanganyika and Nyasa, the latter of which has depths of 430 fathoms. Others, however, are shallow, and hardly reach the steep sides of the valleys in the dry season. Such are Lake Rukwa, in a subsidiary depression north of Nyasa, and Eiassi and Manyara in the system of the eastern rift-valley. Lakes of the broad type are of moderate depth, the deepest sounding in Victoria Nyanza being under 50 fathoms. Apart from the seasonal variations of level, most of the lakes show periodic fluctuations, while a progressive desiccation of the whole region is said to be traceable, tending to the ultimate disappearance of the lakes. Such a drying up has been in progress during long geologic ages, but doubt exists as to its practical importance at the present time. The periodic fluctuations in the level of Lake Tanganyika are such that its outflow is intermittent. Besides the East African lakes the principal are:—Lake Chad, in the northern area of inland drainage; Bangweulu and Mweru, traversed by the head-stream of the Congo; and Leopold II. and Ntomba (Mantumba), within the great bend of that river. All, except possibly Mweru, are more or less shallow, and Chad appears to by drying up. The altitudes of the African lakes have already been stated.

Divergent opinions have been held as to the mode of origin of the East African lakes, especially Tanganyika, which some geologists have considered to represent an old arm of the sea, dating from a time when the whole central Congo basin was under water; others holding that the lake water has accumulated in a depression caused by subsidence. The former view is based on the existence in the lake of organisms of a decidedly marine type. They include a jelly-fish, molluscs, prawns, crabs, &c., and were at first considered to form an isolated group found in no other of the African lakes; but this supposition has been proved to be erroneous.

Islands.—With one exception—Madagascar—the African islands are small. Madagascar, with an area of 229,820 sq. m., is, after New Guinea and Borneo, the largest island of the world. It lies off the S.E. coast of the continent, from which it is separated by the deep Mozambique channel, 250 m. wide at its narrowest point. Madagascar in its general structure, as in flora and fauna, forms a connecting link between Africa and southern Asia. East of Madagascar are the small islands of Mauritius and Réunion. Sokotra lies E.N.E. of Cape Guardafui. Off the north-west coast are the Canary and Cape Verde archipelagoes, which, like some small islands in the Gulf of Guinea, are of volcanic origin.

Climate and Health.—Lying almost entirely within the tropics, and equally to north and south of the equator, Africa does not show excessive variations of temperature. Great heat is experienced in the lower plains and desert regions of North Africa, removed by the great width of the continent from the influence of the ocean, and here, too, the contrast between day and night, and between summer and winter, is greatest. (The rarity of the air and the great radiation during the night cause the temperature in the Sahara to fall occasionally to freezing point.) Farther south, the heat is to some extent modified by the moisture brought from the ocean, and by the greater elevation of a large part of the surface, especially in East Africa, where the range of temperature is wider than in the Congo basin or on the Guinea coast. In the extreme north and south the climate is a warm temperate one, the northern countries being on the whole hotter and drier than those in the southern zone; the south of the continent being narrower than the north, the influence of the surrounding ocean is more felt. The most important climatic differences are due to variations in the amount of rainfall. The wide heated plains of the Sahara, and in a lesser degree the corresponding zone of the Kalahari in the south, have an exceedingly scanty rainfall, the winds which blow over them from the ocean losing part of their moisture as they pass over the outer highlands, and becoming constantly drier owing to the heating effects of the burning soil of the interior; while the scarcity of mountain ranges in the more central parts likewise tends to prevent condensation. In the inter-tropical zone of summer precipitation, the rainfall is greatest when the sun is vertical or soon after. It is therefore greatest of all near the equator, where the sun is twice vertical, and less in the direction of both tropics. The rainfall zones are, however, somewhat deflected from a due west-to-east direction, the drier northern conditions extending southwards along the east coast, and those of the south northwards along the west. Within the equatorial zone certain areas, especially on the shores of the Gulf of Guinea and in the upper Nile basin, have an intensified rainfall, but this rarely approaches that of the rainiest regions of the world. The rainiest district in all Africa is a strip of coastland west of Mount Cameroon, where there is a mean annual rainfall of about 390 in. as compared with a mean of 458 in. at Cherrapunji, in Assam. The two distinct rainy seasons of the equatorial zone, where the sun is vertical at half-yearly intervals, become gradually merged into one in the direction of the tropics, where the sun is overhead but once. Snow falls on all the higher mountain ranges, and on the highest the climate is thoroughly Alpine. The countries bordering the Sahara are much exposed to a very dry wind, full of fine particles of sand, blowing from the desert towards the sea. Known in Egypt as the khamsin, on the Mediterranean as the sirocco, it is called on the Guinea coast the harmattan. This wind is not invariably hot; its great dryness causes so much evaporation that cold is not infrequently the result. Similar dry winds blow from the Kalahari in the south. On the eastern coast the monsoons of the Indian Ocean are regularly felt, and on the south-east hurricanes are occasionally experienced.

While the climate of the north and south, especially the south, is eminently healthy, and even the intensely heated Sahara is salubrious by reason of its dryness, the tropical zone as a whole is, for European races, the most unhealthy portion of the world. This is especially the case in the lower and moister regions, such as the west coast, where malarial fever is very prevalent and deadly; the most unfavourable factors being humidity with absence of climatic variation (daily or seasonal). The higher plateaus, where not only is the average temperature lower, but such variations are more extensive, are more healthy; and in certain localities (*e.g.* Abyssinia and parts of British East Africa) Europeans find the climate suitable for permanent residence. On tablelands over 6500 ft. above the sea, frost is not uncommon at night, even in places directly under the equator. The acclimatization of white men in tropical Africa generally is dependent largely on the successful treatment of tropical diseases. Districts which had been notoriously deadly to Europeans were rendered comparatively healthy after the discovery, in 1899, of the species of mosquito which propagates malarial fever, and the measures thereafter taken for its destruction and the filling up of swamps. The rate of mortality among the natives from tropical diseases is also high, one of the most fatal being that known as sleeping sickness. (The ravages of this disease, which also attacks Europeans, reached alarming proportions between 1893 and 1907, and in the last-named year an international conference was held in London to consider measures to combat it.) When removed to colder regions natives of the equatorial districts suffer greatly from chest complaints. Smallpox also makes great ravages among the negro population.

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[1] The estimate of Capt. H. G. Lyons in 1905 was 1,107,227 sq. m.

[2] Including waterless tracts naturally belonging to the river-basin.

Flora.—The vegetation of Africa follows very closely the distribution of heat and moisture. The northern and southern temperate zones have a flora distinct from that of the continent generally, which is tropical. In the countries bordering the Mediterranean are groves of oranges and olive trees, evergreen oaks, cork trees and pines, intermixed with cypresses, myrtles, arbutus and fragrant tree-heaths. South of the Atlas range the conditions alter. The zones of minimum rainfall have a very scanty flora, consisting of plants adapted to resist the great dryness. Characteristic of the Sahara is the date-palm, which flourishes where other vegetation can scarcely maintain existence, while in the semi-desert regions the acacia (whence is obtained gum-arabic) is abundant. The more humid regions have a richer vegetation—dense forest where the rainfall is greatest and variations of temperature least, conditions found chiefly on the tropical coasts, and in the west African equatorial basin with its extension towards the upper Nile; and savanna interspersed with trees on the greater part of the plateaus, passing as the desert regions are approached into a scrub vegetation consisting of thorny acacias, &c. Forests also occur on the humid slopes of mountain ranges up to a certain elevation. In the coast regions the typical tree is the mangrove, which flourishes wherever the soil is of a swamp character. The dense forests of West Africa contain, in addition to a great variety of dicotyledonous trees, two palms, the *Elaeis guineensis* (oil-palm) and *Raphia vinifera* (bamboo-palm), not found, generally speaking, in the savanna regions. The bombax or silk-cotton tree attains gigantic proportions in the forests, which are the home of the indiarubber-producing plants and of many valuable kinds of timber trees, such as odum (*Chlorophora excelsa*), ebony, mahogany (*Khaya senegalensis*), African teak or oak (*Oldfieldia africana*) and camwood (*Baphia nitida*). The climbing plants in the tropical forests are exceedingly luxuriant and the undergrowth or "bush" is extremely dense. In the savannas the most characteristic trees are the monkey bread tree or baobab (*Adansonia digitata*), doom palm (*Hyphaene*) and euphorbias. The coffee plant grows wild in such widely separated places as Liberia and southern Abyssinia. The higher mountains have a special flora showing close agreement over wide intervals of space, as well as affinities with the mountain flora of the eastern Mediterranean, the Himalayas and Indo-China (cf. A. Engler, *Über die Hochgebirgsflora des tropischen Afrika*, 1892).

In the swamp regions of north-east Africa the papyrus and associated plants, including the soft-wooded ambach, flourish in immense quantities—and little else is found in the way of vegetation. South Africa is largely destitute of forest save in the lower valleys and coast regions. Tropical flora disappears, and in the semi-desert plains the fleshy, leafless, contorted species of kapsias, mesembryanthemums, aloes and other succulent plants make their appearance. There are, too, valuable timber trees, such as the yellow pine (*Podocarpus elongatus*), stinkwood (*Ocotea*), sneezewood or Cape ebony (*Pteroxylon utile*) and ironwood. Extensive miniature woods of heaths are found in almost endless variety and covered throughout the greater part of the year with innumerable blossoms in which red is very prevalent. Of the grasses of Africa alfa is very abundant in the plateaus of the Atlas range.

Fauna.—The fauna again shows the effect of the characteristics of the vegetation. The open savannas are the home of large ungulates, especially antelopes, the giraffe (peculiar to Africa), zebra, buffalo, wild ass and four species of rhinoceros; and of carnivores, such as the lion, leopard, hyaena, &c. The okapi (a genus restricted to Africa) is found only in the dense forests of the Congo basin. Bears are confined to the Atlas region, wolves and foxes to North Africa. The elephant (though its range has become restricted through the attacks of hunters) is found both in the savannas and forest regions, the latter being otherwise poor in large game, though the special habitat of the chimpanzee and gorilla. Baboons and mandrills, with few exceptions, are peculiar to Africa. The single-humped camel—as a domestic animal—is especially characteristic of the northern deserts and steppes.

The rivers in the tropical zone abound with hippopotami and crocodiles, the former entirely confined to Africa. The vast herds of game, formerly so characteristic of many parts of Africa, have much diminished with the increase of intercourse with the interior. Game reserves have, however, been established in South Africa, British Central Africa, British East Africa, Somaliland, &c., while measures for the protection of wild animals were laid down in an international convention signed in May 1900.

The ornithology of northern Africa presents a close resemblance to that of southern Europe, scarcely a species being found which does not also occur in the other countries bordering the Mediterranean. Among the birds most characteristic of Africa are the ostrich and the secretary-bird. The ostrich is widely dispersed, but is found chiefly in the desert and steppe regions. The secretary-bird is common in the south. The weaver birds and their allies, including the long-tailed whydahs, are abundant, as are, among game-birds, the francolin and guinea-fowl. Many of the smaller birds, such as the sun-birds, bee-eaters, the parrots and halcyons, as well as the larger plantain-eaters, are noted for the brilliance of their plumage. Of reptiles the lizard and chameleon are common, and there are a number of venomous serpents, though these are not so numerous as in other tropical countries. The scorpion is abundant. Of insects Africa has many thousand different kinds; of these the locust is the proverbial scourge of the continent, and the ravages of the termites or white ants are almost incredible. The spread of malaria by means of mosquitoes has already been mentioned. The tsetse fly, whose bite is fatal to all domestic animals, is common in many districts of South and East Africa. Fortunately it is found nowhere outside Africa. (E. He.; F. R. C.)

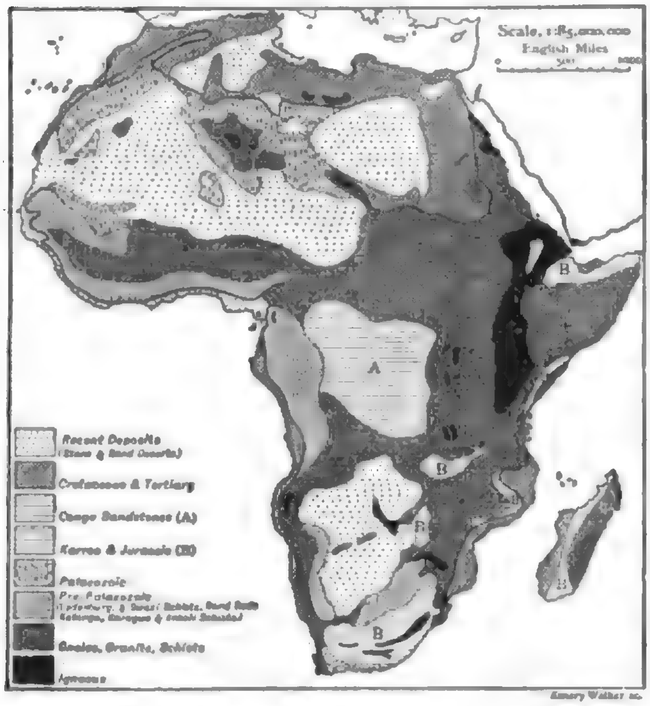
II. Geology

In shape and general geological structure Africa bears a close resemblance to India. Both possess a meridional extension with a broad east and west folded region in the north. In both a successive series of continental deposits, ranging from the Carboniferous to the Rhaetic, rests on an older base of crystalline rocks. In the words of Professor Suess, "India and Africa are true plateau countries."

Of the primitive axes of Africa few traces remain. Both on the east and west a broad zone of crystalline rocks extends parallel with the coast-line to form the margin of the elevated plateau of the interior. Occasionally the crystalline belt comes to the coast, but it is usually reached by two steps known as the coastal belt and foot-plateau. On the flanks of the primitive western axis certain ancient sedimentary strata are thrown into folds which were completed before the commencement of the mesozoic period. In the south, the later palaeozoic rocks are also thrown into acute folds by a movement acting from the south, and which ceased towards the close of the mesozoic period. In northern Africa the folded region of the Atlas belongs to the comparatively recent date of the Alpine system. None of these earth movements affected the interior, for here the continental mesozoic deposits rest, undisturbed by folding, on the primary sedimentary and crystalline rocks. The crystalline *massif*, therefore, presents a solid block which has remained elevated since early palaeozoic times, and against which earth waves of several geological periods have broken.

The formations older than the mesozoic are remarkably unfossiliferous, so that the determination of their age is frequently a matter of speculation, and in the following table the European equivalents of the pre-Karroo formations in many regions must be regarded as subject to considerable revision.

Rocks of Archean age cover wide areas in the interior, in West and East Africa and across the Sahara. Along the coastal margins they underlie the newer formations and appear in the deep valleys and kloofs wherever denudation has laid them bare. The prevailing types are granites, gneisses and schists. In the central regions the predominant strike of the foliae is north and south. The rocks, for convenience classed as pre-Cambrian, occur as several unconformable groups, chiefly developed in the south where alone their stratigraphy has been determined. They are unfossiliferous, and in the absence of undoubted Cambrian, Ordovician and Silurian strata in Africa they may be regarded as of older date than any of these formations. The general occurrence of jasper-bearing rocks is of interest, as these are always present in the ancient pressure-altered sedimentary formations of America and Europe. Some unfossiliferous conglomerates, sandstones and dolomites in South Africa and on the west coast are considered to belong to the Cambrian, Ordovician and Silurian formations, but merely from their occurrence beneath strata yielding Devonian fossils. In Cape Colony the Silurian age of the Table Mountain Sandstone is based on such evidence.



Emery Walker sc.

The Devonian and Carboniferous formations are well represented in the north and south and in northern Angola.

Up to the close of the palaeozoic period the relative positions of the ancient land masses and oceans remain unsolved; but the absence of marine strata of early palaeozoic age from Central Africa points to there being land in this direction. In late Carboniferous times Africa and India were undoubtedly united to form a large continent, called by Suess Gondwana Land. In each country the same succession of the rocks is met with; over both the same specialized orders of reptiles roamed and were entombed.

The interior of the African portion of Gondwana Land was occupied by several large lakes in which an immense thickness—amounting to over 18,000 ft. in South Africa—of sandstones and marls, forming the Karroo system, was laid down. This is *par excellence* the African formation, and covers immense areas in South Africa and the Congo basin, with detached portions in East Africa. During the whole of the time—Carboniferous to Rhaetic—that this great accumulation of freshwater beds was taking place, the interior of the continent must have been undergoing depression. The commencement of the period was marked by one of the most wonderful episodes in the geological history of Africa. Preserved in the formation known as the Dwyka Conglomerate, are evidences that at this time the greater portion of South Africa was undergoing extreme glaciation, while the same conditions appear to have prevailed in India and Australia. At the close of the Karroo period there was a remarkable manifestation of volcanic activity which again has its parallel in the Deccan traps of India.

TABLE OF FORMATIONS

		Sedimentary.	*Igneous.*
	Recent.	Alluvium; travertine; coral; sand dunes; continental dunes. Generally distributed.	Some volcanic islands; rift-valley volcanoes.
	Pleistocene.	Ancient alluviums and gravels; travertine. Generally distributed.	A long-continued succession in the central and northern regions and among the island groups. Doubtfully represented south of the Zambezi.
	Pliocene.	N. Africa; Madagascar.	
	Miocene.	N. Africa.	
	Oligocene.	N. Africa.	
	Eocene.	N. Africa, along east and west coasts; Madagascar.	
	Cretaceous.	Extensively developed in N. Africa; along coast and foot-plateaus in east and west; Madagascar.	Diamond pipes of S. Africa; Kaptian fissure eruptions; Ashangi traps of Abyssinia.
Karroo System.	*Jurassic.*	N. Africa; E. Africa; Madagascar; Stormberg period (Rhaetic) in S. Africa.	Chief volcanic period in S. Africa.
	Trias.	Beaufort Series in S. Africa; Congo basin; Central Africa; Algeria; Tunis.	
	Permian.	Ecca Series in S. Africa.	Feebly, if anywhere developed.
	Carboniferous.	N. Africa; Sabaki Shales in E. Africa; Dwyka and Witteberg Series in S. Africa.	Not recorded.
	Devonian.	N. Africa; Angola; Bokkeveld Series in S. Africa.	
	Silurian.	Table Mountain Sandstone in S. Africa, Silurian(?). Doubtfully represented in N. Africa, French Congo, Angola, and by Vaal River and Waterberg Series in S. Africa.	Klipriversberg and Ventersdorp Series of the Transvaal (?).
	Ordovician.		
	Cambrian.		
	Pre-Cambrian.	Quartzites, conglomerates, phyllites, jasper-bearing rocks and schists. Generally distributed.	S. Africa and generally.
	Archean.	Gneisses and schists of the continental platform.	Igneous complex of sheared igneous rocks; granites.

How far the Karroo formation extended beyond its present confines has not been determined. To the east it reached India. In the south all that can be said is that it extended to the south of Worcester in Cape Colony. The Crystal Mountains of Angola may represent its western boundary; while the absence of mesozoic strata beneath the Cretaceous rocks of the mid-Sahara indicates that the system of Karroo lakeland had here reached its most northerly extension. Towards the close of the Karroo period, possibly about the middle, the southern rim of the great central depression became ridged up to form the folded regions of the Zwaarteberg, Cedarberg and Langeberg mountains in Cape Colony. This folded belt gives Africa its abrupt southern termination, and may be regarded as an embryonic indication of its present outline. The exact date of the maximum development of this folding is unknown, but it had done its work and some 10,000 ft. of strata had been removed before the commencement of the Cretaceous period. It appears to approximate in time to the similar earth movement and denudation at the close of the palaeozoic period in Europe. It was doubtless connected with the disruption of Gondwana Land, since it is known that this great alteration of geographical outline commenced in Jurassic times.

The breaking up of Gondwana Land is usually considered to have been caused by a series of blocks of country being let down by faulting with the consequent formation of the Indian Ocean. Other blocks, termed horsts, remained unmoved, the island of Madagascar affording a striking example. In the African portion Ruwenzori is regarded by some geologists to be a block mountain or horst.

In Jurassic times the sea gained access to East Africa north of Mozambique, but does not appear to have reached far beyond the foot-plateau except in Abyssinia.

The Cretaceous seas appear to have extended into the central Saharan regions, for fossils of this age have been discovered in the interior. On the west coast Cretaceous rocks extend continuously from Mogador to Cape Blanco. From here they are absent up to the Gabun river, where they commence to form a narrow fringe as far as the Kunene river, though often overlain by recent deposits. They are again absent up to the Sunday river in Cape Colony, where Lower Cretaceous rocks (for long considered to be of Oolitic age) of an inshore character are met with. Strata of Upper Cretaceous age occur in Pondoland and Natal, and are of exceptional interest since the fossils show an intermingling of Pacific types with other forms having European affinities. In Mozambique and in German East Africa, Cretaceous rocks extend from the coast to a distance inland of over 100 m.

Except in northern Africa, the Tertiary formations only occur in a few isolated patches on the east and west coasts. In northern Africa they are well developed and of much interest. They contain the well-known nummulitic limestone of Eocene age, which has been traced from Egypt across Asia to China. The Upper Eocene rocks of Egypt have also yielded primeval types of the *Proboscidea* and other mammalia. Evidences for the greater extension of the Eocene seas than was formerly considered to be the case have been discovered around Sokoto. During Miocene times Passarge considers that the region of the Zambezi underwent extreme desiccation.

The effect of the Glacial epoch in Europe is shown in northern Africa by the moraines of the higher Atlas, and the wider extension of the glaciers on Kilimanjaro, Kenya and Ruwenzori, and by the extensive accumulations of gravel over the Sahara.

The earliest signs of igneous activity in Africa are to be found in the granites, intrusive into the older rocks of the Cape peninsula, into those of the Transvaal, and into the gneisses and schists of Central Africa. The Ventersdorp boulder beds of the Transvaal may be of early palaeozoic age; but as a whole the palaeozoic period in Africa was remarkably free from volcanic and igneous disturbances. The close of the Stormberg period (Rhaetic) was one of great volcanic activity in South Africa. Whilst the later Secondary and Tertiary formations were being laid down in North Africa and around the margins of the rest of the continent, Africa received its last great accumulation of strata and at the same time underwent a consecutive series of earth-movements. The additional strata consist of the immense quantities of volcanic material on the plateau of East Africa, the basalt flows of West Africa and possibly those of the Zambezi basin. The exact period of the commencement of volcanic activity is unknown. In Abyssinia the Ashangi traps are certainly post-Oolitic. In East Africa the fissure eruptions are considered to belong to the Cretaceous. These early eruptions were followed by those of Kenya, Mawenzi, Elgon, Chibcharagnani, and these by the eruptions of Kibo, Longonot, Suswa and the Kyulu Mountains. The last phase of vulcanicity took place along the great meridional rifts of East Africa, and though feebly manifested has not entirely passed away. In northern Africa a continuous sequence of volcanic events has taken place from Eocene times to latest Tertiary; but in South Africa it is doubtful if there have been any intrusions later then Cretaceous.

During this long continuance of vulcanicity, earth-movements were in progress. In the north the chief movements gave rise to the system of latitudinal folding and faulting of the Moroccan and Algerian Atlas, the last stages being represented by the formation of the Algerian and Moroccan coast-outline and the sundering of Europe from Africa at the Straits of Gibraltar. Whilst northern Africa was being folded, the East African plateau was broken up by a series of longitudinal rifts extending from Nyasaland to Egypt. The depressed areas contain the long, narrow, precipitously walled lakes of East Africa. The Red Sea also occupies a meridional trough.

Lastly there are the recent elevations of the northern coastal regions, the Barbary coast and along the east coast. (W. G.*)

III. ETHNOLOGY

In attempting a review of the races and tribes which inhabit Africa, their distribution, movements and culture, it is advisable that three points be borne in mind. The first of these is the comparative absence of natural barriers in the interior, owing to which intercommunication between tribes, the dissemination of culture and tribal migration have been considerably facilitated. Hence the student must be prepared to find that, for the most part, there are no sharp divisions to mark the extent of the various races composing the population, but that the number of what may be termed "transitional" peoples is unusually large. The second point is that Africa, with the exception of the lower Nile valley and what is known as Roman Africa (see AFRICA, ROMAN), is, so far as its native inhabitants are concerned, a continent practically without a history, and possessing no records from which such a history might be reconstructed. The early movements of tribes, the routes by which they reached their present abodes, and the origin of such forms of culture as may be distinguished in the general mass of customs, beliefs, &c., are largely matters of conjecture. The negro is essentially the child of the moment; and his memory, both tribal and individual, is very short. The third point is that many theories which have been formulated with respect to such matters are unsatisfactory owing to the small amount of information concerning many of the tribes in the interior.

The chief African races.

Excluding the Europeans who have found a home in various parts of Africa, and the Asiatics, Chinese and natives of India introduced by them (see section *History* below), the population of Africa consists of the following elements:—the Bushman, the Negro, the Eastern Hamite, the Libyan and the Semite, from the intermingling of which in various proportions a vast number of "transitional" tribes has arisen. The Bushmen (*q.v.*), a race of short yellowish-brown nomad hunters, inhabited, in the earliest times of which there is historic knowledge, the land adjoining the southern and eastern borders of the Kalahari desert, into which they were gradually being forced by the encroachment of the Hottentots and Bantu tribes. But signs of their former presence are not wanting as far north as Lake Tanganyika, and even, it is rumoured, still farther north. With them may be classed provisionally the Hottentots, a pastoral people of medium stature and yellowish-brown complexion, who in early times shared with the Bushmen the whole of what is now Cape Colony. Though the racial affinities of the Hottentots have been disputed, the most satisfactory view on the whole is that they represent a blend of Bushman, Negroid and Hamitic elements. Practically the rest of Africa, from the southern fringe of the Sahara and the upper valley of the Nile to the Cape, with the exception of Abyssinia and Galla and Somali-lands, is peopled by Negroes and the "transitional" tribes to which their admixture with Libyans on the north, and Semites (Arabs) and Hamites on the north-east and east, has given rise. A slight qualification of the last statement is necessary, in so far as, among the Fula in the western Sudan, and the Ba-Hima, &c., of the Victoria Nyanza, Libyan and Hamitic elements are respectively stronger than the Negroid. Of the tracts excepted, Abyssinia is inhabited mainly by Semito-Hamites (though a fairly strong negroid element can be found), and Somali and Galla-lands by Hamites. North of the Sahara in Algeria and Morocco are the Libyans (Berbers, *q.v.*), a distinctively white people, who have in certain respects (*e.g.* religion) fallen under Arab influence. In the north-east the brown-skinned Hamite and the Semite mingle in varied proportions. The Negroid peoples, which inhabit the vast tracts of forest and savanna between the areas held by Bushmen to the south and the Hamites, Semites and Libyans to the north, fall into two groups divided by a line running from the Cameroon (Rio del Rey) crossing the Ubangi river below the bend and passing between the Ituri and the Semliki rivers, to Lake Albert and thence with a slight southerly trend to the coast. North of this line are the Negroes proper, south are the Bantu. The division is primarily philological. Among the true Negroes the greatest linguistic confusion prevails; for instance, in certain parts of Nigeria it is possible to find half-a-dozen villages within a comparatively small area speaking, not different dialects, but different languages, a fact which adds greatly to the difficulty of political administration. To the south of the line the condition of affairs is entirely different; here the entire population speaks one or another dialect of the Bantu Languages (*q.v.*). As said before, the division is primarily linguistic and, especially upon the border line, does not always correspond with the variations of physical type. At the same time it is extremely convenient and to a certain extent justifiable on physical and psychological grounds; and it may be said roughly that while the linguistic uniformity of the Bantu is accompanied by great variation of physical type, the converse is in the main true of the Negro proper, especially where least affected by Libyan and Hamitic admixture, *e.g.* on the Guinea coast. The variation of type among the Bantu is due probably to a varying admixture of alien blood, which is more apparent as the east coast is approached. This foreign element cannot be identified with certainty, but since the Bantu seem to approach the Hamites in those points where they differ from the Negro proper, and since the physical characteristics of Hamites and Semites are very similar, it seems probable that the last two races have entered into the composition of the Bantu, though it is highly improbable that Semitic influence should have permeated any distance from the east coast. An extremely interesting section of the population not hitherto mentioned is constituted by the Pygmy tribes inhabiting the densely forested regions along the equator from Uganda to the Gabun and living the life of nomadic hunters. The affinities of this little people are undecided, owing to the small amount of knowledge concerning them. The theories which connected them with the Bushmen do not seem to be correct. It is more probable that they are to be classed among the Negroids, with whom they appear to have intermingled to a certain extent in the upper basin of the Ituri, and perhaps elsewhere. As far as is known they speak no language peculiar to themselves but adopt that of the nearest agricultural tribe. They are of a dark brown complexion, with very broad noses, lips but slightly everted, and small but usually sturdy physique, though often considerably emaciated owing to insufficiency of food. Another peculiar tribe, also of short stature, are the Vaalpens of the steppe region of the north Transvaal. Practically nothing is known of them except that they are said to be very dark in colour and live in holes in the ground, and under rock shelters.

Principal ethnological zones.

Having indicated the chief races of which in various degrees of purity and intermixture the population of Africa is formed, it remains to consider them in greater detail, particularly from the cultural standpoint. This is hardly possible without drawing attention to the main physical characters of the continent, as far as they affect the inhabitants. For ethnological purposes three principal zones may be distinguished; the first two are respectively a large region of steppes and desert in the north, and a smaller region of steppes and desert in the south. These two zones are connected by a vertical strip of grassy highland lying mainly to the east of the chain of great lakes. The third zone is a vast region of forest and rivers in the west centre, comprising the greater part of the basin of the Congo and the Guinea coast. The rainfall, which also has an important bearing upon the culture of peoples, will be found on the whole to be greatest in the third zone and also in the eastern highlands, and of course least in the desert, the steppes and savannas standing midway between the two. As might be expected these variations are accompanied by certain variations in culture. In the best-watered districts agriculture is naturally of the greatest importance, except where the density of the forest renders the work of clearing too arduous. The main portion therefore of the inhabitants of the forest zone are agriculturists, save only the nomad Pygmies, who live in the inmost recesses of the forest and support themselves by hunting the game with which it abounds. Agriculture, too, flourishes in the eastern highlands, and throughout the greater part of the steppe and savanna region of the northern and southern zones, especially the latter. In fact the only Bantu tribes who are not agriculturists are the Ova-Herero of German South-West Africa, whose purely pastoral habits are the natural outcome of the barren country they inhabit. But the wide open plains and slopes surrounding the forest area are eminently suited to cattle-breeding, and there are few tribes who do not take advantage of the fact. At the same time a natural check is imposed upon the desire for cattle, which is so characteristic of the Bantu peoples. This is constituted by the tsetse fly, which renders a pastoral life absolutely impossible throughout large tracts in central and southern Africa. In the northern zone this check is absent, and the number of more essentially pastoral peoples, such as the eastern Hamites, Masai, Dinka, Fula, &c., correspondingly greater. The desert regions yield support only to nomadic peoples, such as the Tuareg, Tibbu, Bedouins and Bushmen, though the presence of numerous oases in the north renders the condition of life easier for the inhabitants. Upon geographical conditions likewise depend to a large extent the political conditions prevailing among the various tribes. Thus among the wandering tribes of the desert and of the heart of the forests, where large communities are impossible, a patriarchal system prevails with the family as the unit. Where the forest is less dense and small agricultural communities begin to make their appearance, the unit expands to the village with its headman. Where the forest thins to the savanna and steppe, and communication is easier, are found the larger kingdoms and "empires" such as, in the north those established by the Songhai, Hausa, Fula, Bagirmi, Ba-Hima, &c., and in the south the states of Lunda, Kazembe, the Ba-Rotse, &c.

But if ease of communication is favourable to the rise of large states and the cultural progress that usually accompanies it, it is, nevertheless, often fatal to the very culture which, at first, it fostered, in so far as the absence of natural boundaries renders invasion easy. A good example of this is furnished by the history of the western Sudan and particularly of East and South-East Africa. From its geographical position Africa looks naturally to the east, and it is on this side that it has been most affected by external culture both by land (across the Sinaitic peninsula) and by sea. Though a certain amount of Indonesian and even aboriginal Indian influence has been traced in African ethnography, the people who have produced the most serious ethnic disturbances (apart from modern Europeans) are the Arabs. This is particularly the case in East Africa, where the systematic slave raids organized by them and carried out with the assistance of various warlike tribes reduced vast regions to a state of desolation. In the north and west of Africa, however, the Arab has had a less destructive but more extensive and permanent influence in spreading the Mahommedan religion throughout the whole of the Sudan.

The fact that the physical geography of Africa affords fewer natural obstacles to racial movements on the side most exposed to foreign influence, renders it obvious that the culture most characteristically African must be sought on the other side.

The characteristic African culture.

It is therefore in the forests of the Congo, and among the lagoons and estuaries of the Guinea coast, that this earlier culture will most probably be found. That there is a culture distinctive of this area, irrespective of the linguistic line dividing the Bantu from the Negro proper, has now been recognized. Its main features may be summed as follows:—a purely agricultural life, with the plantain, yam and manioc (the last two of American origin) as the staple food; cannibalism common; rectangular houses with ridged roofs; scar-tattooing; clothing of bark-cloth or palm-fibre; occasional chipping or extraction of upper incisors; bows with strings of cane, as the principal weapons, shields of wood or wickerwork; religion, a primitive form of fetishism with the belief that death is due to witchcraft; ordeals, secret societies, the use of masks and anthropomorphic figures, and wooden gongs. With this may be contrasted the culture of the Bantu peoples to the south and east, also agriculturists, but in addition, where possible, great cattle-breeders, whose staple food is millet and milk. These are distinguished by circular huts with domed or conical roofs; clothing of skin or leather; occasional chipping or extraction of lower incisors; spears as the principal weapons, bows, where found, with a sinew cord, shields of hide or leather; religion, ancestor-worship with belief in the power of the magicians as rain-makers. Though this difference in culture may well be explained on the supposition that the first is the older and more representative of Africa, this theory must not be pushed too far. Many of the distinguishing characteristics of the two regions are doubtless due simply to environment, even the difference in religion. Ancestor-worship occurs most naturally among a people where tribal organization has reached a fairly advanced stage, and is the natural outcome of patriotic reverence for a successful chief and his councillors. Rain-making, too, is of little importance in a well-watered region, but a matter of vital interest to an agricultural people where the rainfall is slight and irregular.

Within the eastern and southern Bantu area certain cultural variations occur; beehive huts are found among the Zulu-Xosa and Herero, giving place among the Bechuana to the cylindrical variety with conical roof, a type which, with few exceptions, extends north to Abyssinia. The tanged spear-head characteristic of the south is replaced by the socketed variety towards the north. Circumcision, characteristic of the Zulu-Xosa and Bechuana, is not practised by many tribes farther north; tooth-mutilation, on the contrary, is absent among the more southern tribes. The lip-plug is found in the eastern area, especially among the Nyasa tribes, but not in the south. The head-rest common in the south-east and the southern fringe of the forest area is not found far north of Tanganyika until the Horn of Africa is reached.

In the regions outside the western area occupied by the Negro proper, exclusive of the upper Nile, the similarities of culture outweigh the differences. Here the cylindrical type of hut prevails; clothing is of skin or leather but is very scanty; iron ornaments are worn in profusion; arrows are not feathered; shields of hide, spears with leather sheaths are found and also fighting bracelets. Certain small differences appear between the eastern and western portions, the dividing line being formed by the boundary between Bornu and Hausaland. Characteristic of the east are the harp and the throwing-club and throwing-knife, the last of which has penetrated into the forest area. Typical of the west are the bow and the dagger with the ring hilt. The tribes of the upper Nile are somewhat specialized, though here, too, are found the cylindrical hut, iron ornaments, fighting bracelets, &c., characteristic of the Sudanese tribes. Here the removal of the lower incisors is common, and circumcision entirely absent.

Throughout the rest of the Sudan is found Semitic culture introduced by the Arabized Libyan. Circumcision, as is usual among Mahommedan tribes, is universal, and tooth-mutilation absent; of other characteristics, the use of the sword has penetrated to the northern portion of the forest area. The culture prevailing in the Horn of Africa is, naturally, mainly Hamito-Semitic; here are found both cylindrical and bee-hive huts, the sword (which has been adopted by the Masai to the south), the lyre (which has found its way to some of the Nilotic tribes) and the head-rest. Circumcision is practically universal.

As has been said earlier, the history of Africa reaches back but a short distance, except, of course, as far as the lower Nile valley and Roman Africa is concerned; elsewhere no records exist, save tribal traditions, and these only relate to very recent events. Even archaeology, which can often sketch the main outlines of a people's history, is here practically powerless, owing to the insufficiency of data. It is true that stone implements of palaeolithic and neolithic types are found sporadically in the Nile valley, Somaliland, on the Zambezi, in Cape Colony and the northern portions of the Congo Free State, as well as in Algeria and Tunisia; but the localities are far too few and too widely separated to warrant the inference that they are to be in any way connected. Moreover, where stone implements are found they are, as a rule, very near, even actually on, the surface of the earth; nothing occurs resembling the regular stratification of Europe, and consequently no argument based on geological grounds is possible.

The lower Nile valley, however, forms an exception; flint implements of a palaeolithic type have been found near Thebes, not only on the surface of the ground, which for several thousand years has been desert owing to the contraction of the river-bed, but also in stratified gravel of an older date. References to a number of papers bearing on the discussion to which their discovery has given rise may be found in an article by Mr H. R. Hall in *Man*, 1905, No. 19. The Egyptian and also the Somaliland finds appear to be true palaeoliths in type and remarkably similar to those found in Europe. But evidence bearing on the Stone age in Africa, if the latter existed apart from the localities mentioned, is so slight that little can be said save that from the available evidence the palaeoliths of the Nile valley alone can with any degree of certainty be assigned to a remote period of antiquity, and that the chips scattered over Mashonaland and the regions occupied within historic times by Bushmen are the most recent; since it has been shown that the stone flakes were used by the medieval Makalanga to engrave their hard pottery and the Bushmen were still using stone implements in the 19th century. Other early remains, but of equally uncertain date, are the stone circles of Algeria, the Cross river and the Gambia. The large system of ruined forts and "cities" in Mashonaland, at Zimbabwe and elsewhere, concerning which so many ingenious theories have been woven, have been proved to date from medieval times.

Origin and spread of the racial stocks.

Thus while in Europe there is a Stone age, divided into periods according to various types of implement disposed in geological strata, and followed in orderly succession by the ages of Bronze and Iron, in Africa can be found no true Stone age and practically no Bronze at all. The reason is not far to seek; Africa is a country of iron, which is found distributed widely throughout the continent in ores so rich that the metal can be extracted with very little trouble and by the simplest methods. Iron has been worked from time immemorial by the Negroid peoples, and whole tribes are found whose chief industry is the smelting and forging of the metal. Under such conditions, questions relating to the origin and spread of the racial stocks which form the population of Africa cannot be answered with any certainty; at best only a certain amount of probability can be attained.

Five of these racial stocks have been mentioned: Bushman, Negro, Hamite, Semite, Libyan, the last three probably related through some common ancestor. Of these the honour of being considered the most truly African belongs to the two first. It is true that people of Negroid type are found elsewhere, principally in Melanesia, but as yet their possible connexion with the African Negro is little more than theoretical, and for the present purposes it need not be considered.

The origin of the Bushman is lost in obscurity, but he may be conceived as the original inhabitant of the southern portion of the continent. The original home of the Negro, at first an agriculturist, is most probably to be found in the neighbourhood of the great lakes, whence he penetrated along the fringe of the Sahara to the west and across the eastern highlands southward. Northerly expansion was prevented by the early occupation of the Nile valley, the only easy route to the Mediterranean, but there seems no doubt that the population of ancient Egypt contained a distinct Negroid element. The question as to the ethnic affinities of the pre-dynastic Egyptians is still unsolved; but they may be regarded as, in the main, Hamitic, though it is a question how far it is just to apply a name which implies a definite specialization in what may be comparatively modern times to a people of such antiquity.

The Horn of Africa appears to have been the centre from which the Hamites spread, and the pressure they seem to have applied to the Negro tribes, themselves also in process of expansion, sent forth larger waves of emigrants from the latter. These emigrants, already affected by the Hamitic pastoral culture, and with a strain of Hamitic blood in their veins, passed rapidly down the open tract in the east, doubtless exterminating their predecessors, except such few as took refuge in the mountains and swamps. The advance-guard of this wave of pastoral Negroids, in fact primitive Bantu, mingled with the Bushmen and produced the Hottentots. The penetration of the forest area must certainly have taken longer and was probably accomplished as much from the south-east, up the Zambezi valley, as from any other quarter. It was a more peaceful process, since natural obstacles are unfavourable to rapid movements of large bodies of immigrants, though not so serious as to prevent the spread of language and culture. A modern parallel to the spread of Bantu speech is found in the rise of the Hausa language, which is gradually enlarging its sphere of influence in the western and central Sudan. Thus those qualities, physical and otherwise, in which the Bantu approach the Hamites gradually fade as we proceed westward through the Congo basin, while in the east, among the tribes to the west of Tanganyika and on the upper Zambezi, "transitional" forms of culture are found. In later times this gradual pressure from the south-east became greater, and resulted, at a comparatively recent date, in the irruption of the Fang into the Gabun.

The earlier stages of the southern movement must have been accompanied by a similar movement westward between the Sahara and the forest; and, probably, at the same time, or even earlier, the Libyans crossing the desert had begun to press upon the primitive Negroes from the north. In this way were produced the Fula, who mingled further with the Negro to give birth to the Mandingo, Wolof and Tukulor. It would appear that either Libyan (Fula) or, less probably, Hamitic, blood enters into the composition of the Zandeh peoples on the Nile-Congo watershed. These Libyans or Berbers, included by G. Sergi in his "Mediterranean Race," were active on the north coast of Africa in very early times, and had relations with the Egyptians from a prehistoric period. For long these movements continued, always in the same direction, from north to south and from east to west; though, of course, more rapid changes took place in the open country, especially in the great eastern highway from north to south, than in the forest area. Large states arose in the western Sudan; Ghana flourished in the 7th century A.D., Melle in the 11th, Songhai in the 14th, and Bornu in the 16th.

Meanwhile in the east began the southerly movement of the Bechuana, which was probably spread over a considerable period. Later than they, but proceeding faster, came the Zulu-Xosa ("Kaffir") peoples, who followed a line nearer the coast and outflanked them, surrounding them on the south. Then followed a time of great ethnical confusion in South Africa, during which tribes flourished, split up and disappeared; but ere this the culture represented by the ruins in Rhodesia had waxed and waned. It is uncertain who were the builders of the forts and "cities," but it is not improbable that they may be found to have been early Bechuana. The Zulu-Xosa, Bechuana and Herero together form a group which may conveniently be termed "Southern Bantu."

Finally began a movement hitherto unparalleled in the history of African migration; certain peoples of Zulu blood began to press north, spreading destruction in their wake. Of these the principal were the Matabele and Angoni. The movement continued as far as the Victoria Nyanza. Here, on the border-line of Negro, Bantu and Hamite, important changes had taken place. Certain of the Negro tribes had retired to the swamps of the Nile, and had become somewhat specialized, both physically and culturally (Shilluk, Dinka, Alur, Acholi, &c.). These had blended with the Hamites to produce such races as the Masai and kindred tribes. The old Kitwara empire, which comprised the plateau land between the Ruwenzori range and Kavirondo, had broken up into small states, usually governed by a Hamitic (Ba-Hima) aristocracy. The more extensive Zang (Zenj) empire, of which the name Zanzibar (Zanguebar) is a lasting memorial, extending along the sea-board from Somaliland to the Zambezi, was also extinct. The Arabs had established themselves firmly on the coast, and thence made continual slave-raids into the interior, penetrating later to the Congo. The Swahili, inhabiting the coast-line from the equator to about 16° S., are a somewhat heterogeneous mixture of Bantu with a tinge of Arab blood.

In the neighbourhood of Victoria Nyanza, where Hamite, Bantu, Nilotic Negro and Pygmy are found in close contact, the ethnic relations of tribes are often puzzling, but the Bantu not under a Hamitic domination have been divided by F. Stuhlmann into the Older Bantu (Wanyamwezi, Wasukuma, Wasambara, Waseguha, Wasagara, Wasaramo, &c.) and the Bantu of Later Immigration (Wakikuyu, Wakamba, Wapokomo, Wataita, Wachaga, &c.), who are more strongly Hamitized and in many cases have adopted Masai customs. These peoples, from the Victoria Nyanza to the Zambezi, may conveniently be termed the "Eastern Bantu."

Turning to the Congo basin in the south, the great Luba and Lunda peoples are found stretching nearly across the continent, the latter, from at any rate the end of the 16th century until the close of the 19th century, more or less united under a single ruler, styled Muata Yanvo. These seem to have been the most recent immigrants from the south-east, and to exhibit certain affinities with the Barotse on the upper Zambezi. Among the western Baluba, or Bashilange, a remarkable politico-religious revolution took place at a comparatively recent date, initiated by a secret society termed *Bena Riamba* or "Sons of Hemp," and resulted in the subordination of the old fetishism to a cult of hemp, in accordance with which all hemp-smokers consider themselves brothers, and the duty of mutual hospitality, &c., is acknowledged. North of these, in the great bend of the Congo, are the Balolo, &c., the Balolo a nation of iron-workers; and westward, on the Kasai, the Bakuba, and a large number of tribes as yet imperfectly known. Farther west are the tribes of Angola, many of whom were included within the old "Congo empire," of which the kingdom of Loango was an offshoot. North of the latter lies the Gabun, with a large number of small tribes dominated by the Fang who are recent arrivals from the Congo. Farther to the north are the Bali and other tribes of the Cameroon, among whom many primitive Negroid elements begin to appear. Eastward are the Zandeh peoples of the Welle district (primitive Negroids with a Hamitic or, more probably, Libyan strain), with whom the Dor tribe of Nilotes on their eastern border show certain affinities; while to the west along the coast are the Guinea Negroes of primitive type. Here, amidst great linguistic confusion, may be distinguished the tribes of Yoruba speech in the Niger delta and the east portion of the Slave Coast; those of Ewe speech, in the western portion of the latter; and those of Ga and Tshi speech, on the Gold Coast. Among the last two groups respectively may be mentioned the Dahomi and Ashanti. Similar tribes are found along the coast to the Bissagos Islands, though the introduction in Sierra Leone and Liberia of settlements of repatriated slaves from the American plantations has in those places modified the original ethnic distribution. Leaving the forest zone and entering the more open country there are, on the north from the Niger to the Nile, a number of Negroids strongly tinged with Libyan blood and professing the Mahommedan religion. Such are the

Mandingo, the Songhai, the Fula, Hausa, Kanuri, Bagirmi, Kanembu, and the peoples of Wadai and Darfur; the few aborigines who persist, on the southern fringe of the Chad basin, are imperfectly known.

Peculiar conditions in Madagascar.

The island of Madagascar, belonging to the African continent, still remains for discussion. Here the ethnological conditions are peculiar. Before the French occupation the dominant people were the Hova, a Malayo-Indonesian people who must have come from the Malay Peninsula or the adjacent islands. The date of their immigration has been the subject of a good deal of dispute, but it may be argued that their arrival must have taken place in early times, since Malagasy speech, which is the language of the island, is principally Malayo-Polynesian in origin, and contains no traces of Sanskrit. Such traces, introduced with Hinduism, are present in all the cultivated languages of Malaysia at the present day. The Hova occupy the table-land of Imerina and form the first of the three main groups into which the population of Madagascar may be divided. They are short, of an olive-yellow complexion and have straight or faintly wavy hair. On the east coast are the Malagasy, who in physical characteristics stand halfway between the Hova and the Sakalava, the last occupying the remaining portion of the island and displaying almost pure Negroid characteristics.

Though the Hova belong to a race naturally addicted to seafaring, the contrary is the case respecting the Negroid population, and the presence of the latter in the island has been explained by the supposition that they were imported by the Hova. Other authorities assign less antiquity to the Hova immigration and believe that they found the Negroid tribes already in occupation of the island.

As might be expected, the culture found in Madagascar contains two elements, Negroid and Malayo-Indonesian. The first of these two shows certain affinities with the culture characteristic of the western area of Africa, such as rectangular huts, clothing of bark and palm-fibre, fetishism, &c., but cattle-breeding is found as well as agriculture. However, the Negroid tribes are more and more adopting the customs and mode of life of the Hova, among whom are found pile-houses, the *sarong*, *fadi* or tabu applied to food, a non-African form of bellows, &c., all characteristic of their original home. The Hova, during the 19th century, embraced Christianity, but retain, nevertheless, many of their old animistic beliefs; their original social organization in three classes, *andriana* or nobles, *hova* or freemen, and *andevo* or slaves, has been modified by the French, who have abolished kingship and slavery. An Arab infusion is also to be noticed, especially on the north-east and south-east coasts.

It is impossible to give a complete list of the tribes inhabiting Africa, owing to the fact that the country is not fully explored. Even where the names of the tribes are known their ethnic relations are still a matter of uncertainty in many localities.

The following list, therefore, must be regarded as purely tentative, and liable to correction in the light of fuller information:—

AFRICAN TRIBAL DISTRIBUTION

LIBYANS

(North Africa, excluding Egypt)

- Berbers, including—
  - Kabyles
  - Mzab
  - Shawia
  - Tuareg

LIBYO-NEGROID TRANSITIONAL

- Fula (West Sudan)
- Tibbu (Central Sudan)

HAMITES

(East Sudan and Horn of Africa)

- Beja, including—
  - Ababda
  - Hadendoa
  - Bisharin
  - Beni-Amer
  - Hamran

HAMITES—continued

(East Sudan and Horn of Africa)—continued

- Galla
- Somali
- Danakil (Afar)
- Ba-Hima, including—
  - Wa-Tussi
  - Wa-Hha
  - Wa-Rundi
  - Wa-Ruanda

HAMITO-SEMITES

- Fellahin (Egypt)
- Abyssinians (with Negroid admixture)

HAMITO-NEGROID TRANSITIONAL

- Masai
- Wa-Kuafi

NEGROID TRIBES

West Sudan

- Tukulor
- Wolof
- Serer
- Leybu
- Mandingo, including—
  - Kassonké
  - Yallonké
  - Soninké
  - Bambara
  - Vei
  - Susu
  - Solima
  - Malinké
- Probably also—
  - Mossi
  - Borgu
- Tombo
- Gurma
- Gurunga
- Dagomba
- Mampursi
- Gonja
- &c.

(Tombo to Gonja &c.:) Probably with Mandingan elements

Central Sudan

- Songhai
- Hausa
- Bagirmi
- Kanembu
- Kanuri
- Tama
- Maba
- Birkit
- Massalit
- Korunga
- Kabbaga
- &c.

Eastern

- Fur
- Dago
- Kunjara
- Tegele
- Nuba
- Kargo
- Kulfan
- Kolaji
- Tumali

Zandeh Tribes

(Akin to Nilotics, but probably with Fula element)

- Azandeh (Niam Niam)
- Makaraka
- Mundu
- Mangbettu
- Ababwa
- Mege
- Abisanga
- Mabode
- Momfu

(Mabode, Momfu:) probably with Pygmy element

Allied are—

- Banziri
- Ndris
- Togbo
- Languassi
- Wia-Wia
- Awaka
- &c.

NEGROES

West African Tribes

- Khabunké
- Balanta
- Bagnori
- Bagnum
- Felup, including—
  - Ayamat
  - Jola
  - Jigush
  - Vaca
  - Joat
  - Karon
  - Banyum
  - Banjar
  - Fulum
  - Bayot
  - &c.
- Bujagos
- Biafare
- Landuman
- Nalu
- Baga
- Sapé
- Bulam
- Mendi
- Limba
- Gallina
- Timni
- Pessi
- Gola
- Kondo
- Bassa
- Kru
- Grebo
- Awekwom
- Agni
- Oshiu

Tribes of Tshi and Ga speech, including—

- Ashanti
- Safwi
- Denkera
- Bekwai
- Nkoranza
- Adansi
- Assin
- Wassaw
- Ahanta
- Fanti
- Agona
- Akwapim
- Akim
- Akwamu
- Kwao
- Ga

Tribes of Ewe speech, including—

- Dahomi
- Eweawo
- Agotine
- Krepi
- Avenor
- Awuna
- Agbosomi
- Aflao
- Ataklu
- Krikor
- Geng
- Attakpami
- Aja
- Ewemi
- Appa

Tribes of Yoruba speech, including—

- Yoruba
- Ibadan
- Ketu
- Egba
- Jebu
- Remo
- Ode
- Illorin
- Ijesa
- Ondo
- Mahin
- Bini
- Kakanda
- Wari
- Ibo
- Efik
- Andoni
- Kwa
- Ibibio
- Ekoi
- Inokun
- Akunakuna
- Munshi
- Ikwe

NEGROES—continued

Central Negroes

- Bolo
- Yako
- Tangala
- Kali
- Mishi
- Doma
- Mosgu, including—
  - Mandara
  - Margi
  - Logon
  - Gamergu
  - Keribina
- Yedina
- Kuri
- &c.

Nilotics with affinity with Zandeh tribes

- Dor (Bongo)

Eastern Negroes

Pure Nilotics

- Shilluk
- Nuer
- Dinka
- Jur (Diur)
- Mittu
- Jibbeh
- Madi
- Lendu
- Alur (Lur)
- Acholi
- Lango
- Abaka
- Golo

Nilotics with affinity with Masai

- Latuka
- Bari

NEGRO-BANTU TRANSITIONAL

- Bali
- Ba-Kossi
- Ba-Ngwa
- Ba-Nyang
- Ngolo
- Ba-Fo
- Ba-Kundu
- Isubu
- Ba-Kwiri
- Abo
- Dualla
- Bassa
- Ba-Noko
- Ba-Puko
- Ba-Koko

NILOTIC-BANTU TRANSITIONAL

- Ja-Luo

PYGMY TRIBES

(Central Africa)

- Akka
- Ba-Mbute
- Ba-Bongo
- Ashango
- &c.

BANTU NEGROIDS

Western

- Ogowé
- Ashira
- Ishogo
- Ashango
- Bakalai
- Nkomi
- Orungu
- Mpongwe
- Oshekiani
- Benga
- Ininga
- Galao
- Apingi
- Okanda
- Osaka
- Aduma
- Mbamba
- Umbete
- Bule
- Bane
- Yaunde
- Maka
- Bomone
- Kunabembe
- Fang (recent immigrants from the Congo group)
- &c.
- Ba-Kongo, including—
  - Mushi-Kongo
  - Mussorongo
  - Kabinda
  - Ka-Kongo
  - Ba-Vili
  - Ma-Yumbe
  - Ba-Lumbo
  - Ba-Sundi
  - Ba-Bwende
  - Ba-Lali
  - Ba-Kunya

Central

Luba-Lunda Group

- Ba-Luba, including—
  - Ba-Songe
  - Wa-Rua
  - Wa-Guha
  - Katanga
  - Ba-Shilange (with Ba-Kete element)
- Ba-Lunda
  - Probably connected are—
- Manyema
- Ba-Kumu
- Wa-Regga
- Ba-Rotse, including—
  - Ma-Mbunda
  - Ma-Supia
  - Ma-Shukulumbwe
  - Ba-Tonga
  - and probably
  - Va-Lovale

Tribes of the Congo Bend

- Ba-Kussu
- Ba-Tetela
- Ba-Songo Mino
- Ba-Kuba
- Ba-Lolo
- Ba-Kuti
- Ba-Mbala
- Ba-Huana
- Ba-Yaka
- Ba-Pindi
- Ba-Kwese
- &c.

Tribes of the Congo Bank

- Wa-Genia
- Ba-Soko
- Ba-Poto
- Mobali
- Mogwandi
- Ba-Ngala
- Ba-Bangi

} connected with Zandeh group

- Wa-Buma

Eastern

Lacustrians

- Ba-Nyoro
- Ba-Toro
- Wa-Siba
- Wa-Sinja
- Wa-Kerewe
- Wa-Shashi
- Wa-Rundi
- Ba-Iro
- Ba-Ganda
- Ba-Soga
- Ba-Kavirondo, including—
  - Awaware
  - Awarimi
  - Awakisii
  - &c.

Bantu of Recent Immigration

- Wa-Kikuyu
- Wa-Kamba
- Wa-Pokomo
- Wa-Duruma
- Wa-Digo
- Wa-Giriama
- Wa-Taita
- Wa-Nyaturu
- Wa-Iramba
- Wa-Mbugwe
- Wa-Kaguru
- Wa-Gogo
- Wa-Chaga

} possible Masai element

Older Bantu

- Wa-Nyamwezi, including—
  - Wa-Sukuma
  - Wa-Sumbwa
  - Wa-Nyanyembe
  - Wa-Jui
  - Wa-Kimbu
  - Wa-Kanongo
  - Wa-Wende

} Transitional to Bantu of Recent Immigration

BANTU NEGROIDS—continued

Western

Central

- Ba-Nunu
- Ba-Loi
- Ba-Teke
- Wa-Pfuru
- Wa-Mbundu
- Wa-Mfumu
- Ba-Nsinik
- Ma-Wumba
- Ma-Yakalla
- &c.

TRANSITIONAL FROM CENTRAL TO SOUTHERN BANTU

- Amboela
- Ganguela
- Kioko
- Minungo
- Imbangala
- Ba-Achinji
- Golo
- Hollo
- &c.
- Mbunda peoples including—
  - Bihé
  - Dembo
  - Mbaka
  - Ngola
  - Bondo
  - Ba-Ngala
  - Songo
  - Haku
  - Lubolo
  - Kisama
  - &c.

Eastern

- Wa-Gunda
- Wa-Guru
- Wa-Galla
- Wa-Sambara
- Wa-Seguha
- Wa-Nguru
- Wa-Sagara
- Wa-Doe
- Wa-Khutu
- Wa-Saramo
- Wa-Hehe
- Wa-Bena
- Wa-Sanga
- Wa-Swahili (with Arab elements)
  - Connected are—
- Wa-Kisi
- Wa-Mpoto
- Ba-Tonga
- Ba-Tumbuka
- Wa-Nyika
- Wa-Nyamwanga
- A-Mambwe
- Wa-Fipa
- Wa-Rungu
- A-Wemba
- A-Chewa
- A-Maravi
- Ba-Senga
- Ba-Bisa

} Akin to Luba-Lunda group

- A-Jawa (Yaos)
- Wa-Mwera
- Wa-Gindo
- Ma-Konde
- Ma-Wia
- Ma-Nganja
- Ma-Kua

SOUTHERN BANTU

(South and South-East Africa)

- Ba-Nyai
- Ma-Kalanga, including Mashona
- Ba-Ronga

} Affinity with Bechuana

- Be-Chuana, including—
  - Ba-Tlapin
  - Ba-Rolong
  - Ba-Ratlou
  - Ba-Taung
  - Ba-Rapulana
  - Ba-Seleka
  - Ba-Hurutsi
  - Ba-Tlaru
  - Ba-Mangwato
  - Ba-Tauana
  - Ba-Ngwaketse
  - Ba-Kuena
  - &c.
- Ama-Zulu, including—
  - Ama-Swazi
  - Ama-Tonga
  - Matabele
  - Angoni
  - Ma-Gwangwara
  - Ma-Huhu
  - Ma-Viti
  - Ma-Situ
  - Ma-Henge
  - &c.
- Ama-Xosa, including—
  - Ama-Gcaleka
  - Ama-Hahabe
  - Ama-Ngqika
  - Ama-Tembu
  - Ama-Pondo
  - &c.
- Ova-Herero
- Ova-Mpo

HAMITO-BANTU BUSHMAN TRANSITIONAL

- Hottentots, including—
  - Namaqua
  - Koranna

} S. W. Africa

BUSHMEN

TRIBES IN MADAGASCAR

MALAYO-INDONESIANS

- Hova
- Betsileo (slight Bantu admixture)

HOVA-BANTU TRANSITIONAL

- Malagasy, including—
  - Bestimisaraka
  - Antambahoaka
  - Antaimoro
  - Antaifasina
  - Antaisaka
  - Antanosi
  - Antsihanaka
  - Antanala
  - Antaisara
  - &c.

BANTU-NEGROIDS

- Sakalava, including—
  - Menabe
  - Milaka
  - Ronondra
  - Mahafali
  - &c.

(T. A. J.)

IV. History

The origin and meaning of the name of the continent are discussed elsewhere (see Africa, Roman). The word Africa was applied originally to the country in the immediate neighbourhood of Carthage, that part of the continent first known to the Romans, and it was subsequently extended with their increasing knowledge, till it came at last to include all that they knew of the continent. The Arabs still confine the name Ifrikia to the territory of Tunisia.

Phoenician and Greek colonization.

The valley of the lower Nile was the home in remotest antiquity of a civilized race. Egyptian culture had, however, remarkably little direct influence on the rest of the continent, a result due in large measure to the fact that Egypt is shut off landwards by immense deserts. If ancient Egypt and Ethiopia (*q.v.*) be excluded, the story of Africa is largely a record of the doings of its Asiatic and European conquerors and colonizers, Abyssinia being the only state which throughout historic times has maintained its independence. The countries bordering the Mediterranean were first exploited by the Phoenicians, whose earliest settlements were made before 1000 B.C. Carthage, founded about 800 B.C., speedily grew into a city without rival in the Mediterranean, and the Phoenicians, subduing the Berber tribes, who then as now formed the bulk of the population, became masters of all the habitable region of North Africa west of the Great Syrtis, and found in commerce a source of immense prosperity. Both Egyptians and Carthaginians made attempts to reach the unknown parts of the continent by sea. Herodotus relates that an expedition under Phoenician navigators, employed by Necho, king of Egypt, *c.* 600 B.C., circumnavigated Africa from the Red Sea to the Mediterranean, a voyage stated to have been accomplished in three years. Apart from the reported circumnavigation of the continent, the west coast was well known to the Phoenicians as far as Cape Nun, and *c.* 520 B.C. Hanno, a Carthaginian, explored the coast as far, perhaps, as the Bight of Benin, certainly as far as Sierra Leone. A vague knowledge of the Niger regions was also possessed by the Phoenicians.

Meantime the first European colonists had planted themselves in Africa. At the point where the continent approaches nearest the Greek islands, Greeks founded the city of Cyrene (*c.* 631 B.C.). Cyrenaica became a flourishing colony, though being hemmed in on all sides by absolute desert it had little or no influence on inner Africa. The Greeks, however, exerted a powerful influence in Egypt. To Alexander the Great the city of Alexandria owes its foundation (332 B.C.), and under the Hellenistic dynasty of the Ptolemies attempts were made to penetrate southward, and in this way was obtained some knowledge of Abyssinia. Neither Cyrenaica nor Egypt was a serious rival to the Carthaginians, but all three powers were eventually supplanted by the Romans. After centuries of rivalry for supremacy[1] the struggle was ended by the fall of Carthage in 146 B.C. Within little more than a century from that date Egypt and Cyrene had become incorporated in the Roman empire. Under Rome the settled portions of the country were very prosperous, and a Latin strain was introduced into the land. Though Fezzan was occupied by them, the Romans elsewhere found the Sahara an impassable barrier. Nubia and Abyssinia were reached, but an expedition sent by the emperor Nero to discover the source of the Nile ended in failure. The utmost extent of geographical knowledge of the continent is shown in the writings of Ptolemy (2nd century A.D.), who knew of or guessed the existence of the great lake reservoirs of the Nile and had heard of the river Niger. Still Africa for the civilized world remained simply the countries bordering the Mediterranean. The continual struggle between Rome and the Berber tribes; the introduction of Christianity and the glories and sufferings of the Egyptian and African Churches; the invasion and conquest of the African provinces by the Vandals in the 5th century; the passing of the supreme power in the following century to the Byzantine empire—all these events are told fully elsewhere.

North Africa conquered by the Arabs.

In the 7th century of the Christian era occurred an event destined to have a permanent influence on the whole continent. Invading first Egypt, an Arab host, fanatical believers in the new faith of Mahommed, conquered the whole country from the Red Sea to the Atlantic and carried the Crescent into Spain. Throughout North Africa Christianity well-nigh disappeared, save in Egypt (where the Coptic Church was suffered to exist), and Upper Nubia and Abyssinia, which were not subdued by the Moslems. In the 8th, 9th and 10th centuries the Arabs in Africa were numerically weak; they held the countries they had conquered by the sword only, but in the 11th century there was a great Arab immigration, resulting in a large absorption of Berber blood. Even before this the Berbers had very generally adopted the speech and religion of their conquerors. Arab influence and the Mahommedan religion thus became indelibly stamped on northern Africa. Together they spread southward across the Sahara. They also became firmly established along the eastern sea-board, where Arabs, Persians and Indians planted flourishing colonies, such as Mombasa, Malindi and Sofala, playing a rôle, maritime and commercial, analogous to that filled in earlier centuries by the Carthaginians on the northern sea-board. Of these eastern cities and states both Europe and the Arabs of North Africa were long ignorant.

Appearance of the Turks.

The first Arab invaders had recognized the authority of the caliphs of Bagdad, and the Aghlabite dynasty—founded by Aghlab, one of Haroun al Raschid's generals, at the close of the 8th century—ruled as vassals of the caliphate. However, early in the 10th century the Fatimite dynasty established itself in Egypt, where Cairo had been founded A.D. 968, and from there ruled as far west as the Atlantic. Later still arose other dynasties such as the Almoravides and Almohades. Eventually the Turks, who had conquered Constantinople in 1453, and had seized Egypt in 1517, established the regencies of Algeria, Tunisia and Tripoli (between 1519 and 1551), Morocco remaining an independent Arabized Berber state under the Sharifan dynasty, which had its beginnings at the end of the 13th century. Under the earlier dynasties Arabian or Moorish culture had attained a high degree of excellence, while the spirit of adventure and the proselytizing zeal of the followers of Islam led to a considerable extension of the knowledge of the continent. This was rendered more easy by their use of the camel (first introduced into Africa by the Persian conquerors of Egypt), which enabled the Arabs to traverse the desert. In this way Senegambia and the middle Niger regions fell under the influence of the Arabs and Berbers, but it was not until 1501 that Timbuktu—a city founded in the 11th century—became Moslem. That city had been reached in 1352 by the great Arab traveller Ibn Batuta, to whose journey to Mombasa and Quiloa (Kilwa) was due the first accurate knowledge of those flourishing Moslem cities on the east African sea-boards. Except along this sea-board, which was colonized directly from Asia, Arab progress southward was stopped by the broad belt of dense forest which, stretching almost across the continent somewhat south of 10° N., barred their advance as effectually as had the Sahara that of their predecessors, and cut them off from knowledge of the Guinea coast and of all Africa beyond. One of the regions which came latest under Arab control was that of Nubia, where a Christian civilization and state existed up to the 14th century.

For a time the Moslem conquests in South Europe had virtually made of the Mediterranean an Arab lake, but the expulsion in the 11th century of the Saracens from Sicily and southern Italy by the Normans was followed by descents of the conquerors on Tunisia and Tripoli. Somewhat later a busy trade with the African coast-lands, and especially with Egypt, was developed by Venice, Pisa, Genoa and other cities of North Italy. By the end of the 15th century Spain had completely thrown off the Moslem yoke, but even while the Moors were still in Granada, Portugal was strong enough to carry the war into Africa.

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[1] Commercial treaties between Carthage and Rome were made in the 6th and 5th centuries B.C. The first armed conflict between the rival powers, begun in 264 B.C., was a contest for the possession of Sicily.

Spain and Portugal invade the Barbary States.

In 1415 a Portuguese force captured the citadel of Ceuta on the Moorish coast. From that time onward Portugal repeatedly interfered in the affairs of Morocco, while Spain acquired many ports in Algeria and Tunisia. Portugal, however, suffered a crushing defeat in 1578 at al Kasr al Kebir, the Moors being led by Abd el Malek I. of the then recently established Sharifan dynasty. By that time the Spaniards had lost almost all their African possessions. The Barbary states, primarily from the example of the Moors expelled from Spain, degenerated into mere communities of pirates, and under Turkish influence civilization and commerce declined. The story of these states from the beginning of the 16th century to the third decade of the 19th century is largely made up of piratical exploits on the one hand and of ineffectual reprisals on the other. In Algiers, Tunis and other cities were thousands of Christian slaves.

Discovery of the Guinea Coast—Rise of the slave trade.

But with the battle of Ceuta Africa had ceased to belong solely to the Mediterranean world. Among those who fought there was one, Prince Henry "the Navigator," son of King John I., who was fired with the ambition to acquire for Portugal the unknown parts of Africa. Under his inspiration and direction was begun that series of voyages of exploration which resulted in the circumnavigation of Africa and the establishment of Portuguese sovereignty over large areas of the coast-lands. Cape Bojador was doubled in 1434, Cape Verde in 1445, and by 1480 the whole Guinea coast was known. In 1482 Diogo Cam or Cão discovered the mouth of the Congo, the Cape of Good Hope was doubled by Bartholomew Diaz in 1488, and in 1498 Vasco da Gama, after having rounded the Cape, sailed up the east coast, touched at Sofala and Malindi, and went thence to India. Over all the countries discovered by their navigators Portugal claimed sovereign rights, but these were not exercised in the extreme south of the continent. The Guinea coast, as the first discovered and the nearest to Europe, was first exploited. Numerous forts and trading stations were established, the earliest being São Jorge da Mina (Elmina), begun in 1482. The chief commodities dealt in were slaves, gold, ivory and spices. The discovery of America (1492) was followed by a great development of the slave trade, which, before the Portuguese era, had been an overland trade almost exclusively confined to Mahommedan Africa. The lucrative nature of this trade and the large quantities of alluvial gold obtained by the Portuguese drew other nations to the Guinea coast. English mariners went thither as early as 1553, and they were followed by Spaniards, Dutch, French, Danish and other adventurers. Much of Senegambia was made known as a result of quests during the 16th century for the "hills of gold" in Bambuk and the fabled wealth of Timbuktu, but the middle Niger was not reached. The supremacy along the coast passed in the 17th century from Portugal to Holland and from Holland in the 18th and 19th centuries to France and England. The whole coast from Senegal to Lagos was dotted with forts and "factories" of rival powers, and this international patchwork persists though all the *hinterland* has become either French or British territory.

Southward from the mouth of the Congo[1] to the inhospitable region of Damaraland, the Portuguese, from 1491 onward, acquired influence over the Bantu-Negro inhabitants, and in the early part of the 16th century through their efforts Christianity was largely adopted in the native kingdom of Congo. An irruption of cannibals from the interior later in the same century broke the power of this semi-Christian state, and Portuguese activity was transferred to a great extent farther south, São Paulo de Loanda being founded in 1576. The sovereignty of Portugal over this coast region, except for the mouth of the Congo, has been once only challenged by a European power, and that was in 1640–1648, when the Dutch held the seaports.

The Portuguese in East Africa and Abyssinia.

Neglecting the comparatively poor and thinly inhabited regions of South Africa, the Portuguese no sooner discovered than they coveted the flourishing cities held by Arabized peoples between Sofala and Cape Guardafui. By 1520 all these Moslem sultanates had been seized by Portugal, Mozambique being chosen as the chief city of her East African possessions. Nor was Portuguese activity confined to the coast-lands. The lower and middle Zambezi valley was explored (16th and 17th centuries), and here the Portuguese found semi-civilized Bantu-Negro tribes, who had been for many years in contact with the coast Arabs. Strenuous efforts were made to obtain possession of the country (modern Rhodesia) known to them as the kingdom or empire of Monomotapa, where gold had been worked by the natives from about the 12th century A.D., and whence the Arabs, whom the Portuguese dispossessed, were still obtaining supplies in the 16th century. Several expeditions were despatched inland from 1569 onward and considerable quantities of gold were obtained. Portugal's hold on the interior, never very effective, weakened during the 17th century, and in the middle of the 18th century ceased with the abandonment of the forts in the Manica district.

At the period of her greatest power Portugal exercised a strong influence in Abyssinia also. In the ruler of Abyssinia (to whose dominions a Portuguese traveller had penetrated before Vasco da Gama's memorable voyage) the Portuguese imagined they had found the legendary Christian king, Prester John, and when the complete overthrow of the native dynasty and the Christian religion was imminent by the victories of Mahommedan invaders, the exploits of a band of 400 Portuguese under Christopher da Gama during 1541–1543 turned the scale in favour of Abyssinia and had thus an enduring result on the future of North-East Africa. After da Gama's time Portuguese Jesuits resorted to Abyssinia. While they failed in their efforts to convert the Abyssinians to Roman Catholicism they acquired an extensive knowledge of the country. Pedro Paez in 1615, and, ten years later, Jeronimo Lobo, both visited the sources of the Blue Nile. In 1663 the Portuguese, who had outstayed their welcome, were expelled from the Abyssinian dominions. At this time Portuguese influence on the Zanzibar coast was waning before the power of the Arabs of Muscat, and by 1730 no point on the east coast north of Cape Delgado was held by Portugal.

English and Dutch at Table Bay—Cape Colony founded.

It has been seen that Portugal took no steps to acquire the southern part of the continent. To the Portuguese the Cape of Good Hope was simply a landmark on the road to India, and mariners of other nations who followed in their wake used Table Bay only as a convenient spot wherein to refit on their voyage to the East. By the beginning of the 17th century the bay was much resorted to for this purpose, chiefly by English and Dutch vessels. In 1620, with the object of forestalling the Dutch, two officers of the East India Company, on their own initiative, took possession of Table Bay in the name of King James, fearing otherwise that English ships would be "frustrated of watering but by license." Their action was not approved in London and the proclamation they issued remained without effect. The Netherlands profited by the apathy of the English. On the advice of sailors who had been shipwrecked in Table Bay the Netherlands East India Company, in 1651, sent out a fleet of three small vessels under Jan van Riebeek which reached Table Bay on the 6th of April 1652, when, 164 years after its discovery, the first permanent white settlement was made in South Africa. The Portuguese, whose power in Africa was already waning, were not in a position to interfere with the Dutch plans, and England was content to seize the island of St Helena as her half-way house to the East.[2] In its inception the settlement at the Cape was not intended to become an African colony, but was regarded as the most westerly outpost of the Dutch East Indies. Nevertheless, despite the paucity of ports and the absence of navigable rivers, the Dutch colonists, freed from any apprehension of European trouble by the friendship between Great Britain and Holland, and leavened by Huguenot blood, gradually spread northward, stamping their language, law and religion indelibly upon South Africa. This process, however, was exceedingly slow.

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[1] This river was called by the Portuguese the Zaire. They appear to have made no attempt to trace its course beyond the rapids which stop navigation from the sea.

[2] France acquired, as stations for her ships on the voyage to and from India, settlements in Madagascar and the neighbouring islands. The first settlement was made in 1642.

Waning and revival of interest in Africa.

During the 18th century there is little to record in the history of Africa. The nations of Europe, engaged in the later half of the century in almost constant warfare, and struggling for supremacy in America and the East, to a large extent lost their interest in the continent. Only on the west coast was there keen rivalry, and here the motive was the securance of trade rather than territorial acquisitions. In this century the slave trade reached its highest development, the trade in gold, ivory, gum and spices being small in comparison. In the interior of the continent—Portugal's energy being expended—no interest was shown, the nations with establishments on the coast "taking no further notice of the inhabitants or their land than to obtain at the easiest rate what they procure with as little trouble as possible, or to carry them off for slaves to their plantations in America" (*Encyclopaedia Britannica*, 3rd ed., 1797). Even the scanty knowledge acquired by the ancients and the Arabs was in the main forgotten or disbelieved. It was the period when—

> Geographers, in Afric maps,
> With savage pictures filled their gaps,
> And o'er unhabitable downs
> Placed elephants for want of towns.
> (*Poetry, a Rhapsody.* By Jonathan Swift.)

The prevailing ignorance may be gauged by the statement in the third edition of the *Encyclopaedia Britannica* that "the Gambia and Senegal rivers are only branches of the Niger." But the closing years of the 18th century, which witnessed the partial awakening of the public conscience of Europe to the iniquities of the slave trade, were also notable for the revival of interest in inner Africa. A society, the African Association,[1] was formed in London in 1788 for the exploration of the interior of the continent. The era of great discoveries had begun a little earlier in the famous journey (1770–1772) of James Bruce through Abyssinia and Sennar, during which he determined the course of the Blue Nile. But it was through the agents of the African Association that knowledge was gained of the Niger regions. The Niger itself was first reached by Mungo Park, who travelled by way of the Gambia, in 1795. Park, on a second journey in 1805, passed Timbuktu and descended the Niger to Bussa, where he lost his life, having just failed to solve the question as to where the river reached the ocean. (This problem was ultimately solved by Richard Lander and his brother in 1830.) The first scientific explorer of South-East Africa, Dr Francisco de Lacerda, a Portuguese, also lost his life in that country. Lacerda travelled up the Zambezi to Tete, going thence towards Lake Mweru, near which he died in 1798. The first recorded crossing of Africa was accomplished between the years 1802 and 1811 by two half-caste Portuguese traders, Pedro Baptista and A. José, who passed from Angola eastward to the Zambezi.

Effects of the Napoleonic wars—Britain seizes the Cape.

Although the Napoleonic wars distracted the attention of Europe from exploratory work in Africa, those wars nevertheless exercised great influence on the future of the continent, both in Egypt and South Africa. The occupation of Egypt (1798–1803) first by France and then by Great Britain resulted in an effort by Turkey to regain direct control over that country,[2] followed in 1811 by the establishment under Mehemet Ali of an almost independent state, and the extension of Egyptian rule over the eastern Sudan (from 1820 onward). In South Africa the struggle with Napoleon caused Great Britain to take possession of the Dutch settlements at the Cape, and in 1814 Cape Colony, which had been continuously occupied by British troops since 1806, was formally ceded to the British crown.

The close of the European conflicts with the battle of Waterloo was followed by vigorous efforts on the part of the British government to become better acquainted with Africa, and to substitute colonization and legitimate trade for the slave traffic, declared illegal for British subjects in 1807 and abolished by all other European powers by 1836. To West Africa Britain devoted much attention. The slave trade abolitionists had already, in 1788, formed a settlement at Sierra Leone, on the Guinea coast, for freed slaves, and from this establishment grew the colony of Sierra Leone, long notorious, by reason of its deadly climate, as "The White Man's Grave."[3] Farther east the establishments on the Gold Coast began to take a part in the politics of the interior, and the first British mission to Kumasi, despatched in 1817, led to the assumption of a protectorate over the maritime tribes heretofore governed by the Ashanti.

An expedition sent in 1816 to explore the Congo from its mouth did not succeed in getting beyond the rapids which bar the way to the interior, but in the central Sudan much better results were obtained. In 1823 three English travellers, Walter Oudney, Dixon Denham and Hugh Clapperton, reached Lake Chad from Tripoli—the first white men to reach that lake. The partial exploration of Bornu and the Hausa states by Clapperton, which followed, revealed the existence of large and flourishing cities and a semi-civilized people in a region hitherto unknown. The discovery in 1830 of the mouth of the Niger by Clapperton's servant Lander, already mentioned, had been preceded by the journeys of Major A. G. Laing (1826) and René Caillié (1827) to Timbuktu, and was followed (1832–1833) by the partial ascent of the Benue affluent of the Niger by MacGregor Laird. In 1841 a disastrous attempt was made to plant a white colony on the lower Niger, an expedition (largely philanthropic and anti-slavery in its inception) which ended in utter failure. Nevertheless from that time British traders remained on the lower Niger, their continued presence leading ultimately to the acquisition of political rights over the delta and the Hausa states by Great Britain.[4] Another endeavour by the British government to open up commercial relations with the Niger countries resulted in the addition of a vast amount of information concerning the countries between Timbuktu and Lake Chad, owing to the labours of Heinrich Barth (1850–1855), originally a subordinate, but the only surviving member of the expedition sent out.

Meantime considerable changes had been made in other parts of the continent, the most notable being—the occupation of Algiers by France in 1830, an end being thereby put to the piratical proceedings of the Barbary states; the continued expansion southward of Egyptian authority with the consequent additions to the knowledge of the Nile; and the establishment of independent states (Orange Free State and the Transvaal) by Dutch farmers (Boers) dissatisfied with British rule in Cape Colony. Natal, so named by Vasco da Gama, had been made a British colony (1843), the attempt of the Boers to acquire it being frustrated. The city of Zanzibar, on the island of that name, founded in 1832 by Seyyid Said of Muscat, rapidly attained importance, and Arabs began to penetrate to the great lakes of East Africa,[5] concerning which little more was known (and less believed) than in the time of Ptolemy. Accounts of a vast inland sea, and the discovery in 1848–1849, by the missionaries Ludwig Krapf and J. Rebmann, of the snow-clad mountains of Kilimanjaro and Kenya, stimulated in Europe the desire for further knowledge.

The era of great explorers.

At this period, the middle of the 19th century, Protestant missions were carrying on active propaganda on the Guinea coast, in South Africa and in the Zanzibar dominions. Their work, largely beneficent, was being conducted in regions and among peoples little known, and in many instances missionaries turned explorers and became pioneers of trade and empire. One of the first to attempt to fill up the remaining blank spaces in the map was David Livingstone, who had been engaged since 1840 in missionary work north of the Orange. In 1849 Livingstone crossed the Kalahari Desert from south to north and reached Lake Ngami.

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[1] The Association, in 1831, was merged in the Royal Geographical Society.

[2] The Mamelukes, whom the Turks had overthrown in the 16th century, had regained practically independent power.

[3] In imitation of the British example, an American society founded in 1822 the negro colony (now republic) of Liberia.

[4] The first territorial acquisition made by Great Britain in this region was in 1851, when Lagos Island was annexed.

[5] As early as 1848 an Arab from Zanzibar journeying across the continent had arrived at Benguella.

and between 1851 and 1856 he traversed the continent from west to east, making known the great waterways of the upper Zambezi. During these journeyings Livingstone discovered, November 1855, the famous Victoria Falls, so named after the queen of England. In 1858–1864 the lower Zambezi, the Shiré and Lake Nyasa were explored by Livingstone, Nyasa having been first reached by the confidential slave of Antonio da Silva Porto, a Portuguese trader established at Bihé in Angola, who crossed Africa during 1853–1856 from Benguella to the mouth of the Rovuma. While Livingstone circumnavigated Nyasa, the more northerly lake, Tanganyika, had been visited (1858) by Richard Burton and J. H. Speke, and the last named had sighted Victoria Nyanza. Returning to East Africa with J. A. Grant, Speke reached, in 1862, the river which flowed from Victoria Nyanza, and following it (in the main) down to Egypt, had the distinction of being the first man to read the riddle of the Nile. In 1864 another Nile explorer, Samuel Baker, discovered the Albert Nyanza, the chief western reservoir of the river. In 1866 Livingstone began his last great journey, in which he made known Lakes Mweru and Bangweulu and discovered the Lualaba (the upper part of the Congo), but died (1873) before he had been able to demonstrate its ultimate course, believing indeed that the Lualaba belonged to the Nile system. Livingstone's lonely death in the heart of Africa evoked a keener desire than ever to complete the work he left undone. H. M. Stanley, who had in 1871 succeeded in finding and succouring Livingstone, started again for Zanzibar in 1874, and in the most memorable of all exploring expeditions in Africa circumnavigated Victoria Nyanza and Tanganyika, and, striking farther inland to the Lualaba, followed that river down to the Atlantic Ocean—reached in August 1877—and proved it to be the Congo. Stanley had been preceded, in 1874, at Nyangwe, Livingstone's farthest point on the Lualaba, by Lovett Cameron, who was, however, unable farther to explore its course, making his way to the west coast by a route south of the Congo.

While the great mystery of Central Africa was being solved explorers were also active in other parts of the continent. Southern Morocco, the Sahara and the Sudan were traversed in many directions between 1860 and 1875 by Gerhard Rohlfs, Georg Schweinfurth and Gustav Nachtigal. These travellers not only added considerably to geographical knowledge, but obtained invaluable information concerning the people, languages and natural history of the countries in which they sojourned.[1] Among the discoveries of Schweinfurth was one that confirmed the Greek legends of the existence beyond Egypt of a pygmy race. But the first discoverer of the dwarf races of Central Africa was Paul du Chaillu, who found them in the Ogowé district of the west coast in 1865, five years before Schweinfurth's first meeting with the Pygmies; du Chaillu having previously, as the result of journeys in the Gabun country between 1855 and 1859, made popular in Europe the knowledge of the existence of the gorilla, perhaps the gigantic ape seen by Hanno the Carthaginian, and whose existence, up to the middle of the 19th century, was thought to be as legendary as that of the Pygmies of Aristotle.

In South Africa the filling up of the map also proceeded apace. The finding, in 1869, of rich diamond fields in the valley of the Vaal river, near its confluence with the Orange, caused a rush of emigrants to that district, and led to conflicts between the Dutch and British authorities and the extension of British authority northward. In 1871 the ruins of the great Zimbabwe in Mashonaland, the chief fortress and distributing centre of the race which in medieval times worked the goldfields of South-East Africa, were explored by Karl Mauch. In the following year F. C. Selous began his journeys over South Central Africa, which continued for more than twenty years and extended over every part of Mashonaland and Matabeleland. (F. R. C.)

V. Partition among European Powers

In the last quarter of the 19th century the map of Africa was transformed. After the discovery of the Congo the story of exploration takes second place; the continent becomes the theatre of European expansion. Lines of partition, drawn often through trackless wildernesses, marked out the possessions of Germany, France, Great Britain and other powers. Railways penetrated the interior, vast areas were opened up to civilized occupation, and from ancient Egypt to the Zambezi the continent was startled into new life.

Before 1875 the only powers with any considerable interest in Africa were Britain, Portugal and France. Between 1815 and 1850, as has been shown above, the British government devoted much energy, not always informed by knowledge, to western and southern Africa. In both directions Great Britain had met with much discouragement; on the west coast, disease, death, decaying trade and useless conflicts with savage foes had been the normal experience; in the south recalcitrant Boers and hostile Kaffirs caused almost endless trouble. The visions once entertained of vigorous negro communities at once civilized and Christian faded away; to the hot fit of philanthropy succeeded the cold fit of indifference and a disinclination to bear the burden of empire. The low-water mark of British interest in South Africa was reached in 1854 when independence was forced on the Orange River Boers, while in 1865 the mind of the nation was fairly reflected by the unanimous resolution of a representative House of Commons committee:[2] "that all further extension of territory or assumption of government, or new treaty offering any protection to native tribes, would be inexpedient." For nearly twenty years the spirit of that resolution paralysed British action in Africa, although many circumstances—the absence of any serious European rival, the inevitable border disputes with uncivilized races, and the activity of missionary and trader—conspired to make British influence dominant in large areas of the continent over which the government exercised no definite authority. The freedom with which blood and treasure were spent to enforce respect for the British flag or to succour British subjects in distress, as in the Abyssinian campaign of 1867–68 and the Ashanti war of 1873, tended further to enhance the reputation of Great Britain among African races, while, as an inevitable result of the possession of India, British officials exercised considerable power at the court of Zanzibar, which indeed owed its separate existence to a decision of Lord Canning, the governor-general of India, in 1861 recognizing the division of the Arabian and African dominions of the imam of Muscat.

It has been said that Great Britain was without serious rival. On the Gold Coast she had bought the Danish forts in 1850 and acquired the Dutch, 1871–1872, in exchange for establishments in Sumatra. But Portugal still held, both in the east and west of Africa, considerable stretches of the tropical coast-lands, and it was in 1875 that she obtained, as a result of the arbitration of Marshal MacMahon, possession of the whole of Delagoa Bay, to the southern part of which England also laid claim by virtue of a treaty of cession concluded with native chiefs in 1823. The only other European power which at the period under consideration had considerable possessions in Africa was France. Besides Algeria, France had settlements on the Senegal, where in 1854 the appointment of General Faidherbe as governor marked the beginning of a policy of expansion; she had also various posts on the upper Guinea coast, had taken the estuary of the Gabun as a station for her navy, and had acquired (1862) Obok at the southern entrance to the Red Sea.

In North Africa the Turks had (in 1835) assumed direct control of Tripoli, while Morocco had fallen into a state of decay though retaining its independence. The most remarkable change was in Egypt, where the Khedive Ismail had introduced a somewhat fantastic imitation of European civilization. In addition Ismail had conquered Darfur, annexed Harrar and the Somali ports on the Gulf of Aden, was extending his power southward to the equatorial lakes, and even contemplated reaching the Indian Ocean. The Suez Canal, opened in 1869, had a great influence on the future of Africa, as it again made Egypt the highway to the East, to the detriment of the Cape route.

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[1] Another great traveller of this stamp was Wilhelm Junker, who spent the greater part of the period 1875–1886 in the east central Sudan.

[2] Specially appointed to consider West African affairs.

The division of the continent in 1875.

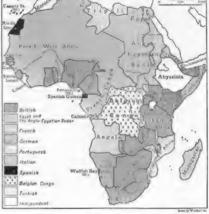
Any estimate of the area of African territory held by European nations in 1875 is necessarily but approximate, and varies chiefly as the compiler of statistics rejects or accepts the vague claims of Portugal to sovereignty over the hinterland of her coast possessions. At that period other European nations—with the occasional exception of Great Britain—were indifferent to Portugal's pretensions, and her estimate of her African empire as covering over 700,000 sq. m. was not challenged.[1] But the area under effective control of Portugal at that time did not exceed 40,000 sq. m. Great Britain then held some 250,000 sq. m., France about 170,000 sq. m. and Spain 1000 sq. m. The area of the independent Dutch republics (the Transvaal and Orange Free State) was some 150,000 sq. m., so that the total area of Africa ruled by Europeans did not exceed 1,271,000 sq. m.; roughly one-tenth of the continent. This estimate, as it admits the full extent of Portuguese claims and does not include Madagascar, in reality considerably overstates the case.

Egypt and the Egyptian Sudan, Tunisia and Tripoli were subject in differing ways to the overlordship of the sultan of Turkey, and with these may be ranked, in the scale of organized governments, the three principal independent states, Morocco, Abyssinia and Zanzibar, as also the negro republic of Liberia. There remained, apart from the Sahara, roughly one half of Africa, lying mostly within the tropics, inhabited by a multitude of tribes and peoples living under various forms of government and subject to frequent changes in respect of political organization. In this region were the negro states of Ashanti, Dahomey and Benin on the west coast, the Mahommedan sultanates of the central Sudan, and a number of negro kingdoms in the east central and south central regions. Of these Uganda on the north-west shores of Victoria Nyanza, Cazembe and Muata Hianvo (or Yanvo) may be mentioned. The two last-named kingdoms occupied respectively the south-eastern and south-western parts of the Congo basin. In all this vast region the Negro and Negro-Bantu races predominated, for the most part untouched by Mahommedanism or Christian influences. They lacked political cohesion, and possessed neither the means nor the inclination to extend their influence beyond their own borders. The exploitation of Africa continued to be entirely the work of alien races.

Causes which led to partition.

The causes which led to the partition of Africa may now be considered. They are to be found in the economic and political state of western Europe at the time. Germany, strong and united as the result of the Franco-Prussian War of 1870, was seeking new outlets for her energies—new markets for her growing industries, and with the markets, colonies. Yet the idea of colonial expansion was of slow growth in Germany, and when Prince Bismarck at length acted Africa was the only field left to exploit, South America being protected from interference by the known determination of the United States to enforce the Monroe Doctrine, while Great Britain, France, the Netherlands, Portugal and Spain already held most of the other regions of the world where colonization was possible. For different reasons the war of 1870 was also the starting-point for France in the building up of a new colonial empire. In her endeavour to regain the position lost in that war France had to look beyond Europe. To the two causes mentioned must be added others. Great Britain and Portugal, when they found their interests threatened, bestirred themselves, while Italy also conceived it necessary to become an African power. Great Britain awoke to the need for action too late to secure predominance in all the regions where formerly hers was the only European influence. She had to contend not only with the economic forces which urged her rivals to action, but had also to combat the jealous opposition of almost every European nation to the further growth of British power. Italy alone acted throughout in cordial co-operation with Great Britain.

It was not, however, the action of any of the great powers of Europe which precipitated the struggle. This was brought about by the ambitious projects of Leopold II., king of the Belgians. The discoveries of Livingstone, Stanley and others had aroused especial interest among two classes of men in western Europe, one the manufacturing and trading class, which saw in Central Africa possibilities of commercial development, the other the philanthropic and missionary class, which beheld in the newly discovered lands millions of savages to Christianize and civilize. The possibility of utilizing both these classes in the creation of a vast state, of which he should be the chief, formed itself in the mind of Leopold II. even before Stanley had navigated the Congo. The king's action was immediate; it proved successful; but no sooner was the nature of his project understood in Europe than it provoked the rivalry of France and Germany, and thus the international struggle was begun.



Emery Walker sc.

Conflicting ambitions of the European powers.

At this point it is expedient, in the light of subsequent events, to set forth the designs then entertained by the European powers that participated in the struggle for Africa. Portugal was striving to retain as large a share as possible of her shadowy empire, and particularly to establish her claims to the Zambezi region, so as to secure a belt of territory across Africa from Mozambique to Angola. Great Britain, once aroused to the imminence of danger, put forth vigorous efforts in East Africa and on the Niger, but her most ambitious dream was the establishment of an unbroken line of British possessions and spheres of influence from south to north of the continent, from Cape Colony to Egypt. Germany's ambition can be easily described. It was to secure as much as possible, so as to make up for lost opportunities. Italy coveted Tripoli, but that province could not be seized without risking war. For the rest Italy's territorial ambitions were confined to North-East Africa, where she hoped to acquire a dominating influence over Abyssinia. French ambitions, apart from Madagascar, were confined to the northern and central portions of the continent. To extend her possessions on the Mediterranean littoral, and to connect them with her colonies in West Africa, the western Sudan, and on the Congo, by establishing her influence over the vast intermediate regions, was France's first ambition. But the defeat of the Italians in Abyssinia and the impending downfall of the khalifa's power in the valley of the upper Nile suggested a still more daring project to the French government—none other than the establishment of French influence over a broad belt of territory stretching across the continent from west to east, from Senegal on the Atlantic coast to the Gulf of Aden. The fact that France possessed a small part of the Red Sea coast gave point to this design. But these conflicting ambitions could not all be realized, and Germany succeeded in preventing Great Britain obtaining a continuous band of British territory from south to north, while Great Britain, by excluding France from the upper Nile valley, dispelled the French dream of an empire from west to east.

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[1] See the tables in Behm and Wagner's *Bevölkerung der Erde* (Gotha, 1872).

King Leopold's ambitions have already been indicated. The part of the continent to which from the first he directed his energies was the equatorial region. In September 1876 he took what may be described as the first definite step in the modern partition of the continent. He summoned to a conference at Brussels representatives of Great Britain, Belgium, France, Germany, Austria-Hungary, Italy and Russia, to deliberate on the best methods to be adopted for the exploration and civilization of Africa, and the opening up of the interior of the continent to commerce and industry. The conference was entirely unofficial. The delegates who attended neither represented nor pledged their respective governments. Their deliberations lasted three days and resulted in the foundation of "The International African Association," with its headquarters at Brussels. It was further resolved to establish national committees in the various countries represented, which should collect funds and appoint delegates to the International Association. The central idea appears to have been to put the exploration and development of Africa upon an international footing. But it quickly became apparent that this was an unattainable ideal. The national committees were soon working independently of the International Association, and the Association itself passed through a succession of stages until it became purely Belgian in character, and at last developed into the Congo Free State, under the personal sovereignty of King Leopold. At first the Association devoted itself to sending expeditions to the great central lakes from the east coast; but failure, more or less complete, attended its efforts in this direction, and it was not until the return of Stanley, in January 1878, from his great journey down the Congo, that its ruling spirit, King Leopold, definitely turned his thoughts towards the Congo. In June of that year, Stanley visited the king at Brussels, and in the following November a private conference was held, and a committee was appointed for the investigation of the upper Congo.

The struggle for the Congo.

Stanley's remarkable discovery had stirred ambition in other capitals than Brussels. France had always taken a keen interest in West Africa, and in the years 1875 to 1878 Savorgnan de Brazza had carried out a successful exploration of the Ogowé river to the south of the Gabun. De Brazza determined that the Ogowé did not offer that great waterway into the interior of which he was in search, and he returned to Europe without having heard of the discoveries of Stanley farther south. Naturally, however, Stanley's discoveries were keenly followed in France. In Portugal, too, the discovery of the Congo, with its magnificent unbroken waterway of more than a thousand miles into the heart of the continent, served to revive the languid energies of the Portuguese, who promptly began to furbish up claims whose age was in inverse ratio to their validity. Claims, annexations and occupations were in the air, and when in January 1879 Stanley left Europe as the accredited agent of King Leopold and the Congo committee, the strictest secrecy was observed as to his real aims and intentions. The expedition was, it was alleged, proceeding up the Congo to assist the Belgian expedition which had entered from the east coast, and Stanley himself went first to Zanzibar. But in August 1879 Stanley found himself again at Banana Point, at the mouth of the Congo, with, as he himself has written, "the novel mission of sowing along its banks civilized settlements to peacefully conquer and subdue it, to remould it in harmony with modern ideas into national states, within whose limits the European merchant shall go hand in hand with the dark African trader, and justice and law and order shall prevail, and murder and lawlessness and the cruel barter of slaves shall be overcome." The irony of human aspirations was never perhaps more plainly demonstrated than in the contrast between the ideal thus set before themselves by those who employed Stanley, and the actual results of their intervention in Africa. Stanley founded his first station at Vivi, between the mouth of the Congo and the rapids that obstruct its course where it breaks over the western edge of the central continental plateau. Above the rapids he established a station on Stanley Pool and named it Leopoldville, founding other stations on the main stream in the direction of the falls that bear his name.

Meanwhile de Brazza was far from idle. He had returned to Africa at the beginning of 1880, and while the agents of King Leopold were making treaties and founding stations along the southern bank of the river, de Brazza and other French agents were equally busy on the northern bank. De Brazza was sent out to Africa by the French committee of the International African Association, which provided him with the funds for the expedition. His avowed object was to explore the region between the Gabun and Lake Chad. But his real object was to anticipate Stanley on the Congo. The international character of the association founded by King Leopold was never more than a polite fiction, and the rivalry between the French and the Belgians on the Congo was soon open, if not avowed. In October 1880 de Brazza made a solemn treaty with a chief on the north bank of the Congo, who claimed that his authority extended over a large area, including territory on the southern bank of the river. As soon as this chief had accepted French protection, de Brazza crossed over to the south of the river, and founded a station close to the present site of Leopoldville. The discovery by Stanley of the French station annoyed King Leopold's agent, and he promptly challenged the rights of the chief who purported to have placed the country under French protection, and himself founded a Belgian station close to the site selected by de Brazza. In the result, the French station was withdrawn to the northern side of Stanley Pool, where it is now known as Brazzaville.

The activity of French and Belgian agents on the Congo had not passed unnoticed in Lisbon, and the Portuguese government saw that no time was to be lost if the claims it had never ceased to put forward on the west coast were not to go by default. At varying periods during the 19th century Portugal had put forward claims to the whole of the West African coast, between 5° 12′ and 8° south. North of the Congo mouth she claimed the territories of Kabinda and Molemba, alleging that they had been in her possession since 1484. Great Britain had never, however, admitted this claim, and south of the Congo had declined to recognize Portuguese possessions as extending north of Ambriz. In 1856 orders were given to British cruisers to prevent by force any attempt to extend Portuguese dominion north of that place. But the Portuguese had been persistent in urging their claims, and in 1882 negotiations were again opened with the British government for recognition of Portuguese rights over both banks of the Congo on the coast, and for some distance inland. Into the details of the negotiations, which were conducted for Great Britain by the 2nd Earl Granville, who was then secretary for foreign affairs, it is unnecessary to enter; they resulted in the signing on the 26th of February 1884 of a treaty, by which Great Britain recognized the sovereignty of the king of Portugal "over that part of the west coast of Africa, situated between 8° and 5° 12′ south latitude," and inland as far as Noki, on the south bank of the Congo, below Vivi. The navigation of the Congo was to be controlled by an Anglo-Portuguese commission. The publication of this treaty evoked immediate protests, not only on the continent but in Great Britain. In face of the disapproval aroused by the treaty, Lord Granville found himself unable to ratify it. The protests had not been confined to France and the king of the Belgians. Germany had not yet acquired formal footing in Africa, but she was crouching for the spring prior to taking her part in the scramble, and Prince Bismarck had expressed, in vigorous language, the objections entertained by Germany to the Anglo-Portuguese treaty.

For some time before 1884 there had been growing up a general conviction that it would be desirable for the powers who were interesting themselves in Africa to come to some agreement as to "the rules of the game," and to define their respective interests so far as that was practicable. Lord Granville's ill-fated treaty brought this sentiment to a head, and it was agreed to hold an international conference on African affairs. But before discussing the Berlin conference of 1884–1885, it will be well to see what was the position, on the eve of the conference, in other parts of the African continent. In the southern section of Africa, south of the Zambezi, important events had been happening. In 1876 Great Britain had concluded an agreement with the Orange Free State for an adjustment of frontiers, the result of which was to leave the Kimberley diamond fields in British territory, in exchange for a payment of £90,000 to the Orange Free State. On the 12th of April 1877 Sir Theophilus Shepstone had issued a proclamation declaring the Transvaal—the South African Republic, as it was officially designated—to be British territory (see TRANSVAAL). In December 1880 war broke out and lasted until March 1881, when a treaty of peace was signed. This treaty of peace was followed by a convention, signed in August of the same year, under which complete self-government was guaranteed to the inhabitants of the Transvaal, subject to the suzerainty of Great Britain, upon certain terms and conditions and subject to certain reservations and limitations. No sooner was the convention signed than it became the object of the Boers to obtain a modification of the conditions and limitations imposed, and in February 1884 a fresh convention was signed, amending the convention of 1881. Article IV. of the new convention provided that "The South African Republic will conclude no treaty or engagement with any state or nation other than the Orange Free State, nor with any native tribe to the eastward or westward of the Republic, until the same has been approved by Her Majesty the Queen." The precise effect of the two conventions has been the occasion for interminable discussions, but as the subject is now one of merely academic interest, it is sufficient to say that when the Berlin conference held its first meeting in 1884 the Transvaal was practically independent, so far as its internal administration was concerned, while its foreign relations were subject to the control just quoted.

British influence consolidated in South Africa.

But although the Transvaal had thus, between the years 1875 and 1884, become and ceased to be British territory, British influence in other parts of Africa south of the Zambezi had been steadily extended. To the west of the Orange Free State, Griqualand West was annexed to the Cape in 1880, while to the east the territories beyond the Kei river were included in Cape Colony between 1877 and 1884, so that in the latter year, with the exception of Pondoland, the whole of South-East Africa was in one form or another under British control. North of Natal, Zululand was not actually annexed until 1887, although since 1879, when the military power of the Zulus was broken up, British influence had been admittedly supreme. In December 1884 St Lucia Bay—upon which Germany was casting covetous eyes—had been taken possession of in virtue of its cession to Great Britain by the Zulu king in 1843, and three years later an agreement of non-cession to foreign powers made by Great Britain with the regent and paramount chief of Tongaland completed the chain of British possessions on the coast of South Africa, from the mouth of the Orange river on the west to Kosi Bay and the Portuguese frontier on the east. In the interior of South Africa the year 1884 witnessed the beginning of that final stage of the British advance towards the north which was to extend British influence from the Cape to the southern shores of Lake Tanganyika. The activity of the Germans on the west, and of the Boer republic on the east, had brought home to both the imperial and colonial authorities the impossibility of relying on vague traditional claims. In May 1884 treaties were made with native chiefs by which the whole of the country north of Cape Colony, west of the Transvaal, south of 22° S. and east of 20° E., was placed under British protection, though a protectorate was not formally declared until the following January.

Meanwhile some very interesting events had been taking place on the west coast, north of the Orange river and south of the Portuguese province of Mossamedes. It must be sufficient here to touch very briefly on the events that preceded the foundation of the colony of German South-West Africa. For many years before 1884 German missionaries had settled among the Damaras (Herero) and Namaquas, often combining small trading operations with their missionary work. From time to time trouble arose between the missionaries and the native chiefs, and appeals were made to the German government for protection. The German government in its turn begged the British government to say whether it assumed responsibility for the protection of Europeans in Damaraland and Namaqualand. The position of the British government was intelligible, if not very intelligent. It did not desire to see any other European power in these countries, and it did not want to assume the responsibility and incur the expense of protecting the few Europeans settled there. Sir Bartle Frere, when governor of the Cape (1877–1880), had foreseen that this attitude portended trouble, and had urged that the whole of the unoccupied coast-line, up to the Portuguese frontier, should be declared under British protection. But he preached to deaf ears, and it was as something of a concession to him that in March 1878 the British flag was hoisted at Walfish Bay, and a small part of the adjacent land declared to be British. The fact appears to be that British statesmen failed to understand the change that had come over Germany. They believed that Prince Bismarck would never give his sanction to the creation of a colonial empire, and, to the German inquiries as to what rights Great Britain claimed in Damaraland and Namaqualand, procrastinating replies were sent. Meanwhile the various colonial societies established in Germany had effected a revolution in public opinion, and, more important still, they had convinced the great chancellor. Accordingly when, in November 1882, F. A. E. Lüderitz, a Bremen merchant, informed the German government of his intention to establish a factory on the coast between the Orange river and the Little Fish river, and asked if he might rely on the protection of his government in case of need, he met with no discouragement from Prince Bismarck. In February 1883 the German ambassador in London informed Lord Granville of Lüderitz's design, and asked "whether Her Majesty's government exercise any authority in that locality." It was intimated that if Her Majesty's government did not, the German government would extend to Lüderitz's factory "the same measure of protection which they give to their subjects in remote parts of the world, but without having the least design to establish any footing in South Africa." An inconclusive reply was sent, and on the 9th of April Lüderitz's agent landed at Angra Pequeña, and after a short delay concluded a treaty with the local chief, by which some 215 square miles around Angra Pequeña were ceded to Lüderitz. In England and at the Cape irritation at the news was mingled with incredulity, and it was fully anticipated that Lüderitz would be disavowed by his government. But for this belief it can scarcely be doubted that the rest of the unoccupied coast-line would have been promptly declared under British protection. Still Prince Bismarck was slow to act. In November the German ambassador again inquired if Great Britain made any claim over this coast, and Lord Granville replied that Her Majesty exercised sovereignty only over certain parts of the coast, as at Walfish Bay, and suggested that arrangements might be made by which Germany might assist in the settlement of Angra Pequeña. By this time Lüderitz had extended his acquisitions southwards to the Orange river, which had been declared by the British government to be the northern frontier of Cape Colony. Both at the Cape and in England it was now realized that Germany had broken away from her former purely continental policy, and, when too late, the Cape parliament showed great eagerness to acquire the territory which had lain so long at its very doors, to be had for the taking. It is not necessary to follow the course of the subsequent negotiations. On the 15th

Germany enters the field.

of August 1884 an official note was addressed by the German consul at Capetown to the high commissioner, intimating that the German emperor had by proclamation taken "the territory belonging to Mr A. Lüderitz on the west coast of Africa under the direct protection of His Majesty." This proclamation covered the coast-line from the north bank of the Orange river to 26° S. latitude, and 20 geographical miles inland, including "the islands belonging thereto by the law of nations." On the 8th of September 1884 the German government intimated to Her Majesty's government "that the west coast of Africa from 26° S. latitude to Cape Frio, excepting Walfish Bay, had been placed under the protection of the German emperor." Thus, before the end of the year 1884, the foundations of Germany's colonial empire had been laid in South-West Africa.

Nachtigal's mission to West Africa.

In April of that year Prince Bismarck intimated to the British government, through the German chargé d'affaires in London, that "the imperial consul-general, Dr Nachtigal, has been commissioned by my government to visit the west coast of Africa in the course of the next few months, in order to complete the information now in the possession of the Foreign Office at Berlin, on the state of German commerce on that coast. With this object Dr Nachtigal will shortly embark at Lisbon, on board the gunboat 'Möwe.' He will put himself into communication with the authorities in the British possessions on the said coast, and is authorized to conduct, on behalf of the imperial government, negotiations connected with certain questions. I venture," the official communication proceeds, "in accordance with my instructions, to beg your excellency to be so good as to cause the authorities in the British possessions in West Africa to be furnished with suitable recommendations." Although at the date of this communication it must have been apparent, from what was happening in South Africa, that Germany was prepared to enter on a policy of colonial expansion, and although the wording of the letter was studiously vague, it does not seem to have occurred to the British government that the real object of Gustav Nachtigal's journey was to make other annexations on the west coast. Yet such was indeed his mission. German traders and missionaries had been particularly active of late years on the coast of the Gulf of Guinea. German factories were dotted all along the coast in districts under British protection, under French protection and under the definite protection of no European power at all. It was to these latter places that Nachtigal turned his attention. The net result of his operations was that on the 5th of July 1884 a treaty was signed with the king of Togo, placing his country under German protection, and that just one week later a German protectorate was proclaimed over the Cameroon district. Before either of these events had occurred Great Britain had become alive to the fact that she could no longer dally with the subject, if she desired to consolidate her possessions in West Africa. The British government had again and again refused to accord native chiefs the protection they demanded. The Cameroon chiefs had several times asked for British protection, and always in vain. But at last it became apparent, even to the official mind, that rapid changes were being effected in Africa, and on the 16th of May Edward Hyde Hewett, British consul, received instructions to return to the west coast and to make arrangements for extending British protection over certain regions. He arrived too late to save either Togoland or Cameroon, in the latter case arriving five days after King Bell and the other chiefs on the river had signed treaties with Nachtigal. But the British consul was in time to secure the delta of the river Niger and the Oil Rivers District, extending from Rio del Rey to the Lagos frontier, where for a long period British traders had held almost a monopoly of the trade.

French and British rivalry in West Africa.

Meanwhile France, too, had been busy treaty-making. While the British government still remained under the spell of the fatal resolution of 1865, the French government was strenuously endeavouring to extend France's influence in West Africa, in the countries lying behind the coast-line. During the year 1884 no fewer than forty-two treaties were concluded with native chiefs, an even larger number having been concluded in the previous twelve months. In this fashion France was pushing on towards Timbuktu, in steady pursuance of the policy which resulted in surrounding all the old British possessions in West Africa with a continuous band of French territory. There was, however, one region on the west coast where, notwithstanding the lethargy of the British government, British interests were being vigorously pushed, protected and consolidated. This was on the lower Niger, and the leading spirit in the enterprise was Mr Goldie Taubman (afterwards Sir George Taubman Goldie). In 1877 Sir George Goldie visited the Niger and conceived the idea of establishing a settled government in that region. Through his efforts the various trading firms on the lower Niger formed themselves in 1879 into the "United African Company," and the foundations were laid of something like settled administration. An application was made to the British government for a charter in 1881, and the capital of the company increased to a million sterling. Henceforth the company was known as the "National African Company," and it was acknowledged that its object was not only to develop the trade of the lower Niger, but to extend its operations to the middle reaches of the river, and to open up direct relations with the great Fula empire of Sokoto and the smaller states associated with Sokoto under a somewhat loosely defined suzerainty. The great development of trade which followed the combination of British interests carried out under Goldie's skilful guidance did not pass unnoticed in France, and, encouraged by Gambetta, French traders made a bold bid for a position on the river. Two French companies, with ample capital, were formed, and various stations were established on the lower Niger. Goldie realized at once the seriousness of the situation, and lost no time in declaring commercial war on the newcomers. His bold tactics were entirely successful, and a few days before the meeting of the Berlin conference he had the satisfaction of announcing that he had bought out the whole of the French interests on the river, and that Great Britain alone possessed any interests on the lower Niger.

The position in Tunisia and Egypt.

To complete the survey of the political situation in Africa at the time the plenipotentiaries met at Berlin, it is necessary to refer briefly to the course of events in North and East Africa since 1875. In 1881 a French army entered Tunisia, and compelled the bey to sign a treaty placing that country under French protection. The sultan of Turkey formally protested against this invasion of Ottoman rights, but the great powers took no action, and France was left in undisturbed possession of her newly acquired territory. In Egypt the extravagance of Ismail Pasha had led to the establishment in 1879, in the interests of European bondholders, of a Dual Control exercised by France and Great Britain. France had, however, in 1882 refused to take part in the suppression of a revolt under Arabi Pasha, which England accomplished unaided. As a consequence the Dual Control had been abolished in January 1883, since when Great Britain, with an army quartered in the country, had assumed a predominant position in Egyptian affairs (see EGYPT). In East Africa, north of the Portuguese possessions, where the sultan of Zanzibar was the most considerable native potentate, Germany was secretly preparing the foundations of her present colony of German East Africa. But no overt act had warned Europe of what was impending. The story of the foundation of German East Africa is one of the romances of the continent. Early in 1884 the Society for German Colonization was founded, with the avowed object of furthering the newly awakened colonial aspirations of the German people.[1] It was a society inspired and controlled by young men, and on the 4th of November 1884, eleven days before the conference assembled at Berlin, three young Germans arrived as deck passengers at Zanzibar. They were disguised as mechanics, but were in fact Dr Karl Peters, the president of the Colonization Society, Joachim Count Pfeil, and Dr Jühlke, and their stock-in-trade consisted of a number of German flags and a supply of blank treaty forms. They proposed to land on the mainland opposite Zanzibar, and to conclude treaties in the back country with native chiefs placing their territories under German protection. The enterprise was frowned upon by the German government; but, encouraged by German residents at Zanzibar, the three young pioneers crossed to the mainland, and on the 19th of November, while the diplomatists assembled at Berlin were solemnly discussing the rules which were to govern the game of partition, the first "treaty" was signed at Mbuzini, and the German flag raised for the first time in East Africa.

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[1] In 1887 this society united with the German Colonial Society, an organization founded in 1882. The united society took the title of the German Colonial Company.

The German flag raised in East Africa.

Italy had also obtained a footing on the African continent before the meeting of the Berlin conference. The Rubattino Steamship Company as far back as 1870 had bought the port of Assab as a coaling station, but it was not until 1882 that it was declared an Italian colony. This was followed by the conclusion of a treaty with the sultan of Assab, chief of the Danakil, signed on the 15th of March 1883, and subsequently approved by the king of Shoa, whereby Italy obtained the cession of part of Ablis (Aussa) on the Red Sea, Italy undertaking to protect with her fleet the Danakil littoral.

Recognition of the International Association.

One other event must be recorded as happening before the meeting of the Berlin conference. The king of the Belgians had been driven to the conclusion that, if his African enterprise was to obtain any measure of permanent success, its international status must be recognized. To this end negotiations were opened with various governments. The first government to "recognize the flag of the International Association of the Congo as the flag of a friendly government" was that of the United States, its declaration to that effect bearing date the 22nd of April 1884. There were, however, difficulties in the way of obtaining the recognition of the European powers, and in order to obtain that of France, King Leopold, on the 23rd of April 1884, while labouring under the feelings of annoyance which had been aroused by the Anglo-Portuguese treaty concluded by Lord Granville in February, authorized Colonel Strauch, president of the International Association, to engage to give France "the right of preference if, through unforeseen circumstances, the Association were compelled to sell its possessions." France's formal recognition of the Association as a government was, however, delayed by the discussion of boundary questions until the following February, and in the meantime Germany, Great Britain, Italy, Austria-Hungary, Holland and Spain had all recognized the Association; though Germany alone had done so—on the 8th of November—before the assembling of the conference.

The Berlin Conference of 1884-85.

The conference assembled at Berlin on the 15th of November 1884, and after protracted deliberations the "General Act of the Berlin Conference" was signed by the representatives of all the powers attending the conference, on the 26th of February 1885. The powers represented were Germany, Austria-Hungary, Belgium, Denmark, Spain, the United States, France, Great Britain, Italy, Holland, Portugal, Russia, Sweden and Norway, and Turkey, to name them in the alphabetical order adopted in the preamble to the French text of the General Act. Ratifications were deposited by all the signatory powers with the exception of the United States. It is unnecessary to examine in detail the results of the labours of the conference. The General Act dealt with six specific subjects: (1) freedom of trade in the basin of the Congo, (2) the slave trade, (3) neutrality of territories in the basin of the Congo, (4) navigation of the Congo, (5) navigation of the Niger, (6) rules for future occupation on the coasts of the African continent. It will be seen that the act dealt with other matters than the political partition of Africa; but, so far as they concern the present purpose, the results effected by the Berlin Act may be summed up as follows. The signatory powers undertook that any fresh act of taking possession on any portion of the African coast must be notified by the power taking possession, or assuming a protectorate, to the other signatory powers. It was further provided that any such occupation to be valid must be effective. It is also noteworthy that the first reference in an international act to the obligations attaching to "spheres of influence" is contained in the Berlin Act.

Constitution of the Congo State.

It will be remembered that when the conference assembled, the International Association of the Congo had only been recognized as a sovereign state by the United States and Germany. But King Leopold and his agents had taken full advantage of the opportunity which the conference afforded, and before the General Act was signed the Association had been recognized by all the signatory powers, with the not very important exception of Turkey, and the fact communicated to the conference by Colonel Strauch. It was not, however, until two months later, in April 1885, that King Leopold, with the sanction of the Belgian legislature, formally assumed the headship of the new state; and on the 1st of August in the same year His Majesty notified the powers that from that date the "Independent State of the Congo" declared that "it shall be perpetually neutral" in conformity with the provisions of the Berlin Act. Thus was finally constituted the Congo Free State, under the sovereignty of King Leopold, though the boundaries claimed for it at that time were considerably modified by subsequent agreements.

The chief partition treaties.

From 1885 the scramble among the powers went on with renewed vigour, and in the fifteen years that remained of the century the work of partition, so far as international agreements were concerned, was practically completed. To attempt to follow the process of acquisition year by year would involve a constant shifting of attention from one part of the continent to another, inasmuch as the scramble was proceeding simultaneously all over Africa. It will therefore be the most convenient plan to deal with the continent in sections. Before doing so, however, the international agreements which determined in the main the limits of the possessions of the various powers may be set forth. They are:—

I. The agreement of the 1st of July 1890 between Great Britain and Germany defining their spheres of influence in East, West and South-West Africa. This agreement was the most comprehensive of all the "deals" in African territory, and included in return for the recognition of a British protectorate over Zanzibar the cession of Heligoland to Germany.

II. The Anglo-French declaration of the 5th of August 1890, which recognized a French protectorate over Madagascar, French influence in the Sahara, and British influence between the Niger and Lake Chad.

III. The Anglo-Portuguese treaty of the 11th of June 1891, whereby the Portuguese possessions on the west and east coasts were separated by a broad belt of British territory, extending north to Lake Tanganyika.

IV. The Franco-German convention of the 15th of March 1894, by which the Central Sudan was left to France (this region by an Anglo-German agreement of the 15th of November 1893 having been recognized as in the German sphere). By this convention France was able to effect a territorial junction of her possessions in North and West Africa with those in the Congo region.

V. Protocols of the 24th of March and the 15th of April 1891, for the demarcation of the Anglo-Italian spheres in East Africa.

VI. The Anglo-French convention of the 14th of June 1898, for the delimitation of the possessions of the two countries west of Lake Chad, with the supplementary declaration of the 21st of March 1899 whereby France recognized the upper Nile valley as in the British sphere of influence.

The growth of the Congo State.

Coming now to a more detailed consideration of the operations of the powers, the growth of the Congo Free State, which occupied, geographically, a central position, may serve as the starting-point for the story of the partition after the Berlin conference. In the notification to the powers of the 1st of August 1885, the boundaries of the Free State were set out in considerable detail. The limits thus determined resulted partly from agreements made with France, Germany and Portugal, and partly from treaties with native chiefs. The state acquired the north bank of the Congo from its mouth to a point in the unnavigable reaches, and in the interior the major part of the Congo basin. In the north-east the northern limit was 4° N. up to 30° E., which formed the eastern boundary of the state. The south-eastern frontier claimed by King Leopold extended to Lakes Tanganyika, Mweru and Bangweulu, but it was not until some years later that it was recognized and defined by the agreement of May 1894 with Great Britain. The international character of King Leopold's enterprise had not long been maintained, and his recognition as sovereign of the Free State confirmed the distinctive character which the Association had assumed, even before that event.

In April 1887 France was informed that the right of preemption accorded to her in 1884 had not been intended by King Leopold to prejudice Belgium's right to acquire the Congo State, and in reply the French minister at Brussels took note of the explanation, "in so far as this interpretation is not contrary to pre-existing international engagements." By his will, dated the 2nd of August 1889, King Leopold made Belgium formally heir to the sovereign rights of the Congo Free State. In 1895 an annexation bill was introduced into the Belgian parliament, but at that time Belgium had no desire to assume responsibility for the Congo State, and the bill was withdrawn. In 1901, by the terms of a loan granted in 1890, Belgium had again an opportunity of annexing the Congo State, but a bill in favour of annexation was opposed by the government and was withdrawn after King Leopold had declared that the time was not ripe for the transfer. Concessionaire companies and a *Domaine de la Couronne* had been created in the state, from which the sovereign derived considerable revenues—facts which helped to explain the altered attitude of Leopold II. The agitation in Great Britain and America against the Congo system of government, and the admissions of an official commission of inquiry concerning its maladministration, strengthened, however, the movement in favour of transfer. Nevertheless in June 1906 the king again declared himself opposed to immediate annexation. But under pressure of public opinion the Congo government concluded, 28th of November 1907, a new annexation treaty. As it stipulated for the continued existence of the crown domain the treaty provoked vehement opposition. Leopold II. was forced to yield, and an additional act was signed, 5th of March 1908, providing for the suppression of the domain in return for financial subsidies. The treaty, as amended, was approved by the Belgian parliament in the session of 1908. Thus the Congo state, after an existence of 24 years as an independent power, became a Belgian colony. (See CONGO FREE STATE.)

The area of the Free State, vast as it was, did not suffice to satisfy the ambition of its sovereign. King Leopold maintained that the Free State enjoyed equally with any other state the right to extend its frontiers. His ambition involved the state in the struggle between Great Britain and France for the upper Nile. To understand the situation it is necessary to remember the condition of the Egyptian Sudan at that time. The mahdi, Mahommed Ahmed, had preached a holy war against the Egyptians, and, after the capture of Khartum and the death of General C. G. Gordon, the Sudan was abandoned to the dervishes. The Egyptian frontier was withdrawn to Wadi Halfa, and the vast provinces of Kordofan, Darfur and the Bahr-el-Ghazal were given over to dervish tyranny and misrule. It was obvious that Egypt would sooner or later seek to recover her position in the Sudan, as the command of the upper Nile was recognized as essential to her continued prosperity. But the international position of the abandoned provinces was by no means clear. The British government, by the Anglo-German agreement of July 1890, had secured the assent of Germany to the statement that the British sphere of influence in East Africa was bounded on the west by the Congo Free State and by "the western watershed of the basin of the upper Nile"; but this claim was not recognized either by France or by the Congo Free State. From her base on the Congo, France was busily engaged pushing forward along the northern tributaries of the great river. On the 27th of April 1887 an agreement was signed with the Congo Free State by which the right bank of the Ubangi river was secured to French influence, and the left bank to the Congo Free State. The desire of France to secure a footing in the upper Nile valley was partly due, as has been seen, to her anxiety to extend a French zone across Africa, but it was also and to a large extent attributable to the belief, widely entertained in France, that by establishing herself on the upper Nile France could regain the position in Egyptian affairs which she had sacrificed in 1882. With these strong inducements France set steadily to work to consolidate her position on the tributary streams of the upper Congo basin, preparatory to crossing into the valley of the upper Nile. Meanwhile a similar advance was being made from the Congo Free State northwards and eastwards. King Leopold had two objects in view—to obtain control of the rich province of the Bahr-el-Ghazal and to secure an outlet on the Nile. Stations were established on the Welle river, and in February 1891 Captain van Kerckhoven left Leopoldville for the upper Welle with the most powerful expedition which had, up to that time, been organized by the Free State. After some heavy fighting the expedition reached the Nile in September 1892, and opened up communications with the remains of the old Egyptian garrison at Wadelai. Other expeditions under Belgian officers penetrated into the Bahr-el-Ghazal, and it was apparent that King Leopold proposed to rely on effective occupation as an answer to any claims which might be advanced by either Great Britain or France. The news of what was happening in this remote region of Africa filtered through to Europe very slowly, but King Leopold was warned on several occasions that Great Britain would not recognize any claims by the Congo Free State on the Bahr-el-Ghazal. The difficulty was, however, that neither from Egypt, whence the road was barred by the khalifa (the successor of the mahdi), nor from Uganda, which was far too remote from the coast to serve as the base of a large expedition, could a British force be despatched to take effective occupation of the upper Nile valley. There was, therefore, danger lest the French should succeed in establishing themselves on the upper Nile before the preparations which were being made in Egypt for "smashing" the khalifa were completed.

The contest for the upper Nile.

In these circumstances Lord Rosebery, who was then British foreign minister, began, and his successor, the 1st earl of Kimberley, completed, negotiations with King Leopold which resulted in the conclusion of the Anglo-Congolese agreement of 12th May 1894. By this agreement King Leopold recognized the British sphere of influence as laid down in the Anglo-German agreement of July 1890, and Great Britain granted a lease to King Leopold of certain territories in the western basin of the upper Nile, extending on the Nile from a point on Lake Albert to Fashoda, and westwards to the Congo-Nile watershed. The practical effect of this agreement was to give the Congo Free State a lease, during its sovereign's lifetime, of the old Bahr-el-Ghazal province, and to secure after His Majesty's death as much of that territory as lay west of the 30th meridian, together with access to a port on Lake Albert, to his successor. At the same time the Congo Free State leased to Great Britain a strip of territory, 15½ m. in breadth, between the north end of Lake Tanganyika and the south end of Lake Albert Edward. This agreement was hailed as a notable triumph for British diplomacy. But the triumph was short-lived. By the agreement of July 1890 with Germany, Great Britain had been reluctantly compelled to abandon her hopes of through communication between the British spheres in the northern and southern parts of the continent, and to consent to the boundary of German East Africa marching with the eastern frontier of the Congo Free State. Germany frankly avowed that she did not wish to have a powerful neighbour interposed between herself and the Congo Free State. It was obvious that the new agreement would effect precisely what Germany had declined to agree to in 1890. Accordingly Germany protested in such vigorous terms that, on the 22nd of June 1894, the offending article was withdrawn by an exchange of notes between Great Britain and the Congo Free State. Opinion in France was equally excited by the new agreement. It was

The Anglo-Congolese agreement of 1894.

obvious that the lease to the Congo Free State was intended to exclude France from the Nile by placing the Congo Free State as a barrier across her path. Pressure was brought to bear on King Leopold, from Paris, to renounce the rights acquired under the agreement, and on the 14th of August 1894 King Leopold signed an agreement with France by which, in exchange for France's acknowledgment of the Mbomu river as his northern frontier, His Majesty renounced all occupation and all exercise of political influence west of 30° E., and north of a line drawn from that meridian to the Nile along 5° 30′ N.

This left the way still open for France to the Nile, and in June 1896 Captain J. Marchand left France with secret instructions to lead an expedition into the Nile valley. On the 1st of March in the following year he left Brazzaville, and began a journey which all but plunged Great Britain and France into war. The difficulties which Captain Marchand had to overcome were mainly those connected with transport. In October 1897 the expedition reached the banks of the Sue, the waters of which eventually flow into the Nile. Here a post was established and the "Faidherbe," a steamer which had been carried across the Congo-Nile watershed in sections, was put together and launched. On the 1st of May 1898 Marchand started on the final stage of his journey, and reached Fashoda on the 10th of July, having established a chain of posts *en route*. At Fashoda the French flag was at once raised, and a "treaty" made with the local chief. Meanwhile other expeditions had been concentrating on Fashoda—a mud-flat situated in a swamp, round which for many months raged the angry passions of two great peoples. French expeditions, with a certain amount of assistance from the emperor Menelek of Abyssinia, had been striving to reach the Nile from the east, so as to join hands with Marchand and complete the line of posts into the Abyssinian frontier. In this, however, they were unsuccessful. No better success attended the expedition under Colonel (afterwards Sir) Ronald Macdonald, R.E., sent by the British government from Uganda to anticipate the French in the occupation of the upper Nile. It was from the north that claimants arrived to dispute with the French their right to Fashoda, and all that the occupation of that dismal post implied. In 1896 an Anglo-Egyptian army, under the direction of Sir Herbert (afterwards Lord) Kitchener, had begun to advance southwards for the reconquest of the Egyptian Sudan. On the 2nd of September 1898 Khartum was captured, and the khalifa's army dispersed. It was then that news reached the Anglo-Egyptian commander, from native sources, that there were white men flying a strange flag at Fashoda. The sirdar at once proceeded in a steamer up the Nile, and courteously but firmly requested Captain Marchand to remove the French flag. On his refusal the Egyptian flag was raised close to the French flag, and the dispute was referred to Europe for adjustment between the British and French governments. A critical situation ensued. Neither government was inclined to give way, and for a time war seemed imminent. Happily Lord Salisbury was able to announce, on the 4th of November, that France was willing to recognize the British claims, and the incident was finally closed on the 21st of March 1899, when an Anglo-French declaration was signed, by the terms of which France withdrew from the Nile valley and accepted a boundary line which satisfied her earlier ambition by uniting the whole of her territories in North, West and Central Africa into a homogeneous whole, while effectually preventing the realization of her dream of a transcontinental empire from west to east. By this declaration it was agreed that the dividing line between the British and French spheres, north of the Congo Free State, should follow the Congo-Nile water-parting up to its intersection with the 11th parallel of north latitude, from which point it was to be "drawn as far as the 15th parallel in such a manner as to separate in principle the kingdom of Wadai from what constituted in 1882 the province of Darfur," but in no case was it to be drawn west of the 21st degree of east longitude, or east of the 23rd degree. From the 15th parallel the line was continued north and north-west to the intersection of the Tropic of Cancer with 16° E. French influence was to prevail west of this line, British influence to the east. Wadai was thus definitely assigned to France.

The French at Fashoda.

Fate of the Bahr-el-Ghazal.

When, by the declaration of the 21st of March 1899, France renounced all territorial ambitions in the upper Nile basin, King Leopold revived his claims to the Bahr-el-Ghazal province under the terms of the lease granted by Article 2 of the Anglo-Congolese agreement of 1894. This step he was encouraged to take by the assertion of Lord Salisbury, in his capacity as secretary of state for foreign affairs during the negotiations with France concerning Fashoda, that the lease to King Leopold was still in full force. But the assertion was made simply as a declaration of British right to dispose of the territory, and the sovereign of the Congo State found that there was no disposition in Great Britain to allow the Bahr-el-Ghazal to fall into his hands. Long and fruitless negotiations ensued. The king at length (1904) sought to force a settlement by sending armed forces into the province. Diplomatic representations having failed to secure the withdrawal of these forces, the Sudan government issued a proclamation which had the effect of cutting off the Congo stations from communication with the Nile, and finally King Leopold consented to an agreement, signed in London on the 9th of May 1906, whereby the 1894 lease was formally annulled. The Bahr-el-Ghazal thenceforth became undisputedly an integral part of the Anglo-Egyptian Sudan. King Leopold had, however, by virtue of the 1894 agreement administered the comparatively small portion of the leased area in which his presence was not resented by France. This territory, including part of the west bank of the Nile and known as the Lado Enclave, the 1906 agreement allowed King Leopold to "continue during his reign to occupy." Provision was made that within six months of the termination of His Majesty's reign the enclave should be handed over to the Sudan government (see CONGO FREE STATE). In this manner ended the long struggle for supremacy on the upper Nile, Great Britain securing the withdrawal of all European rivals.

Portugal's trans-African schemes.

The course of events in the southern half of the continent may now be traced. By the convention of the 14th of February 1885, in which Portugal recognized the sovereignty of the Congo Free State, and by a further convention concluded with France in 1886, Portugal secured recognition of her claim to the territory known as the Kabinda enclave, lying north of the Congo, but not to the northern bank of the river. By the same convention of 1885 Portugal's claim to the southern bank of the river as far as Noki (the limit of navigation from the sea) had been admitted. Thus Portuguese possessions on the west coast extended from the Congo to the mouth of the Kunene river. In the interior the boundary with the Free State was settled as far as the Kwango river, but disputes arose as to the right to the country of Lunda, otherwise known as the territory of the Muato Yanvo. On the 25th of May 1891 a treaty was signed at Lisbon, by which this large territory was divided between Portugal and the Free State. The interior limits of the Portuguese possessions in Africa south of the equator gave rise, however, to much more serious discussions than were involved in the dispute as to the Muato Yanvo's kingdom. Portugal, as has been stated, claimed all the territories between Angola and Mozambique, and she succeeded in inducing both France and Germany, in 1886, to recognize the king of Portugal's "right to exercise his sovereign and civilizing influence in the territories which separate the Portuguese possessions of Angola and Mozambique." The publication of the treaties containing this declaration, together with a map showing Portuguese claims extending over the whole of the Zambezi valley, and over Matabeleland to the south and the greater part of Lake Nyasa to the north, immediately provoked a formal protest from the British government. On the 13th of August 1887 the British chargé d'affaires at Lisbon transmitted to the Portuguese minister for foreign affairs a memorandum from Lord Salisbury, in which the latter formally protested "against any claims not founded on occupation," and contended that the doctrine of effective occupation had been admitted in principle by all the parties to the Act of Berlin. Lord Salisbury further stated that "Her Majesty's government cannot recognize Portuguese sovereignty in territory not occupied by her in sufficient strength to enable her to maintain order, protect foreigners and control the natives." To this Portugal replied that the doctrine of effective occupation was expressly confined by the Berlin Act to the African coast, but at the same time expeditions were hastily despatched up the Zambezi and some of its tributaries to discover traces of former Portuguese occupation. Matabeleland and the districts of Lake Nyasa were specially mentioned in the British protest as countries in which Her Majesty's government took a special interest. As a matter of fact the extension of British influence northwards to the Zambezi had engaged the attention of the British authorities ever since the appearance of Germany in South-West Africa and the declaration of a British protectorate over Bechuanaland. There were rumours of German activity in Matabeleland, and of a Boer trek north of the Limpopo. Hunters and explorers had reported in eulogistic terms on the rich goldfields and healthy plateau lands of Matabeleland and Mashonaland, over both of which countries a powerful chief, Lobengula, claimed authority. There were many suitors for Lobengula's favours; but on the 11th of February 1888 he signed a treaty with J. S. Moffat, the assistant commissioner in Bechuanaland, the effect of which was to place all his territory under British protection. Both the Portuguese and the Transvaal Boers were chagrined at this extension of British influence. A number of Boers attempted unsuccessfully to trek into the country, and Portugal opposed her ancient claims to the new treaty. She contended that Lobengula's authority did not extend over Mashonaland, which she claimed as part of the Portuguese province of Sofala.

Rhodesia secured for Great Britain.

Meanwhile preparations were being actively made by British capitalists for the exploitation of the mineral and other resources of Lobengula's territories. Two rival syndicates obtained, or claimed to have obtained, concessions from Lobengula; but in the summer of 1889 Cecil Rhodes succeeded in amalgamating the conflicting interests, and on the 29th of October of that year the British government granted a charter to the British South Africa Company (see RHODESIA). The first article of the charter declared that "the principal field of the operations" of the company "shall be the region of South Africa lying immediately to the north of British Bechuanaland, and to the north and west of the South African Republic, and to the west of the Portuguese dominions." No time was lost in making preparations for effective occupation. On the advice of F. C. Selous it was determined to despatch an expedition to eastern Mashonaland by a new route, which would avoid the Matabele country. This plan was carried out in the summer of 1890, and, thanks to the rapidity with which the column moved and Selous's intimate knowledge of the country, the British flag was, on the 11th of September, hoisted at a spot on the Makubusi river, where the town of Salisbury now stands, and the country taken possession of in the name of Queen Victoria. Disputes with the Portuguese ensued, and there were several frontier incidents which for a time embittered the relations between the two countries.

Anglo-Portuguese disputes in Central Africa.

Meanwhile, north of the Zambezi, the Portuguese were making desperate but futile attempts to repair the neglect of centuries by hastily organized expeditions and the hoisting of flags. In 1888 an attempt to close the Zambezi to British vessels was frustrated by the firmness of Lord Salisbury. In a despatch to the British minister at Lisbon, dated the 25th of June 1888, Lord Salisbury, after brushing aside the Portuguese claims founded on doubtful discoveries three centuries old, stated the British case in a few sentences:—

> It is (he wrote) an undisputed point that the recent discoveries of the English traveller, Livingstone, were followed by organized attempts on the part of English religious and commercial bodies to open up and civilize the districts surrounding and adjoining the lake. Many British settlements have been established, the access to which from the sea is by the rivers Zambesi and Shiré. Her Majesty's government and the British public are much interested in the welfare of these settlements. Portugal does not occupy, and has never occupied, any portion of the lake, nor of the Shiré; she has neither authority nor influence beyond the confluence of the Shiré and Zambesi, where her interior custom-house, now withdrawn, was placed by the terms of the Mozambique Tariff of 1877.

In 1889 it became known to the British government that a considerable Portuguese expedition was being organized under the command of Major Serpa Pinto, for operating in the Zambezi region. In answer to inquiries addressed to the Portuguese government, the foreign minister stated that the object of the expedition was to visit the Portuguese settlements on the upper Zambezi. The British government was, even so late as 1889, averse from declaring a formal protectorate over the Nyasa region; but early in that year H. H. (afterwards Sir Harry) Johnston was sent out to Mozambique as British consul, with instructions to travel in the interior and report on the troubles that had arisen with the Arabs on Lake Nyasa and with the Portuguese. The discovery by D. J. Rankin in 1889 of a navigable mouth of the Zambezi—the Chinde—and the offer by Cecil Rhodes of a subsidy of £10,000 a year from the British South Africa Company, removed some of the objections to a protectorate entertained by the British government; but Johnston's instructions were not to proclaim a protectorate unless circumstances compelled him to take that course. To his surprise Johnston learnt on his arrival at the Zambezi that Major Serpa Pinto's expedition had been suddenly deflected to the north. Hurrying forward, Johnston overtook the Portuguese expedition and warned its leader that any attempt to establish political influence north of the Ruo river would compel him to take steps to protect British interests. On arrival at the Ruo, Major Serpa Pinto returned to Mozambique for instructions, and in his absence Lieutenant Coutinho crossed the river, attacked the Makololo chiefs and sought to obtain possession of the Shiré highlands by a *coup de main*. John Buchanan, the British vice-consul, lost no time in declaring the country under British protection, and his action was subsequently confirmed by Johnston on his return from a treaty-making expedition on Lake Nyasa. On the news of these events reaching Europe the British government addressed an ultimatum to Portugal, as the result of which Lieutenant Coutinho's action was disavowed, and he was ordered to withdraw the Portuguese forces south of the Ruo. After prolonged negotiations, a convention was signed between Great Britain and Portugal on the 20th of August 1890, by which Great Britain obtained a broad belt of territory north of the Zambezi, stretching from Lake Nyasa on the east, the southern end of Tanganyika on the north, and the Kabompo tributary of the Zambezi on the west; while south of the Zambezi Portugal retained the right bank of the river from a point ten miles above Zumbo, and the western boundary of her territory south of the river was made to coincide roughly with the 33rd degree of east longitude. The publication of the convention aroused deep resentment in Portugal, and the government, unable to obtain its ratification by the chamber of deputies, resigned. In October the abandonment of the convention was accepted by the new Portuguese ministry as a *fait accompli*; but on the 14th of November the two governments signed an agreement for a *modus vivendi*, by which they engaged to recognize the territorial limits indicated in the convention of 20th August "in so far that from the date of the present agreement to the termination thereof neither Power will make treaties, accept protectorates, nor exercise any act of sovereignty within the spheres of influence assigned to the other party by the said convention." The breathing-space thus gained enabled feeling in Portugal to cool down, and on the 11th of June 1891 another treaty was signed, the ratifications being exchanged on the 3rd of July. As already stated, this is the main treaty defining the British and Portuguese spheres both south and north of the Zambezi. It contained many other provisions relating to trade and navigation, providing, *inter alia*, a maximum transit duty of 3% on imports and exports crossing Portuguese territories on the east coast to the British sphere, freedom of navigation of the

British and Portuguese spheres defined.

Zambezi and Shiré for the ships of all nations, and stipulations as to the making of railways, roads and telegraphs. The territorial readjustment effected was slightly more favourable to Portugal than that agreed upon by the 1890 convention. Portugal was given both banks of the Zambezi to a point ten miles west of Zumbo—the farthest settlement of the Portuguese on the river. South of the Zambezi the frontier takes a south and then an east course till it reaches the edge of the continental plateau, thence running, roughly, along the line of 33° E. southward to the north-eastern frontier of the Transvaal. Thus by this treaty Portugal was left in the possession of the coast-lands, while Great Britain maintained her right to Matabele and Mashona lands. The boundary between the Portuguese sphere of influence on the west coast and the British sphere of influence north of the Zambezi was only vaguely indicated; but it was to be drawn in such a manner as to leave the Barotse country within the British sphere, Lewanika, the paramount chief of the Marotse, claiming that his territory extended much farther to the west than was admitted by the Portuguese. In August 1903 the question what were the limits of the Barotse kingdom was referred to the arbitration of the king of Italy. By his award, delivered in June 1905, the western limit of the British sphere runs from the northern frontier of German South-West Africa up the Kwando river to 22° E., follows that meridian north to 13° S., then runs due east to 24° E., and then north again to the frontier of the Congo State.

Before the conclusion of the treaty of June 1891 with Portugal, the British government had made certain arrangements for the administration of the large area north of the Zambezi reserved to British influence. On the 1st of February Sir Harry Johnston was appointed imperial commissioner in Nyasaland, and a fortnight later the British South Africa Company intimated a desire to extend its operations north of the Zambezi. Negotiations followed, and the field of operations of the Chartered Company was, on the 2nd of April 1891, extended so as to cover (with the exception of Nyasaland) the whole of the British sphere of influence north of the Zambezi (now known as Northern Rhodesia). On the 14th of May a formal protectorate was declared over Nyasaland, including the Shiré highlands and a belt of territory extending along the whole of the western shore of Lake Nyasa. The name was changed in 1893 to that of the British Central Africa Protectorate, for which designation was substituted in 1907 the more appropriate title of Nyasaland Protectorate.

Germany's share of South Africa.

At the date of the assembling of the Berlin conference the German government had notified that the coast-line on the south-west of the continent, from the Orange river to Cape Frio, had been placed under German protection. On the 13th of April 1885 the German South-West Africa Company was constituted under an order of the imperial cabinet with the rights of state sovereignty, including mining royalties and rights, and a railway and telegraph monopoly. In that and the following years the Germans vigorously pursued the business of treaty-making with the native chiefs in the interior; and when, in July 1890, the British and German governments came to an agreement as to the limits of their respective spheres of influence in various parts of Africa, the boundaries of German South-West Africa were fixed in their present position. By Article III. of this agreement the north bank of the Orange river up to the point of its intersection by the 20th degree of east longitude was made the southern boundary of the German sphere of influence. The eastern boundary followed the 20th degree of east longitude to its intersection by the 22nd parallel of south latitude, then ran eastwards along that parallel to the point of its intersection by the 21st degree of east longitude. From that point it ran northwards along the last-named meridian to the point of its intersection by the 18th parallel of south latitude, thence eastwards along that parallel to the river Chobe or Kwando, and along the main channel of that river to its junction with the Zambezi, where it terminated. The northern frontier marched with the southern boundary of Portuguese West Africa. The object of deflecting the eastern boundary near its northern termination was to give Germany access by her own territory to the upper waters of the Zambezi, and it was declared that this strip of territory was at no part to be less than 20 English miles in width.

Fate of the Dutch Republics.

To complete the survey of the political partition of Africa south of the Zambezi, it is necessary briefly to refer to the events connected with the South African Republic and the Orange Free State. In October 1886 the British government made an agreement with the New Republic, a small community of Boer farmers who had in 1884–85 seized part of Zululand and set up a government of their own, defining the frontier between the New Republic and Zululand; but in July 1888 the New Republic was incorporated in the South African Republic. In a convention of July–August 1890 the British government and the government of the South African Republic confirmed the independence of Swaziland, and on the 8th of November 1893 another convention was signed with the same object; but on the 19th of December 1894 the British government agreed to the South African Republic exercising "all rights and powers of protection, legislation, jurisdiction and administration over Swaziland and the inhabitants thereof," subject to certain conditions and provisions, and to the non-incorporation of Swaziland in the Republic. In the previous September Pondoland had been annexed to Cape Colony; on the 23rd of April 1895 Tongaland was declared by proclamation to be added to the dominions of Queen Victoria, and in December 1897 Zululand and Tongaland, or Amatongaland, were incorporated with the colony of Natal. The history of the events that led up to the Boer War of 1899–1902 cannot be recounted here (see TRANSVAAL, *History*), but in October 1899 the South African Republic and the Orange Free State addressed an ultimatum to Great Britain and invaded Natal and Cape Colony. As a result of the military operations that followed, the Orange Free State was, on the 28th of May 1900, proclaimed by Lord Roberts a British colony under the name "Orange River Colony," and the South African Republic was on the 25th of October 1900 incorporated in the British empire as the "Transvaal Colony." In January 1903 the districts of Vryheid (formerly the New Republic), Utrecht and part of the Wakkerstroom district, a tract of territory comprising in all about 7000 sq. m., were transferred from the Transvaal colony to Natal. In 1907 both the Transvaal and Orange River Colony were granted responsible government.

Anglo-German rivalry in East Africa.

On the east coast the two great rivals were Germany and Great Britain. Germany on the 30th of December 1886, and Great Britain on the 11th of June 1891, formally recognized the Rovuma river as the northern boundary of the Portuguese sphere of influence on that coast; but it was to the north of that river, over the vast area of East or East Central Africa in which the sultan of Zanzibar claimed to exercise suzerainty, that the struggle between the two rival powers was most acute. The independence of the sultans of Zanzibar had been recognized by the governments of Great Britain and France in 1862, and the sultan's authority extended almost uninterruptedly along the coast of the mainland, from Cape Delgado in the south to Warsheik on the north—a stretch of coast more than a thousand miles long—though to the north the sultan's authority was confined to certain ports. In Zanzibar itself, where Sir John Kirk, Livingstone's companion in his second expedition, was British consul-general, British influence was, when the Berlin conference met, practically supreme, though German traders had established themselves on the island and created considerable commercial interests. Away from the coasts the limits and extent of the sultan's authority were far from being clearly defined. The sultan himself claimed that it extended as far as Lake Tanganyika, but the claim did not rest on any very solid ground of effective occupation. The little-known region of the Great Lakes had for some time attracted the attention of the men who were directing the colonial movement in Germany; and, as has been stated, a small band of pioneers actually landed on the mainland opposite Zanzibar in November 1884, and made their first "treaty" with the chief of Mbuzini on the 19th of that month. Pushing up the Wami river the three adventurers reached the Usagara country, and concluded more "treaties," the net result being that when, in the middle of December, Karl Peters returned to the coast he brought back with him documents which were claimed to concede some 60,000 sq. m. of country to the German Colonization Society. Peters hurried back to Berlin, and on the 17th of February 1885 the German emperor issued a "Charter of Protection" by which His Majesty accepted the suzerainty of the newly-acquired territory, and "placed under our Imperial protection the territories in question." The conclusion of these treaties was, on the 6th of March, notified to the British government and to the sultan of Zanzibar. Immediately on receipt of the notification the sultan telegraphed an energetic protest to Berlin, alleging that the places placed under German protection had belonged to the sultanate of Zanzibar from the time of his fathers. The German consul-general refused to admit the sultan's claims, and meanwhile agents of the German society were energetically pursuing the task of treaty-making. The sultan (Seyyid Bargash) despatched a small force to the disputed territory, which was subsequently withdrawn, and in May sent a more imposing expedition under the command of General Lloyd Mathews, the commander-in-chief of the Zanzibar army, to the Kilimanjaro district, in order to anticipate the action of German agents. Meanwhile Lord Granville, then at the British Foreign Office, had taken up an extremely friendly attitude towards the German claims. Before these events the sultan of Zanzibar had, on more than one occasion, practically invited Great Britain to assume a protectorate over his dominions. But the invitations had been declined. Egyptian affairs were, in the year 1885, causing considerable anxiety to the British government, and the fact was not without influence on the attitude of the British foreign secretary. On the 25th of May 1885, in a despatch to the British ambassador at Berlin, Lord Granville instructed Sir E. Malet to communicate the views of the British cabinet to Prince Bismarck:—

Lord Granville's complaisance towards Germany.

> I have to request your Excellency to state that the supposition that Her Majesty's Government have no intention of opposing the German scheme of colonization in the neighbourhood of Zanzibar is absolutely correct. Her Majesty's Government, on the contrary, view with favour these schemes, the realization of which will entail the civilization of large tracts over which hitherto no European influence has been exercised, the co-operation of Germany with Great Britain in the work of the suppression of the slave gangs, and the encouragement of the efforts of the Sultan both in the extinction of the slave trade and in the commercial development of his dominions.

In the same despatch Lord Granville instructed Sir E. Malet to intimate to the German government that some prominent capitalists had originated a plan for a British settlement in the country between the coast and the lakes, which are the sources of the White Nile, "and for its connexion with the coast by a railway." But Her Majesty's government would not accord to these prominent capitalists the support they had called for, "unless they were fully satisfied that every precaution was taken to ensure that it should in no way conflict with the interests of the territory that has been taken under German protectorate," and Prince Bismarck was practically invited to say whether British capitalists were or were not to receive the protection of the British government. The reference in Lord Granville's despatch was to a proposal made by a number of British merchants and others who had long been interested in Zanzibar, and who saw in the rapid advance of Germany a menace to the interests which had hitherto been regarded as paramount in the sultanate. In 1884 H. H. Johnston had concluded treaties with the chief of Taveta in the Kilimanjaro district, and had transferred these treaties to John Hutton of Manchester. Hutton, with Mr (afterwards Sir William) Mackinnon, was one of the founders of what subsequently became the Imperial British East Africa Company. But in the early stages the champions of British interests in East Africa received no support from their own government, while Germany was pushing her advantage with the energy of a recent convert to colonial expansion, and had even, on the coast, opened negotiations with the sultan of Witu, a small territory situated north of the Tana river, whose ruler claimed to be independent of Zanzibar. On the 5th of May 1885 the sultan of Witu executed a deed of sale and cession to a German subject of certain tracts of land on the coast, and later in the same year other treaties or sales of territory were effected, by which German subjects acquired rights on the coast-line claimed by the sultan. Inland, treaties had been concluded on behalf of Germany with the chiefs of the Kilimanjaro region, and an intimation to that effect made to the British government. But before this occurred the German government had succeeded in extracting an acknowledgment of the validity of the earlier treaties from the sultan of Zanzibar. Early in August a powerful German squadron appeared off Zanzibar, and on the 14th of that month the sultan yielded to the inevitable, acknowledged the German protectorate over Usagara and Witu, and undertook to withdraw his soldiers.

Partition of the sultanate of Zanzibar.

Meanwhile negotiations had been opened for the appointment of an international commission, "for the purpose of inquiring into the claims of the sultans of Zanzibar to sovereignty over certain territories on the east coast of Africa, and of ascertaining their precise limits." The governments to be represented were Great Britain, France and Germany, and towards the end of 1885 commissioners were appointed. The commissioners reported on the 9th of June 1886, and assigned to the sultan the islands of Zanzibar, Pemba, Lamu, Mafia and a number of other small islands. On the mainland they recognized as belonging to the sultan a continuous strip of territory, 10 sea-miles in depth, from the south bank of the Minengani river, a stream a short distance south of the Rovuma, to Kipini, at the mouth of the Tana river, some 600 m. in length. North of Kipini the commissioners recognized as belonging to the sultan the stations of Kismayu, Brava, Marka and Mukdishu, with radii landwards of 10 sea-miles, and of Warsheik with a radius of 5 sea-miles. By an exchange of notes in October–November 1886 the governments of Great Britain and Germany accepted the reports of the delimitation commissioners, to which the sultan adhered on the 4th of the following December. But the British and German governments did more than determine what territories were to be assigned to the sultanate of Zanzibar. They agreed to a delimitation of their respective spheres of influence in East Africa. The territory to be affected by this arrangement was to be bounded on the south by the Rovuma river, "and on the north by a line which, starting from the mouth of the Tana river, follows the course of that river or its affluents to the point of intersection of the equator and the 38th degree of east longitude, thence strikes direct to the point of intersection of the 1st degree of north latitude with the 37th degree of east longitude, where the line terminates." The line of demarcation between the British and the German spheres of influence was to start from the mouth of the river Wanga or Umba (which enters the ocean opposite Pemba Island to the north of Zanzibar), and running north-west was to skirt the northern base of the Kilimanjaro range, and thence to be drawn direct to the point on the eastern side of Victoria Nyanza intersected by the 1st degree of south latitude. South of this line German influence was to prevail; north of the line was the British sphere. The sultan's dominions having been thus truncated, Germany associated herself with the recognition of the "independence" of Zanzibar in which France and Great Britain had joined in 1862. The effect of this agreement was to define the spheres of influence of the two countries as far as Victoria Nyanza, but it provided no limit westwards, and left the country north of the Tana river, in which Germany had already acquired some interests near the coast, open for fresh annexations. The conclusion of the agreement immediately stimulated the enterprise both of the German East African Company, to which Peters's earlier treaties had been transferred, and of the British capitalists to whom reference had been made in Lord Granville's despatch. The German East African Company was incorporated by imperial charter in March 1887, and the British capitalists formed themselves into the British East Africa Association, and on the 24th of May 1887 obtained, through the good offices of Sir William Mackinnon, *Formation of British East Africa.*

a concession of the 10-miles strip of coast from the Umba river in the south to Kipini in the north. The British association further sought to extend its rights in the sphere reserved to British influence by making treaties with the native chiefs behind the coast strip, and for this purpose various expeditions were sent into the interior. When they had obtained concessions over the country for some 200 m. inland the associated capitalists applied to the British government for a charter, which was granted on the 3rd of September 1888, and the association became the Imperial British East Africa Company (see British East Africa). The example set by the British company in obtaining a lease of the coast strip between the British sphere of influence and the sea was quickly followed by the German association, which, on the 28th of April 1888, concluded an agreement with the sultan Khalifa, who had succeeded his brother Bargash, by which the association leased the strip of Zanzibar territory between the German sphere and the sea. It was not, however, until August that the German officials took over the administration, and their want of tact and ignorance of native administration almost immediately provoked a rebellion of so serious a character that it was not suppressed until the imperial authorities had taken the matter in hand. Shortly after its suppression the administration was entrusted to an imperial officer, and the sultan's rights on the mainland strip were bought outright by Germany for four millions of marks (£200,000).

Uganda secured by Great Britain.

Events of great importance had been happening, meanwhile, in the country to the west and north of the British sphere of influence. The British company had sent caravans into the interior to survey the country, to make treaties with the native chiefs and to report on the commercial and agricultural possibilities. One of these had gone up the Tana river. But another and a rival expedition was proceeding along the northern bank of this same river. Karl Peters, whose energy cannot be denied, whatever may be thought of his methods, set out with an armed caravan up the Tana on the pretext of leading an expedition to the relief of Emin Pasha, the governor of the equatorial province of the Egyptian Sudan, then reported to be hemmed in by the dervishes at Wadelai. His expedition was not sanctioned by the German government, and the British naval commander had orders to prevent his landing. But Peters succeeded in evading the British vessels and proceeded up the river, planting German flags and fighting the natives who opposed his progress. Early in 1890 he reached Kavirondo, and there found letters from Mwanga, king of Uganda, addressed to F. J. Jackson, the leader of an expedition sent out by the British East Africa Company, imploring the company's representative to come to his assistance and offering to accept the British flag. To previous letters, less plainly couched, from the king, Jackson had returned the answer that his instructions were not to enter Uganda, but that he would do so in case of need. The letters that fell into Peters's hands were in reply to those from Jackson. Peters did not hesitate to open the letters, and on reading them he at once proceeded to Uganda, where, with the assistance of the French Roman Catholic priests, he succeeded in inducing Mwanga to sign a loosely worded treaty intended to place him under German protection. On hearing of this Jackson at once set out for Uganda, but Peters did not wait for his arrival, leaving for the south of Victoria Nyanza some days before Jackson arrived at Mengo, Mwanga's capital. As Mwanga would not agree to Jackson's proposals, Jackson returned to the coast, leaving a representative at Mengo to protect the company's interests. Captain (afterwards Sir) F. D. Lugard, who had recently entered the company's employment, was at once ordered to proceed to Uganda. But in the meantime an event of great importance had taken place, the conclusion of the agreement between Great Britain and Germany with reference to their different spheres of influence in various parts of Africa.

Limits of German East Africa defined.

The Anglo-German agreement of the 1st of July 1890 has already been referred to and its importance insisted upon. Here we have to deal with the provisions in reference to East Africa. In return for the cession of Heligoland, Lord Salisbury obtained from Germany the recognition of a British protectorate over the dominions of the sultan of Zanzibar, including the islands of Zanzibar and Pemba, but excluding the strip leased to Germany, which was subsequently ceded absolutely to Germany. Germany further agreed to withdraw the protectorate declared over Witu and the adjoining coast up to Kismayu in favour of Great Britain, and to recognize as within the British sphere of influence the vast area bounded, on the south by the frontier line laid down in the agreement of 1886, which was to be extended along the first parallel of south latitude across Victoria Nyanza to the frontiers of the Congo Free State, on the west by the Congo Free State and the western watershed of the Nile, and on the north by a line commencing on the coast at the north bank of the mouth of the river Juba, then ascending that bank of the river until it reached the territory at that time regarded as reserved to the influence of Italy[1] in Gallaland and Abyssinia, when it followed the frontier of the Italian sphere to the confines of Egypt. To the south-west of the German sphere in East Africa the boundary was formed by the eastern and northern shore of Lake Nyasa, and round the western shore to the mouth of the Songwe river, from which point it crossed the Nyasa-Tanganyika plateau to the southern end of the last-named lake, leaving the Stevenson Road on the British side of the boundary. The effect of this treaty was to remove all serious causes of dispute about territory between Germany and Great Britain in East Africa. It rendered quite valueless Peters's treaty with Mwanga and his promenade along the Tana; it freed Great Britain from any fear of German competition to the northwards, and recognized that her influence extended to the western limits of the Nile valley. But, on the other hand, Great Britain had to relinquish the ambition of connecting her sphere of influence in the Nile valley with her possessions in Central and South Africa. On this point Germany was quite obdurate; and, as already stated, an attempt subsequently made (May 1894) to secure this object by the lease of a strip of territory from the Congo Free State was frustrated by German opposition.

Uganda having thus been assigned to the British sphere of influence by the only European power in a position to contest its possession with her, the subsequent history of that region, and of the country between the Victoria Nyanza and the coast, must be traced in the articles on British East Africa and Uganda, but it may be well briefly to record here the following facts:—The Imperial British East Africa Company, finding the burden of administration too heavy for its financial resources, and not receiving the assistance it felt itself entitled to receive from the imperial authorities, intimated that it would be compelled to withdraw at the end of the year 1892. Funds were raised to enable the company to continue its administration until the end of March 1893, and a strong public protest against evacuation compelled the government to determine in favour of the retention of the country. In January 1893 Sir Gerald Portal left the coast as a special commissioner to inquire into the "best means of dealing with the country, whether through Zanzibar or otherwise." On the 31st of March the union jack was raised, and on the 29th of May a fresh treaty was concluded with King Mwanga placing his country under British protection. A formal protectorate was declared over Uganda proper on the 19th of June 1894, which was subsequently extended so as to include the countries westwards towards the Congo Free State, eastwards to the British East Africa protectorate and Abyssinia, and northwards to the Anglo-Egyptian Sudan. The British East Africa protectorate was constituted in June 1895, when the Imperial British East Africa Company relinquished all its rights in exchange for a money payment, and the administration was assumed by the imperial authorities. On the 1st of April 1902 the eastern province of the Uganda protectorate was transferred to the British East Africa protectorate, which thus secured control of the whole length of the so-called Uganda railway, and at the same time obtained access to the Victoria Nyanza.

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[1] At this period negotiations between Great Britain and Italy had begun but were not concluded.

Italy in East Africa.

Early in the 'eighties, as already seen, Italy had obtained her first formal footing on the African coast at the Bay of Assab (Aussa) on the Red Sea. In 1885 the troubles in which Egypt found herself involved compelled the khedive and his advisers to loosen their hold on the Red Sea littoral, and, with the tacit approval of Great Britain, Italy took possession of Massawa and other ports on that coast. By 1888 Italian influence had been extended from Ras Kasar on the north to the northern frontier of the French colony of Obok on the south, a distance of some 650 m. The interior limits of Italian influence were but ill defined, and the negus Johannes (King John) of Abyssinia viewed with anything but a favourable eye the approach of the Italians towards the Abyssinian highlands. In January 1887 an Italian force was almost annihilated at Dogali, but the check only served to spur on the Italian government to fresh efforts. The Italians occupied Keren and Asmara in the highlands, and eventually, in May 1889, concluded a treaty of peace and friendship with the negus Menelek, who had seized the throne on the death of Johannes, killed in battle with the dervishes in March of the same year. This agreement, known as the treaty of Uccialli, settled the frontiers between Abyssinia and the Italian sphere, and contained the following article:—

> XVII. His Majesty the King of Kings of Ethiopia consents to avail himself of the Italian government for any negotiations which he may enter into with the other powers or governments.

In Italy and by other European governments this article was generally regarded as establishing an Italian protectorate over Abyssinia; but this interpretation was never accepted by the emperor Menelek, and at no time did Italy succeed in establishing any very effective control over Abyssinian affairs. North of the Italian coast sphere the Red Sea littoral was still under Egyptian rule, while immediately to the south a small stretch of coast on the Gulf of Tajura constituted the sole French possession on the East African mainland (see SOMALILAND). Moreover, when Egyptian claims to the Somali coast were withdrawn, Great Britain took the opportunity to establish her influence on the northern Somali coast, opposite Aden. Between the 1st of May 1884 and the 15th of March 1886 ten treaties were concluded, placing under British influence the northern Somali coast from Ras Jibuti on the west to Bandar Ziada on the east. In the meantime Italy, not content with her acquisitions on the Red Sea, had been concluding treaties with the Somali chiefs on the east coast. The first treaty was made with the sultan of Obbia on the 8th of February 1889. Later in the same year the British East Africa Company transferred to Italy—the transference being subsequently approved by the sultan of Zanzibar—the ports of Brava, Marka, Mukdishu and Warsheik, leased from Zanzibar. On the 24th of March 1891 an agreement between Italy and Great Britain fixed the northern bank of the Juba up to latitude 6° N. as the southern boundary of Italian influence in Somaliland, the boundary being provisionally prolonged along lines of latitude and longitude to the intersection of the Blue Nile with 35° E. longitude. On the 15th of April 1891 a further agreement fixed the northern limit of the Italian sphere from Ras Kasar on the Red Sea to the point on the Blue Nile just mentioned. By this agreement Italy was to have the right temporarily to occupy Kassala, which was left in the Anglo-Egyptian sphere, in trust for Egypt—a right of which she availed herself in 1894. To complete the work of delimitation the British and Italian governments, on the 5th of May 1894, fixed the boundary of the British sphere of influence in Somaliland from the Anglo-French boundary, which had been settled in February 1888.

The independence of Abyssinia recognized.

But while Great Britain was thus lending her sanction to Italy's ambitious schemes, the Abyssinian emperor was becoming more and more incensed at Italy's pretensions to exercise a protectorate over Ethiopia. In 1893 Menelek denounced the treaty of Uccialli, and eventually, in a great battle, fought at Adowa on the 1st of March 1896, the Italians were disastrously defeated. By the subsequent treaty of Adis Ababa, concluded on the 26th of October 1896, the whole of the country to the south of the Mareb, Belesa and Muna rivers was restored to Abyssinia, and Italy acknowledged the absolute independence of Abyssinia. The effect of this was practically to destroy the value of the Anglo-Italian agreement as to the boundaries to the south and west of Abyssinia; and negotiations were afterwards set on foot between the emperor Menelek and his European neighbours with the object of determining the Abyssinian frontiers. Italian Somaliland, bordering on the south-eastern frontier of Abyssinia, became limited to a belt of territory with a depth inland from the Indian Ocean of from 180 to 250 m. The negotiations concerning the frontier lasted until 1908, being protracted over the question as to the possession of Lugh, a town on the Juba, which eventually fell to Italy. After the battle of Adowa the Italian government handed over the administration of the southern part of the country to the Benadir Company, but in January 1905 the government resumed control and at the same time transformed the leasehold rights it held from the sultan of Zanzibar into sovereign rights by the payment to the sultan of £144,000. To facilitate her communications with the interior, Italy also secured from the British government the lease of a small area of land immediately to the north of Kismayu. In British Somaliland the frontier fixed by agreement with Italy in 1894 was modified, in so far as it marched with Abyssinian territory, by an agreement which Sir Rennell Rodd concluded with the emperor Menelek in 1897. The effect of this agreement was to reduce the area of British Somaliland from 75,000 to 68,000 sq. m. In the same year France concluded an agreement with the emperor, which is known to have fixed the frontier of the French Somali Coast protectorate at a distance of 90 kilometres (56 m.) from the coast. The determination of the northern, western and southern limits of Abyssinia proved a more difficult matter. A treaty of July 1900 followed by an agreement of November 1901 defined the boundaries of Eritrea on the side of Abyssinia and the Sudan respectively. In certain details the boundaries thus laid down were modified by an Anglo-Italian-Abyssinian treaty signed at Adis Ababa on the 15th of May 1902. On the same day another treaty was signed at the Abyssinian capital by Sir John Harrington, the British minister plenipotentiary, and the emperor Menelek, whereby the western, or Sudan-Abyssinian, frontier was defined as far south as the intersection of 6° N. and 35° E. Within the British sphere were left the Atbara up to Gallabat, the Blue Nile up to Famaka and the Sobat up to the junction of the Baro and Pibor. While not satisfying Abyssinian claims to their full extent, the frontier laid down was on the whole more favourable to Abyssinia than was the line fixed in the Anglo-Italian agreement of 1891. On the other hand, Menelek gave important economic guarantees and concessions to the Sudan government.

The Anglo-French agreements of April 1904.

In Egypt the result of the abolition of the Dual Control was to make British influence virtually predominant, though theoretically Turkey remained the suzerain power; and after the reconquest of the Sudan by the Anglo-Egyptian army a convention between the British and Egyptian governments was signed at Cairo on the 19th of January 1899, which, *inter alia*, provided for the joint use of the British and Egyptian flags in the territories south of the 22nd parallel of north latitude. From the international point of view the British position in Egypt was strengthened by the Anglo-French declaration of the 8th of April 1904. For some time previously there had been a movement on both sides of the Channel in favour of the settlement of a number of important questions in which British and French interests were involved. The movement was no doubt strengthened by the desire to reduce to their least dimensions the possible causes of trouble between the two countries at a time when the outbreak of hostilities between Russia (the ally of France) and Japan (the ally of Great Britain) rendered the European situation peculiarly delicate. On the 8th of April

1904 there was signed in London by the British foreign secretary, the marquess of Lansdowne, and the French ambassador, M. Paul Cambon, a series of agreements relating to several parts of the globe. Here we are concerned only with the joint declaration respecting Egypt and Morocco and a convention relating, in part, to British and French frontiers in West Africa. The latter we shall have occasion to refer to later. The former, notwithstanding the declarations embodied in it that there was "no intention of altering the political status" either of Egypt or of Morocco, cannot be ignored in any account of the partition in Africa. With regard to Egypt the French government declared "that they will not obstruct the action of Great Britain in that country by asking that a limit of time be fixed for the British occupation or in any other manner." France also assented—as did subsequently the other powers interested—to a khedivial decree simplifying the international control exercised by the Caisse de la Dette over the finances of Egypt.

France's privileged position in Morocco.

In order to appreciate aright that portion of the declaration relating to Morocco it is necessary to say a few words about the course of French policy in North-West Africa. In Tunisia the work of strengthening the protectorate established in 1881 had gone steadily forward; but it was in Algeria that the extension of French influence had been most marked. The movement of expansion southwards was inevitable. With the progress of exploration it became increasingly evident that the Sahara constituted no insurmountable barrier between the French possessions in North and West Central Africa. But France had not only the hope of placing Algeria in touch with the Sudan to spur her forward. To consolidate her position in North-West Africa she desired to make French influence supreme in Morocco. The relations between the two countries did not favour the realization of that ambition. The advance southwards of the French forces of occupation evoked loud protests from the Moorish government, particularly with regard to the occupation in 1900–1901 of the Tuat Oases. Under the Franco-Moorish treaty of 1845 the frontier between Algeria and Morocco was defined from the Mediterranean coast as far south as the pass of Teniet el Sassi, in about 34° N.; beyond that came a zone in which no frontier was defined, but in which the tribes and desert villages (*ksurs*) belonging to the respective spheres of influence were named; while south of the desert villages the treaty stated that in view of the character of the country "the delimitation of it would be superfluous." Though the frontier was thus left undefined, the sultan maintained that in her advance southwards France had trespassed on territories that unmistakably belonged to Morocco. After some negotiation, however, a protocol was signed in Paris on the 20th of July 1901, and commissioners appointed to devise measures for the co-operation of the French and Moorish authorities in the maintenance of peaceful conditions in the frontier region. It was reported that in April 1902 the commissioners signed an agreement whereby the Sharifan government undertook to consolidate its authority on the Moorish side of the frontier as far south as Figig. The agreement continued: "*Le Gouvernement français, en raison de son voisinage, lui prêtera son appui, en cas de besoin. Le Gouvernement français établira son autorité et la paix dans les régions du Sahara, et le Gouvernement marocain, son voisin, lui aidera de tout son pouvoir.*" Meanwhile in the northern districts of Morocco the conditions of unrest under the rule of the young sultan, Abd el Aziz IV., were attracting an increasing amount of attention in Europe and were calling forth demands for their suppression. It was in these circumstances that in the Anglo-French declaration of April 1904 the British government recognized "that it appertains to France, more particularly as a power whose dominions are conterminous for a great distance with those of Morocco, to preserve order in that country, and to provide assistance for the purpose of all administrative, economic, financial and military reforms which it may require." Both parties to the declaration, "inspired by their feeling of sincere friendship for Spain, take into special consideration the interests which that country derives from her geographical position and from her territorial possessions on the Moorish coast of the Mediterranean. In regard to these interests the French government will come to an understanding with the Spanish government." The understanding thus foreshadowed was reached later in the same year, Spain securing a sphere of interest on the Mediterranean coast. In pursuance of the policy marked out in the Anglo-French declaration, France was seeking to strengthen her influence in Morocco when in 1905 the attitude of Germany seriously affected her position. On the 8th of July France secured from the German government formal "recognition of the situation created for France in Morocco by the contiguity of a vast extent of territory of Algeria and the Sharifan empire, and by the special relations resulting therefrom between the two adjacent countries, as well as by the special interest for France, due to this fact, that order should reign in the Sharifan Empire." Finally, in January–April 1906, a conference of the powers was held at Algeciras to devise, by invitation of the sultan, a scheme of reforms to be introduced into Morocco (*q.v.*). French capital was allotted a larger share than that of any other power in the Moorish state bank which it was decided to institute, and French and Spanish officers were entrusted with the organization of a police force for the maintenance of order in the principal coast towns. The new régime had not been fully inaugurated, however, when a series of outrages led, in 1907, to the military occupation by France of Udja, a town near the Algerian frontier, and of the port of Casablanca on the Atlantic coast of Morocco.

It only remains to be noted, in connexion with the story of French activity in North-West Africa, that with such energy was the penetration of the Sahara pursued that in April 1904 flying columns from Insalah and Timbuktu met by arrangement in mid-desert, and in the following year it was deemed advisable to indicate on the maps the boundary between the Algerian and French West African territories.

Italy's interest in Tripoli.

Brief reference must be made to the position of Tripoli. While Egypt was brought under British control and Tunisia became a French protectorate, Tripoli remained a province of the Turkish empire with undefined frontiers in the hinterland, a state of affairs which more than once threatened to lead to trouble with France during the expansion of the latter's influence in the Sahara. As already stated, Italy early gave evidence that it was her ambition to succeed to the province, and, not only by the sultan of Turkey but in Italy also, the Anglo-French declaration of March 1899, respecting the limits of the British and French spheres of influence in north Central Africa, was viewed with some concern. By means of a series of public utterances on the part of French and Italian statesmen in the winter 1901–1902 it was made known that the two powers had come to an understanding with regard to their interests in North Africa, and in May 1902 Signor Prinetti, then Italian minister for foreign affairs, speaking in parliament in reply to an interpellation on the subject of Tripoli, declared that if "the *status quo* in the Mediterranean were ever disturbed, Italy would be sure of finding no one to bar the way to her legitimate aspirations."

Spanish colonies.

At the opening of the Berlin conference Spain had established no formal claim to any part of the coast to the south of Morocco; but while the conference was sitting, on the 9th of January 1885, the Spanish government intimated that in view of the importance of the Spanish settlements on the Rio de Oro, at Angra de Cintra, and at Western Bay (Cape Blanco), and of the documents signed with the independent tribes on that coast, the king of Spain had taken under his protection "the territories of the western coast of Africa comprised between the fore-mentioned Western Bay and Cape Bojador." The interior limits of the Spanish sphere were defined by an agreement concluded in 1900 with France. By this document some 70,000 sq. m. of the western Sahara were recognized as Spanish.

The same agreement settled a long-standing dispute between Spain and France as to the ownership of the district around the Muni river to be south of Cameroon, Spain securing a block of territory with a coast-line from the Campo river on the north to the Muni river on the south. The northern frontier is formed by the German Cameroon colony, the eastern by 11° 20′ E., and the southern by the first parallel of north latitude to its point of intersection with the Muni river.

Division of the Guinea coast.

Apart from this small block of Spanish territory south of Cameroon, the stretch of coast between Cape Blanco and the mouth of the Congo is partitioned among four European powers—Great Britain, France, Germany and Portugal—and the negro republic of Liberia. Following the coast southwards from Cape Blanco is first the French colony of Senegal, which is indented, along the Gambia river, by the small British colony of that name, and then the comparatively small territory of Portuguese Guinea, all that remains on this coast to represent Portugal's share in the scramble in a region where she once played so conspicuous a part. To the south of Portuguese Guinea is the French Guinea colony, and still going south and east are the British colony of Sierra Leone, the republic of Liberia, the French colony of the Ivory coast, the British Gold Coast, German Togoland, French Dahomey, the British colony (formerly known as the Lagos colony) and protectorate of Southern Nigeria, the German colony of Cameroon, the Spanish settlements on the Muni river, the French Congo colony, and the small Portuguese enclave north of the Congo to which reference has already been made, which is administratively part of the Angola colony. When the General Act of the Berlin conference was signed the whole of this coast-line had not been formally claimed; but no time was lost by the powers interested in notifying claims to the unappropriated sections, and the conflicting claims put forward necessitated frequent adjustments by international agreements. By a Franco-Portuguese agreement of the 12th of May 1886 the limits of Portuguese Guinea—surrounded landwards by French territory—were defined, and by agreements with Great Britain in 1885 and France in 1892 and 1907 the Liberian republic was confined to an area of about 43,000 sq. m.

The real struggle in West Africa was between France and Great Britain, and France played the dominant part, the exhaustion of Portugal, the apathy of the British government and the late appearance of Germany in the field being all elements that favoured the success of French policy. Before tracing the steps in the historic contest between France and Great Britain it is necessary, however, to deal briefly with the part played by Germany. She naturally could not be disposed of by the chief rivals as easily as were Portugal and Liberia. It will be remembered that Dr Nachtigal, while the proposals for the Berlin conference were under discussion, had planted the German flag on the coast of Togo and in Cameroon in the month of July 1884. In Cameroon Germany found herself with Great Britain for a neighbour to the north, and with France as her southern neighbour on the Gabun river. The utmost activity was displayed in making treaties with native chiefs, and in securing as wide a range of coast for German enterprise as was possible. After various provisional agreements had been concluded between Great Britain and Germany, a "provisional line of demarcation" was adopted in the famous agreement of the 1st of July 1890, starting from the head of the Rio del Rey creek and going to the point, about 9° 8′ E., marked "rapids" on the British Admiralty chart. By a further agreement of the 14th of April 1893, the right bank of the Rio del Rey was made the boundary between the Oil Rivers Protectorate (now Southern Nigeria) and Cameroon. In the following November (1893) the boundary was continued from the "rapids" before mentioned, on the Calabar or Cross river, in a straight line towards the centre of the town of Yola, on the Benue river. Yola itself, with a radius of some 3 m., was left in the British sphere, and the German boundary followed the circle eastwards from the point of intersection as it neared Yola until it met the Benue river. From that point it crossed the river to the intersection of the 13th degree of longitude with the 10th degree of north latitude, and then made direct for a point on the southern shore of Lake Chad "situated 35 minutes east of the meridian of Kuka." By this agreement the British government withdrew from a considerable section of the upper waters of the Benue with which the Royal Niger Company had entered into relations. The limit of Germany's possible extension eastwards was fixed at the basin of the river Shari, and Darfur, Kordofan and the Bahr-el-Ghazal were to be excluded from her sphere of influence. The object of Great Britain in making the sacrifice she did was two-fold. By satisfying Germany's desire for a part of Lake Chad a check was put on French designs on the Benue region, while by recognizing the central Sudan (Wadai, &c.) in the German sphere, a barrier was interposed to the advance of France from the Congo to the Nile. This last object was not attained, inasmuch as Germany in coming to terms with France as to the southern and eastern limits of Cameroon abandoned her claims to the central Sudan. She had already, on the 24th of December 1885, signed a protocol with France fixing her southern frontier, where it was coterminous with the French Congo colony. But to the east German explorers were crossing the track of French explorers from the northern bank of the Ubangi, and the need for an agreement was obvious. Accordingly, on the 4th of February 1894, a protocol—which, some weeks later, was confirmed by a convention— was signed at Berlin, by which France accepted the presence of Germany on Lake Chad as a *fait accompli* and effected the best bargain she could by making the left bank of the Shari river, from its outlet into Lake Chad to the 10th parallel of north latitude, the eastern limit of German extension. From this point the boundary line went due west some 230 m., then turned south, and with various indentations joined the south-eastern frontier, which had been slightly extended so as to give Germany access to the Sanga river— a tributary of the Congo. Thus, early in 1894, the German Cameroon colony had reached fairly definite limits. In 1908 another convention, modifying the frontier, gave Germany a larger share of the Sanga, while France, among other advantages, gained the left bank of the Shari to 10° 40′ N.

Germany in west Central Africa.

Exclusion of Germany from the Niger.

The German Togoland settlements occupy a narrow strip of the Guinea coast, some 35 m. only in length, wedged in between the British Gold Coast and French Dahomey. At first France was inclined to dispute Germany's claims to Little Popo and Porto Seguro; but in December 1885 the French government acknowledged the German protectorate over these places, and the boundary between French and German territory, which runs north from the coast to the 11th degree of latitude, was laid down by the Franco-German convention of the 12th of July 1897. The fixing of the 11th parallel as the northern boundary of German expansion towards the interior was not accomplished without some sacrifice of German ambitions. Having secured an opening on Lake Chad for her Cameroon colony, Germany was anxious to obtain a footing on the middle Niger for Togoland. German expeditions reached Gando, one of the tributary states of the Sokoto empire on the middle Niger, and, notwithstanding the existence of prior treaties with Great Britain, sought to conclude agreements with the sultan of that country. But this German ambition conflicted both with the British and the French designs in West Africa, and eventually Germany had to be content with the 11th parallel as her northern frontier. On the west the Togoland frontier on the coast was fixed in July 1886 by British and German commissioners at 1° 10′ E. longitude, and its extension towards the interior laid down for a short distance. A curious feature in the history of its prolongation was the establishment in 1888 of a neutral zone wherein neither power was to seek to acquire protectorates nor exclusive influence. It was not until November 1899 that, as part of the Samoa settlement, this neutral zone was partitioned between the two powers and the frontier extended to the 11th parallel.

Anglo-French rivalry in West Africa.

The story of the struggle between France and Great Britain in West Africa may roughly be divided into two sections, the first dealing with the Coast colonies, the second dealing with the struggle for the middle Niger and Lake Chad. As regards the Coast colonies, France was wholly successful in her design of isolating all Great Britain's separate possessions in that region, and of securing for herself undisputed possession of the upper Niger and of the countries lying within the great bend of that river.

When the British government awoke to the consciousness of what was at stake France had obtained too great a start. French governors of the Senegal had succeeded, before the Berlin conference, in establishing forts on the upper Niger, and the advantage thus gained was steadily pursued. Every winter season French posts were pushed farther and farther along the river, or in the vast regions watered by the southern tributaries of the Senegal and Niger rivers. This ceaseless activity met with its reward. Great Britain found herself compelled to acknowledge accomplished facts and to conclude agreements with France, which left her colonies mere coast patches, with a very limited extension towards the interior. On the 10th of August 1889 an agreement was signed by which the Gambia colony and protectorate was confined to a narrow strip of territory on both banks of the river for about 200 m. from the sea. In June 1882 and in August 1889 provisional agreements were made with France fixing the western and northern limits of Sierra Leone, and commissioners were appointed to trace the line of demarcation agreed upon by the two governments. But the commissioners failed to agree, and on the 21st of January 1895 a fresh agreement was made, the boundary being subsequently traced by a mixed commission. Sierra Leone, as now definitely constituted, has a coast-line of about 180 m. and a maximum extension towards the interior of some 200 m.

At the date of the Berlin conference the present colonies of Southern Nigeria and the Gold Coast constituted a single colony under the title of the Gold Coast colony, but on the 13th of January 1886 the territory comprised under that title was erected into two separate colonies—Lagos and the Gold Coast (the name of the former being changed in February 1906 to the colony of Southern Nigeria). The coast limits of the new Gold Coast colony were declared to extend from 5° W. to 2° E., but these limits were subsequently curtailed by agreements with France and Germany. The arrangements that fixed the eastern frontier of the Gold Coast colony and its hinterland have already been stated in connexion with German Togoland. On the western frontier it marches with the French colony of the Ivory Coast, and in July 1893, after an unsuccessful attempt to achieve the same end by an agreement concluded in 1889, the frontier was defined from the neighbourhood of the Tano lagoon and river of the same name, to the 9th degree of north latitude. In August 1896, following the destruction of the Ashanti power and the deportation of King Prempeh, as a result of the second Ashanti campaign, a British protectorate was declared over the whole of the Ashanti territories and a resident was installed at Kumasi. But no northern limit had been fixed by the 1893 agreement beyond the 9th parallel, and the countries to the north—Gurunsi (Grusi), Mossi and Gurma—were entered from all sides by rival British, French and German expeditions. The conflicting claims established by these rival expeditions may, however, best be considered in connexion with the struggle for supremacy on the middle Niger and in the Chad region, to which it is now necessary to turn.

A few days before the meeting of the Berlin conference Sir George Goldie had succeeded in buying up all the French interests on the lower Niger. The British company's influence had at that date been extended by treaties with the native chiefs up the main Niger stream to its junction with the Benue, and some distance along this latter river. But the great Fula states of the central Sudan were still outside European influence, and this fact did not escape attention in Germany. German merchants had been settled for some years on the coast, and one of them, E. R. Flegel, had displayed great interest in, and activity on, the river. He recognized that in the densely populated states of the middle Niger, Sokoto and Gando, and in Bornu to the west of Lake Chad, there was a magnificent field for Germany's new-born colonizing zeal. The German African Company[1] and the German Colonial Society listened eagerly to Flegel's proposals, and in April 1885 he left Berlin on a mission to the Fula states of Sokoto and Gando. But it was impossible to keep his intentions entirely secret, and the (British) National African Company had no desire to see the French rivals, whom they had with so much difficulty dislodged from the river, replaced by the even more troublesome German. Accordingly Joseph Thomson, the young Scottish explorer, was sent out to the Niger, and had the satisfaction of concluding on the 1st of June 1885 a treaty with "Umoru, King of the Mussulmans of the Sudan and Sultan of Sokoto," which practically secured the whole of the trading rights and the control of the sultan's foreign relations to the British company. Thomson concluded a similar treaty with the sultan of Gando, so as to provide against the possibility of its being alleged that Gando was an independent state and not subject to the suzerainty of the sultan of Sokoto. As Thomson descended the river with his treaties, he met Flegel going up the river, with bundles of German flags and presents for the chiefs. The German government continued its efforts to secure a footing on the lower Niger until the fall of Prince Bismarck from power in March 1890, when opposition ceased, and on the failure of the half-hearted attempt made later to establish relations with Gando from Togoland, Germany dropped out of the competition for the western Sudan and left the field to France and Great Britain. After its first great success the National African Company renewed its efforts to obtain a charter from the British government, and on the 10th of July 1886 the charter was granted, and the company became "The Royal Niger Company, chartered and limited." In June of the previous year a British protectorate had been proclaimed over the whole of the coast from the Rio del Rey to the Lagos frontier, and as already stated, on the 13th of January 1886 the Lagos settlements had been separated from the Gold Coast and erected into a separate colony. It may be convenient to state here that the western boundary of Lagos with French territory (Dahomey) was determined in the Anglo-French agreement of the 10th of August 1889, "as far as the 9th degree of north latitude, where it shall stop." Thus both in the Gold Coast hinterland and in the Lagos hinterland a door was left wide open to the north of the 9th parallel.

The Niger Company granted a charter.

Notwithstanding her strenuous efforts, France, in her advance down the Niger from Senegal, did not succeed in reaching Sego on the upper Niger, a considerable distance above Timbuktu, until the winter of 1890–1891, and the rapid advance of British influence up the river raised serious fears lest the Royal Niger Company should reach Timbuktu before France could forestall her. It was, no doubt, this consideration that induced the French government to consent to the insertion in the agreement of the 5th of August 1890, by which Great Britain recognized France's protectorate over Madagascar, of the following article:

> The Government of Her Britannic Majesty recognizes the sphere of influence of France to the south of her Mediterranean possessions up to a line from Say on the Niger to Barrua on Lake Chad, drawn in such a manner as to comprise in the sphere of action of the Niger Company all that fairly belongs to the kingdom of Sokoto; the line to be determined by the commissioners to be appointed.

The commissioners never were in fact appointed, and the proper meaning to be attached to this article subsequently became a subject of bitter controversy between the two countries. An examination of the map of West Africa will show what possibilities of trouble were left open at the end of 1890 by the various agreements concluded up to that date. From Say on the Niger to where the Lagos frontier came to an abrupt stop in 9° N. there was no boundary line between the French and British spheres of influence. To the north of the Gold Coast and of the French Ivory Coast colony the way was equally open to Great Britain and to France, while the vagueness of the Say-Barrua line left an opening of which France was quick to avail herself. Captain P. L. Monteil, who was despatched by the French government to West Africa in 1890, immediately after the conclusion of the August agreement, did not hesitate to pass well to the south of the Say-Barrua line, and to attempt to conclude treaties with chiefs who were, beyond all question, within the British sphere. Still farther south, on the Benue river, the two expeditions of Lieutenant Mizon—in 1890 and 1892—failed to do any real harm to British interests. In 1892 an event happened which had an important bearing on the future course of the dispute.

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[1] This association, formed in 1878 by a union of associations primarily intended for the exploration of Africa, ceased to exist in 1891.

French advance to Timbuktu.

After a troublesome war with Behanzin, king of the native state of Dahomey, France annexed some portion of Dahomeyan territory on the coast, and declared a protectorate over the rest of the kingdom. Thus was removed the barrier which had up to that time prevented France from pushing her way Nigerwards from her possessions on the Slave Coast, as well as from the upper Niger and the Ivory Coast. Henceforth her progress from all these directions was rapid, and in particular Timbuktu was occupied in the last days of 1893.

In 1894 it appears to have been suddenly realized in France that, for the development of the vast regions which she was placing under her protection in West Africa, it was extremely desirable that she should obtain free access to the navigable portions of the Niger, if not on the left bank, from which she was excluded by the Say-Barrua agreement, then on the right bank, where the frontier had still to be fixed by international agreement. In the neighbourhood of Bussa there is a long stretch of the river so impeded by rapids that navigation is practically impossible, except in small boats and at considerable risk. Below these rapids France had no foothold on the river, both banks from Bussa to the sea being within the British sphere. In 1890 the Royal Niger Company had concluded a treaty with the emir and chiefs of Bussa (or Borgu); but the French declared that the real paramount chief of Borgu was not the king of Bussa, but the king of Nikki, and three expeditions were despatched in hot haste to Nikki to take the king under French protection. Sir George Goldie, however, was not to be baffled. While maintaining the validity of the earlier treaty with Bussa, he despatched Captain (afterwards General Sir) F. D. Lugard to Nikki, and Lugard was successful in distancing all his French competitors by several days, reaching Nikki on the 5th of November 1894 and concluding a treaty with the king and chiefs. The French expeditions, which were in great strength, did not hesitate on their arrival to compel the king to execute fresh treaties with France, and with these in their possession they returned to Dahomey. Shortly afterwards a fresh act of aggression was committed. On the 13th of February 1895 a French officer, Commandant Toutée, arrived on the right bank of the Niger opposite Bajibo and built a fort. His presence there was notified to the Royal Niger Company, who protested to the British government against this invasion of their territory. Lord Rosebery, who was then foreign minister, at once made inquiries in Paris, and received the assurance that Commandant Toutée was "a private traveller." Eventually Commandant Toutée was ordered to withdraw, and the fort was occupied by the Royal Niger Company's troops. Commandant Toutée subsequently published the official instructions from the French government under which he had acted. It was thought that the recognition of the British claims, involved in the withdrawal of Commandant Toutée, had marked the final abandonment by France of the attempt to establish herself on the navigable portions of the Niger below Bussa, but in 1897 the attempt was renewed in the most determined manner. In February of that year a French force suddenly occupied Bussa, and this act was quickly followed by the occupation of Gomba and Illo higher up the river. In November 1897 Nikki was occupied. The situation on the Niger had so obviously been outgrowing the capacity of a chartered company that for some time before these occurrences the assumption of responsibility for the whole of the Niger region by the imperial authorities had been practically decided on; and early in 1898 Lugard was sent out to the Niger with a number of imperial officers to raise a local force in preparation for the contemplated change.

The Franco-British settlement of 1898.

The advance of the French forces from the south and west was the signal for an advance of British troops from the Niger, from Lagos and from the Gold Coast protectorate. The situation thus created was extremely serious. The British and French flags were flying in close proximity, in some cases in the same village. Meanwhile the diplomatists were busy in London and in Paris, and in the latter capital a commission sat for many months to adjust the conflicting claims. Fortunately, by the tact and forbearance of the officers on both sides, no local incident occurred to precipitate a collision, and on the 14th of June 1898 a convention was signed by Sir Edmund Monson and M. G. Hanotaux which practically completed the partition of this part of the continent.

The settlement effected was in the nature of a compromise. France withdrew from Bussa, Gomba and Illo, the frontier line west of the Niger being drawn from the 9th parallel to a point ten miles, as the crow flies, above Giri, the port of Illo. France was thus shut out from the navigable portion of the middle and lower Niger; but for purely commercial purposes Great Britain agreed to lease to France two small plots of land on the river—the one on the right bank between Leaba and the mouth of the Moshi river, the other at one of the mouths of the Niger. By accepting this line Great Britain abandoned Nikki and a great part of Borgu as well as some part of Gando to France. East of the Niger the Say-Barrua line was modified in favour of France, which gained parts of both Sokoto and Bornu where they meet the southern edge of the Sahara. In the Gold Coast hinterland the French withdrew from Wa, and Great Britain abandoned all claim to Mossi, though the capital of the latter country, together with a further extensive area in the territory assigned to both powers, was declared to be equally free, so far as trade and navigation were concerned, to the subjects and protected persons of both nationalities. The western boundary of the Gold Coast was prolonged along the Black Volta as far as latitude 11° N., and this parallel was followed with slight deflexions to the Togoland frontier. In consequence of the acute crisis which shortly afterwards occurred between France and Great Britain on the upper Nile, the ratification of this agreement was delayed until after the conclusion of the Fashoda agreement of March 1899 already referred to. In 1900 the two patches on the Niger leased to France were selected by commissioners representing the two countries, and in the same year the Anglo-French frontier from Lagos to the west bank of the Niger was delimited.

East of the Niger the frontier, even as modified in 1898, failed to satisfy the French need for a practicable route to Lake Chad, and in the convention of the 8th of April 1904, to which reference has been made under Egypt and Morocco, it was agreed, as part of the settlement of the French shore question in Newfoundland, to deflect the frontier line more to the south. The new boundary was described at some length, but provision was made for its modification in points of detail on the return of the commissioners engaged in surveying the frontier region. In 1906 an agreement was reached on all points, and the frontier at last definitely settled, sixteen years after the Say-Barrua line had been fixed. This revision of the Niger-Chad frontier did not, however, represent the only territorial compensation received by France in West Africa in connexion with the settlement of the Newfoundland question. By the same convention of April 1904 the British government consented to modify the frontier between Senegal and the Gambia colony "so as to give to France Yarbutenda and the lands and landing-places belonging to that locality," and further agreed to cede to France the tiny group of islands off the coast of French Guinea known as the Los Islands.

Further concessions to France.

Meantime the conclusion of the 1898 convention had left both the British and the French governments free to devote increased attention to the subdivision and control of their West African possessions. On the 1st of January 1900 the imperial authorities assumed direct responsibility for the whole of the territories of the Royal Niger Company, which became henceforth a purely commercial undertaking. The Lagos protectorate was extended northwards; the Niger Coast protectorate, likewise with extended frontiers, became Southern Nigeria; while the greater part of the territories formerly administered by the company were constituted into the protectorate of Northern Nigeria—all three administrations being directly under the Colonial Office. In February 1906 the administration of the

Organization of the British and French protectorates.

Southern Nigerian protectorate was placed under that of Lagos at the same time as the name of the latter was changed to the Colony of Southern Nigeria, this being a step towards the eventual amalgamation of all three dependencies under one governor or governor-general. In French West Africa changes in the internal frontiers have been numerous and important. The coast colonies have all been increased in size at the expense of the French Sudan, which has vanished from the maps as an administrative entity. There are carved out of the territories comprised in what is officially known as French West Africa five colonies—Senegal, French Guinea, the Ivory Coast, Dahomey and the Upper Senegal and Niger, this last being entirely cut off from the sea—and the civil territory of Mauritania. To the colony of the Upper Senegal and Niger is attached the military territory of the Niger, embracing the French Sahara up to the limit of the Algerian sphere of influence. Not only are all these divisions of French West Africa connected territorially, but administratively they are united under a governor-general. Similarly the French Congo territories have been divided into three colonies—the Gabun, the Middle Congo and the Ubangi-Shari-Chad—all united administratively under a commissioner-general.

Ownership of the African islands.

There are, around the coast, numerous islands or groups of islands, which are regarded by geographers as outliers of the African mainland. The majority of these African islands were occupied by one or other of the European powers long before the period of continental partition. The Madeira Islands to the west of Morocco, the Bissagos Islands, off the Guinea coast, and Prince's Island and St Thomas' Island, in the Gulf of Guinea, are Portuguese possessions of old standing; while in the Canary Islands and Fernando Po Spain possesses remnants of her ancient colonial empire which are a more valuable asset than any she has acquired in recent times on the mainland. St Helena in the Atlantic, Mauritius and some small groups north of Madagascar in the Indian Ocean, are British possessions acquired long before the opening of the last quarter of the 19th century. Zanzibar, Pemba and some smaller islands which the sultan was allowed to retain were, as has already been stated, placed under British protection in 1890, and the island of Sokotra was placed under the "gracious favour and protection" of Great Britain on the 23rd of April 1886. France's ownership of Réunion dates back to the 17th century, but the Comoro archipelago was not placed under French protection until April 1886. None of these islands, with the exception of the Zanzibar group, have, however, materially affected the partition of the continent, and they need not be enumerated in the table which follows. But the important island of Madagascar stands in a different category, both on account of its size and because it was during the period under review that it passed through the various stages which led to its becoming a French colony. The first step was the placing of the foreign relations of the island under French control, which was effected by the treaty of the 17th of December 1885, after the Franco-Malagasy war that had broken out in 1883. In 1890 Great Britain and Germany recognized a French protectorate over the island, but the Hova government declined to acquiesce in this view, and in May 1895 France sent an expedition to enforce her claims. The capital was occupied on the 30th of September in the same year, and on the day following Queen Ranavalona signed a convention recognizing the French protectorate. In January 1896 the island was declared a French possession, and on the 6th of August was declared to be a French colony. In February 1897 the last vestige of ancient rule was swept away by the deportation of the queen.

Thus in its broad outlines the partition of Africa was begun and ended in the short space of a quarter of a century. There are still many finishing touches to be put to the structure. The southern frontiers of Morocco and Tripoli remain undefined, while the mathematical lines by which the spheres of influence of the powers were separated one from the other are being variously modified on the *do ut des* principle as they come to be surveyed and as the effective occupation of the continent progresses. Much labour is necessary before the actual area of Africa and its subdivisions can be accurately determined, but in the following table the figures are at least approximately correct. Large areas of the spheres assigned to different European powers have still to be brought under European control; but this work is advancing by rapid strides.

		Sq. m.
BRITISH—		
Cape Colony		276,995
Natal and Zululand		35,371
Basutoland		10,293
Bechuanaland Protectorate		225,000
Transvaal and Swaziland		117,732
Orange River Colony		50,392
Rhodesia		450,000
Nyasaland Protectorate		43,608
British East Africa Protectorate		240,000
Uganda Protectorate		125,000
Zanzibar Protectorate		1,020
Somaliland		68,000
Northern Nigeria		258,000
Southern Nigeria (colony and protectorate)		80,000
Gold Coast and *hinterland*		82,000
Sierre Leone (colony and protectorate)		34,000
Gambia		4,000
Total British Africa		2,101,411
Egypt and Libyan Desert		650,000
Anglo-Egyptian Sudan		950,000
		1,600,000
FRENCH—		
Algeria and Algerian Sahara		945,000
Tunisia		51,000
French West Africa—		
Senegal	74,000	
French Guinea	107,000	
Ivory Coast	129,000	
Dahomey	40,000	
Upper Senegal and Niger, and Mauritania (including French West African Sahara)	1,581,000	1,931,000
French Congo		700,000
French Somaliland		12,000
Madagascar		227,950
Total French Africa		3,866,950
GERMAN—		
East Africa		364,000
South-West Africa		322,450
Cameroon		190,000
Togoland		33,700
Total German Africa		910,150
ITALIAN—		
Eritrea		60,000
Italian Somaliland		140,000
Total Italian Africa		200,000
PORTUGUESE—		
Guinea		14,000
West Africa		480,000
East Africa		293,500
Total Portuguese Africa		787,500
SPANISH—		
Rio de Oro		70,000
Muni River Settlements		9,800
Total Spanish Africa		79,800
BELGIAN—		
Congo State		900,000
TURKISH—		
Tripoli and Benghazi		400,000
SEPARATE STATES—		
Liberia		43,000
Morocco		220,000
Abyssinia		350,000
Total Independent Africa		613,000

Thus, collecting the totals, the result of the "scramble" has been to divide Africa among the powers as follows:—

	Sq. m.
British Africa	2,101,411
Egyptian Africa	1,600,000
French Africa	3,866,950
German Africa	910,150
Italian Africa	200,000
Portuguese Africa	787,500
Spanish Africa	79,800
Belgian Africa	900,000
Turkish Africa	400,000
Independent Africa	613,000
	11,458,811

(J. S. K.)

VI. Exploration and Survey since 1875

In giving the history of the partition of the continent, the later work of exploration, except where, as in the case of de Brazza's expeditions, it had direct political consequences, has of necessity not been told. The results achieved during and after the period of partition may now be indicated. Stanley's great journey down the Congo in 1875–1876 initiated a new era in African exploration. The numbers of travellers soon became so great that the once marvellous feat of crossing the continent from sea to sea became common. With increased knowledge and much ampler means of communication trans-African travel now presents few difficulties. While d'Anville and other cartographers of the 18th century, by omitting all that was uncertain, had left a great blank on the map, the work accomplished since 1875 has filled it with authentic topographical details. Moreover surveys of high accuracy have been made at several points. As the work of exploration and survey progressed journeys of startling novelty became impossible—save in the eastern Sahara, where the absence of water and boundless wastes of sand render exploration more difficult, perhaps, than in any other region of the globe. Within their respective spheres of influence each power undertook detailed surveys, and the most solid of the latest accessions to knowledge have resulted from the labours of hard-working colonial officials toiling individually in obscurity. Their work it is impossible here to recognize adequately; the following lines record only the more obvious achievements.

Work in the Congo basin.

The relations of the Congo basin to the neighbouring river systems was brought out by the journeys of many travellers. In 1877 an important expedition was sent out by the Portuguese government under Serpa Pinto, Brito Capello and Roberto Ivens for the exploration of the interior of Angola. The first named made his way by the head-streams of the Kubango to the upper Zambezi, which he descended to the Victoria Falls, proceeding thence to Pretoria and Durban. Capello and Ivens confined their attention to the south-west Congo basin, where they disproved the existence of Lake Aquilunda, which had figured on the maps of that region since the 16th century. In a later journey (1884–1885) Capello and Ivens crossed the continent from Mossamedes to the mouth of the Zambezi, adding considerably to the knowledge of the borderlands between the upper Congo and the upper Zambezi. More important results were obtained by the German travellers Paul Pogge and Hermann von Wissmann, who (1880–1882) passed through previously unknown regions beyond Muata Yanvo's kingdom, and reached the upper Congo at Nyangwe, whence Wissmann made his way to the east coast. In 1884–1885 a German expedition under Wissmann solved the most important geographical problem relating to the southern Congo basin by descending the Kasai, the largest southern tributary, which, contrary to expectation, proved to unite with the Kwango and other streams before joining the main river. Further additions to the knowledge of the Congo tributaries were made at the same time by the Rev. George Grenfell, a Baptist missionary, who (accompanied in 1885 by K. von François) made several voyages in the steamer "Peace," especially up the great Ubangi, ultimately proved to be the lower course of the Welle, discovered in 1870 by Schweinfurth.

Opening up East Africa.

In East as in West Africa operations were started by agents of the Belgian committee, but with less success than on the Congo. The first new journey of importance on this side was made (1878–1880) on behalf of the British African Exploration Committee by Joseph Thomson, who after the death of his leader, Keith Johnston, made his way from the coast to the north end of Nyasa, thence to Tanganyika, on both sides of which he broke new ground, sighting the north end of Lake Rukwa on the east. In 1882–1884 the French naval lieutenant Victor Giraud proceeded by the north of Nyasa to Lake Bangweulu, of which he made the first fairly correct map. North of the Zanzibar-Tanganyika route a large area of new ground was opened in 1883–1884 by Joseph Thomson, who traversed the whole length of the Masai country to Lake Baringo and Victoria Nyanza, shedding the first clear light on the great East African rift-valley and neighbouring highlands, including Mounts Kenya and Elgon. A great advance in the region between Victoria Nyanza and Abyssinia was made in 1887–1889 by the Austrians, Count Samuel Teleki and Lieut. Ludwig von Höhnel, who discovered the large Basso Norok, now known as Lake Rudolf, till then only vaguely indicated on the map as Samburu. At this time Somaliland was being opened up by English and Italian travellers. In 1883 the brothers F. L. and W. D. James penetrated from Berbera to the Webi Shebeli; in 1892 Vittorio Bottego (afterwards murdered in the Abyssinian highlands) started from Berbera and reached the upper Juba, which he explored to its source. The first person, however, to cross from the Gulf of Aden to the Indian Ocean was an American, A. Donaldson Smith, who in 1894–1895 explored the head-streams of the Webi Shebeli and also explored the Omo, the feeder of Lake Rudolf.

In the region north-west of Victoria Nyanza the greatest additions to geographical knowledge were made by H. M. Stanley in his last expedition, undertaken for the relief of Emin Pasha. The expedition set out in 1887 by way of the Congo to carry supplies to the governor of the old Egyptian Equatorial province. The route lay up the Aruwimi, the principal tributary of the Congo from the north-east, by which the expedition made its way, encountering immense difficulties, through the great equatorial forest, the character and extent of which were thus for the first time brought to light. The return was made to the east coast, and resulted in the discovery of the great snowy range of Ruwenzori or Runsoro, and the confirmation of the existence of a third Nile lake discharging its waters into the Albert Nyanza by the Semliki river. A further discovery was that of a large bay, hitherto unsuspected, forming the south-west corner of the Victoria Nyanza.

Expeditions in North and West Africa.

Great activity was also displayed in completing the work of earlier explorers in North and West Africa. Morocco was in 1883–1884 the scene of important explorations by de Foucauld, a Frenchman who, disguised as a Jew, crossed and re-crossed the Atlas and supplied the first trustworthy information as to the orography of many parts of the chain. In 1887–1889 Louis Gustave Binger, a French officer, made a great journey through the countries enclosed in the Niger bend, and in 1890–1892 Col. P. F. Monteil went from St Louis to Say, on the Niger, thence through Sokoto to Bornu and Lake Chad, whence he crossed the Sahara to Tripoli.[1] Meantime explorers had been busy in the region between Lake Chad, the Gulf of Guinea and the Congo. The Sanga, one of the principal northern tributaries of the Congo, was reached from the north by Lieut. Louis Mizon, a French naval officer, who drew the first line of communication between the Benue and the Congo (1890–1892). In 1890 Paul Crampel, who in the previous year had explored north of the Ogowé, undertook a great expedition from the Ubangi to the Shari, but was attacked and killed, with several of his companions, on the borders of the Bagirmi. Several other expeditions followed, and in 1896 Emile Gentil reached the Shari, launched a steamer on its waters and pushed on to Lake Chad. Early in 1900 Lake Chad was also reached by F. Foureau, a French traveller, who had already devoted twelve years to the exploration of the

Sahara and who on this occasion had crossed the desert from Algeria and had reached the lake *via* Air and Zinder.

Lakes and mountains of Equatorial Africa.

The last ten years of the 19th century also witnessed many interesting expeditions in east Central Africa. In 1891 Emin Pasha, accompanied by Dr F. Stuhlmann, made his way south of Victoria Nyanza to the western Nile lakes, visiting for the first time the southern and western shores of Albert Edward. Stuhlmann also ascended the Ruwenzori range to a height of over 13,000 ft. In the same year Dr O. Baumann, who had already done good work in Usambara, near the coast, started on a more extended journey through the region of steppes between Kilimanjaro and Victoria Nyanza, afterwards exploring the head-streams of the Kagera, the ultimate sources of the Nile. In the steppe region referred to he discovered two new lakes, Manyara and Eiassi, occupying parts of the East African valley system. This region was again traversed in 1893–1894 by Count von Götzen, who continued his route westwards to Lake Kivu, north of Tanganyika, which, though heard of by Speke over thirty years before, had never yet been visited. He also reached for the first time the line of volcanic peaks north of Kivu, one of which he ascended, afterwards crossing the great equatorial forest by a new route to the Congo and the west coast. Valuable scientific work was done in 1893 by Dr J. W. Gregory, who ascended Mount Kenya to a height of 16,000 ft. In 1893–1894 Scott Elliot reached Ruwenzori by way of Uganda, returning by Tanganyika and Nyasa, and in 1896 C. W. Hobley made the circuit of the great mountain Elgon, north-east of Victoria Nyanza. In 1899 Mount Kenya was ascended to its summit by a party under H. J. Mackinder. The exploration of Mount Kilimanjaro has been the special work of Dr Hans Meyer, who first directed his attention to it in 1887.

The region south of Abyssinia proper and north of Lake Rudolf, being largely the basin of the Sobat tributary of the Nile, was traversed by several explorers, among whom may be mentioned Capt. M. S. Wellby, who in 1898–1899 explored the chain of small lakes in south-east Abyssinia, pushed on to Lake Rudolf, and thence traversed hitherto unknown country to the lower Sobat. Donaldson Smith crossed from Berbera to the Nile by Lake Rudolf in 1899–1900, and Major H. H. Austin commanded two survey parties between the Anglo-Egyptian Sudan and Lake Rudolf during 1899–1901. Meantime in south Central Africa the Barotse country had been partly made known by the missionary F. Coillard, who settled there in 1884, while the middle and upper Zambezi basin were scientifically explored and mapped by Major A. St H. Gibbons and his assistants in 1895–1896 and 1898–1900. In the same period the Congo-Zambezi watershed was traced by a Belgian officer, Capt. C. Lemaire, who had ascended one of the upper tributaries of the Kasai.

In the early years of the 19th century the first recorded crossing of Africa took place. That crossing and all subsequent crossings had been made either from west to east or east to west. The first journey through the whole length of the continent was accomplished in the two last years of the century when a young Englishman, E. S. Grogan, starting from Cape Town reached the Mediterranean by way of the Zambezi, the central line of lakes and the Nile. Other travellers followed in Grogan's footsteps, among the first, Major Gibbons.

Work of international commissions and surveying parties.

Additions to topographical knowledge were made from about 1890 onwards by the international commissions which traced the frontiers of the protectorates of the European powers. On several occasions the labours of the commissions disclosed errors of importance in the maps upon which international agreements had been based. Among those which yielded valuable results were the Anglo-French commission which in 1903 traced the Nigerian frontier from the Niger to Lake Chad, and the Anglo-German commission which in 1903–1904 fixed the Cameroon boundary between Yola, on the Benue, and Lake Chad. These expeditions and French surveys in the same region during 1902–1903 resulted in the discovery that Lake Chad had greatly decreased in area since the middle of the 19th century. In 1903 a French officer, Capt. E. Lenfant, succeeded in establishing the fact of a connexion between the Niger and Chad basins. Subsequently Lenfant explored the western basin of the Shari, determining (1907) the true upper branch of that river.

In East Africa a German-Congolese commission surveyed (1901–1902) Lake Kivu and the volcanic region north of the lake, R. Kandt making a special study of Kivu and the Kagera sources, while the Anglo-German boundary commission of 1902–1904 surveyed the valley of the lower Kagera, and fixed the exact position of Albert Edward Nyanza. Much new information concerning the border-lands of British East Africa and Abyssinia between Lake Rudolf and the lower Juba was obtained by the survey executed in 1902–1903 by a British officer, Captain P. Maud.

While political requirements led to the exact determination of frontiers, administrative needs forced the governments concerned to take in hand the survey of the countries under their protection. Before the close of the first decade of the 20th century tolerably accurate maps had been made of the German colonies, of a considerable part of West Africa, the Algerian Sahara and the Anglo-Egyptian Sudan, mainly by military officers. A British naval officer, Commander B. Whitehouse, mapped the entire coast-line of Victoria Nyanza. Government and railway surveys apart, the chief points of interest for explorers during 1904–1906 were the Ruwenzori range and the connexion of the basin of Lake Chad with the Niger and Congo systems. Lieut. Boyd Alexander was the leader of a party which during the years named surveyed Lake Chad and a considerable part of eastern Nigeria, returning to England via the Shari, the Ubangi and the Nile. Two members of the party, Capt. Claud Alexander and Capt. G. B. Gosling, died during the expedition. The Ruwenzori Mountains proved a great source of attraction. Sir H. H. Johnston had in 1900 ascended beyond the snow-line to 14,800 ft.; in 1903 Dr J. J. David had reached from the west to a height he believed to exceed 16,000 ft.; and in the same year Capt. T. T. Behrens, of the Anglo-German Uganda boundary commission, fixed the highest summit at 16,619 ft. During 1904–1906 some half-dozen expeditions were at work in the region. That of the duke of the Abruzzi was the most successful. In the summer of 1906 the duke or members of his party climbed all the highest peaks, none of which reaches 17,000 ft., and determined the main lines of the watershed. Major Powell-Cotton, a British officer who had previously done good work in Abyssinia and British East Africa, spent 1905–1906 in a detailed examination of the Lado enclave and the country west of Ruwenzori and Albert and Albert Edward lakes. This expedition was specially fruitful in additions to zoological knowledge.

Archaeological research, stimulated by the reports of Thomas Shaw, British consular chaplain at Algiers in 1719–1731, by James Bruce's exploration, 1765–1767, of the ruins in Barbary, and by the French conquest of Egypt in 1798, has been systematically carried out in North Africa since the middle of the 19th century (see EGYPT and AFRICA, ROMAN). In South Africa the first thorough examination of the ruins in Rhodesia was made in 1905, when Randall-MacIver demonstrated that the great Zimbabwe and similar buildings were of medieval or post-medieval origin. (F. R. C.)

VII. SOCIAL AND ECONOMIC CONDITIONS

The eagerness with which the nations of western Europe partitioned Africa between them was due, as has been seen, more to the necessities of commerce than to mere land hunger. Yet, except in the north and south temperate regions, the commercial intercourse of the continent with the rest of the world had been until the closing years of the 19th century of insignificant proportions. In addition to slaves, furnished by the continent from the earliest times, a certain amount of gold and ivory was exported from the tropical regions, but no other product supplied the material for a flourishing trade with those parts. To their

Asiatic and European invaders the Africans indeed owed many creature comforts—the introduction of maize, rice, the sugar cane, the orange, the lemon and the lime, cloves, tobacco and many other vegetable products, the camel, the horse and other animals—but invaluable to Africa as were these gifts they led to little development of commerce. The continent continued in virtual isolation from the great trade movements of the world, an isolation due not so much to its poverty in natural resources, as to the special circumstances which likewise caused so large a part of the continent to remain so long a *terra incognita*. The principal drawbacks may be summarized as: (1) the absence of means of communication with the interior; (2) the unhealthiness of the coast-lands; (3) the small productive activity of the natives; (4) the effects of the slave trade in discouraging legitimate commerce. None of these causes is necessarily permanent, that most difficult to remove being the third; the negro races finding the means of existence easy have little incentive to toil. The first drawback has almost disappeared, and the building of railways and the placing of steamers on the rivers and lakes—a work continually progressing—renders it year by year easier for producer and consumer to come together. As to the second drawback, while the coast-lands in the tropics will always remain comparatively unhealthy, improved sanitation and the destruction of the malarial mosquito have rendered tolerable to Europeans regions formerly notorious for their deadly climate.

Causes of isolation.

At various periods since the partition of the continent began, united action has been taken by the powers of Europe in the interests of African trade. The Berlin conference of 1884–1885 decreed freedom of navigation and trade on the Congo and the Niger, and the Anglo-Portuguese treaty of 1891 secured like privileges for the Zambezi. The Berlin conference likewise enacted that over a wide area of Central Africa—the conventional basin of the Congo—there should be complete freedom of trade, a freedom which later on was held to be infringed in the Congo State and French Congo by the granting to various companies proprietary rights in the disposal of the product of the soil. More important in their effect on the economic condition of the continent than the steps taken to ensure freedom of trade were the measures concerted by the powers for the suppression of the slave trade. The British government had for long borne the greater part of the burden of combating the slave trade on the east coast of Africa and in the Indian Ocean, but the changed conditions which resulted from the appearance of other European powers in Africa induced Lord Salisbury, then foreign secretary, to address, in the autumn of 1888, an invitation to the king of the Belgians to take the initiative in inviting a conference of the powers at Brussels to concert measures for "the gradual suppression of the slave trade on the continent of Africa, and the immediate closing of all the external markets which it still supplies." The conference assembled in November 1889, and on the 2nd of July 1890 a general act was signed subject to the ratification of the various governments represented, ratification taking place subsequently at different dates, and in the case of France with certain reservations. The general act began with a declaration of the means which the powers were of opinion might be most effectually adopted for "putting an end to the crimes and devastations engendered by the traffic in African slaves, protecting effectively the aboriginal populations of Africa, and ensuring for that vast continent the benefits of peace and civilization." It proceeded to lay down certain rules and regulations of a practical character on the lines suggested. The act covers a wide field, and includes no fewer than a hundred separate articles. It established a zone "between the 20th parallel of north latitude, and the 22nd parallel of south latitude, and extending westward to the Atlantic and eastward to the Indian Ocean and its dependencies, comprising the islands adjacent to the coast as far as 100 nautical miles from the shore," within which the importation of firearms and ammunition was forbidden except in certain specified cases, and within which also the powers undertook either to prohibit altogether the importation and manufacture of spirituous liquors, or to impose duties not below an agreed-on minimum.[1] An elaborate series of rules was framed for the prevention of the transit of slaves by sea, the conditions on which European powers were to grant to natives the right to fly the flag of the protecting power, and regulating the procedure connected with the right of search on vessels flying a foreign flag. The Brussels Act was in effect a joint declaration by the signatory powers of their joint and several responsibility towards the African native, and notwithstanding the fact that many of its articles have proved difficult, if not impossible, of enforcement, the solemn engagement taken by Europe in the face of the world has undoubtedly exercised a material influence on the action of several of the powers. Moreover, with the increase of means of communication and the extension of effective European control, slave-raiding in the interior was largely checked and inter-tribal wars prevented, the natives being thus given security in the pursuit of trade and agriculture.

Suppression of the slave trade.

Other important factors in the economic as well as the social conditions of Africa are the advance in civilization made by the natives in several regions and the increase of the areas found suitable for white colonization. The advance in civilization among the natives, exemplified by the granting to them of political rights in such countries as Algeria and Cape Colony, leads directly to increased commercial activity; and commerce increases in a much greater degree when new countries—*e.g.* Rhodesia and British East Africa—become the homes of Europeans. Finally, in reviewing the chief factors which govern the commercial development of the continent, note must be taken of the sparsity of the population over the greater part of Africa, and the efforts made to supplement the insufficient and often ineffective native labour by the introduction of Asiatic labourers in various districts—of Indian coolies in Natal and elsewhere, and of Chinese for the gold mines of the Transvaal.

Chief economic resources.

The resources of Africa may be considered under the head of: (1) jungle products; (2) cultivated products; (3) animal products; (4) minerals. Of the first named the most important are india-rubber and palm-oil, which in tropical Africa supply by far the largest items in the export list. The rubber-producing plants are found throughout the whole tropical belt, and the most important are creepers of the order Apocynaceae, especially various species of *Landolphia* (with which genus *Vahea* is now united). In East Africa *Landolphia kirkii* (Dyer) supplies the largest amount, though various other species are known. Forms of apparently wider distribution are *L. hendelotii*, which is found in the Bahr-el-Ghazal, and extends right across the continent to Senegambia; and *L.* (formerly *Vahea*) *comorensis*, which, including its variety *L. florida*, has the widest distribution of all the species, occurring in Upper and Lower Guinea, the whole of Central Africa, the east coast, the Comoro Islands and Madagascar. In parts of East Africa *Clitandra orientalis* is a valuable rubber vine. In Lagos and elsewhere rubber is produced by the apocynaceous tree, *Funtumia elastica*, and in West Africa generally by various species of Ficus, some species of which are also found in East Africa. The rubber produced is somewhat inferior to that of South America, but this is largely due to careless methods of preparation. The great destruction of vines brought about by native methods of collection much reduced the supply in some districts, and rendered it necessary to take steps to preserve and cultivate the rubber-yielding plants. This has been done in many districts with usually encouraging results. Experiments have been made in the introduction of South American rubber plants, but opinions differ as to the prospects of success, as the plants in question seem to demand very definite conditions of soil and climate. The second product, palm-oil, is derived from a much more limited area than rubber, for although the oil palm is found throughout the greater part of West Africa, from 10° N. to 10° S., the great bulk of the export comes from the coast districts at the head of the Gulf of Guinea. A larger supply, equal to any market demand, could easily be obtained. A third valuable product is the timber supplied by the forest regions, principally in West Africa. It includes African teak or oak (*Oldfieldia africana*), excellent for shipbuilding; the durable odum of the Gold Coast (*Chlorophora excelsa*); African mahogany (*Khaya senegalensis*); ebony (*Diospyros ebenum*); camwood (*Baphia nitida*); and many other ornamental and dye woods. The timber industry on the west coast was long neglected, but since 1898 there have been large exports to Europe. In parts of East Africa the *Podocarpus milanjianus*, a conifer, is economically important. Valuable timber grows too in South Africa, including the yellow wood (*Podocarpus*), stinkwood (*Ocotea*), sneezewood or Cape ebony (*Euclea*) and ironwood.

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[1] Further conferences respecting the liquor traffic in Africa were held in Brussels in 1899 and 1906. In both instances conventions were signed by the powers, raising the minimum duty on imported spirituous liquors.

Other vegetable products of importance are: Gum arabic, obtained from various species of acacia (especially *A. senegal*), the chief supplies of which are obtained from Senegambia and the steppe regions of North Africa (Kordofan, &c.); gum copal, a valuable resin produced by trees of the leguminous order, the best, known as Zanzibar or Mozambique copal, coming from the East African *Trachylobium kornemannianum*, and also found in a fossil state under the soil; kola nuts, produced chiefly in the coast-lands of Upper Guinea by a tree of the order Sterculiaceae (*Kola acuminata*); archil or orchilla, a dye-yielding lichen (*Rocella tinctoria* and *triciformis*) growing on trees and rocks in East Africa, the Congo basin, &c.; cork, the bark of the cork oak, which flourishes in Algeria; and alfa, a grass used in paper manufacture (*Machrochloa tenacissima*), growing in great abundance on the dry steppes of Algeria, Tripoli, &c. A product to which attention has been paid in Angola is the Almeidina gum or resin, derived from the juice of *Euphorbia tirucalli*.

The cultivated products include those of the tropical and warm temperate zones. Of the former, coffee is perhaps the most valuable indigenous plant. It grows wild in many parts, the home of one species being in Kaffa and other Galla countries south of Abyssinia, and of another in Liberia. The Abyssinian coffee is equal to the best produced in any other part of the world. Cultivation is, however, necessary to ensure the best results, and attention has been given to this in various European colonies. Plantations have been established in Angola, Nyasaland, German East Africa, Cameroon, the Congo Free State, &c.

Copra, the produce of the cocoa-nut palm, is supplied chiefly by Zanzibar and neighbouring parts of the east coast. Ground-nuts, produced by the leguminous plant, *Arachis hypogaea*, are grown chiefly in West Africa, and the largest export is from Senegal and the Gambia; while Bambarra ground-nuts (*Voandzeia subterranea*) are very generally cultivated from Guinea to Natal. Cloves are extensively grown on Zanzibar and Pemba islands, Pemba being the chief source of the world's supply of cloves. The chief drawbacks to the industry are the fluctuations of the yield of the trees, and the risk of over-production in good seasons.

Cotton grows wild in many parts of tropical Africa, and is exported in small quantities in the raw state; but the main export is from Egypt, which comes third among the world's sources of supply of the article. It is also cultivated in West Africa—the industry in the Guinea coast colonies having been developed since the beginning of the 20th century—and in the Anglo-Egyptian Sudan, whence came the plants from which Egyptian cotton is grown. Sugar, which is the staple crop of Mauritius, and in a lesser degree of Réunion, is also produced in Natal, Egypt, and, to a certain extent, in Mozambique. Dates are grown in Tunisia and the Saharan oases, especially Tafilet; maize in Egypt, South Africa and parts of the tropical zone; wheat in Egypt, Algeria and the higher regions of Abyssinia; rice in Madagascar. Wine is largely exported from Algeria, and in a much smaller quantity from Cape Colony; fruit and vegetables from Algeria. Tobacco is widely grown on a small scale, but, except perhaps from Algeria, has not become an important article of export, though plantations have been established in various tropical colonies. The cultivation of cocoa has proved successful in the Gold Coast, Cameroon and other colonies, and in various districts the tea plant is cultivated. Indigo, though not originally an African product, has become naturalized and grows wild in many parts, while it is also cultivated on a small scale. The main difficulty in the way of tropical cultivation is the labour question, which has already been referred to.

Of animal products one of the most important is ivory, the largest export of which is from the Congo Free State. The diminution in the number of elephants with the opening up of the remoter districts must in time cause a falling-off in this export. Beeswax is obtained from various parts of the interior of West Africa, and from Madagascar. Raw hides are exported in large quantities from South Africa, as are also the wool and hair of the merino sheep and Angora goat. Both hides and wool are also exported from Algeria and Morocco, and hides from Abyssinia and Somaliland. Ostrich feathers are produced chiefly by the ostrich farms of Cape Colony, but some are also obtained from the steppes to the north of the Central Sudan. Live stock, principally sheep, is exported from Algeria and cattle from Morocco.

Mineral Wealth.

The exploited minerals of Africa are confined to a few districts, the resources of the continent in this respect being largely undeveloped. Since the discovery of gold in the Transvaal, particularly in the district known as the Rand (1885), the output has grown enormously, so that in 1898 the output of gold from South Africa was greater than from any other gold-field in the world. The Anglo-Boer War of 1899–1902 lost the Rand the leading position, but by 1905 the output—in that year over £20,800,000—was greater than it had ever been. The supply of gold from South Africa is roughly 25% of the world's output. The gold-yielding formations extend northwards through Rhodesia. The Gold Coast is so named from the quantity of gold obtained there, and since the close of the 19th century the industry has developed largely in the hands of Europeans. In the Galla countries gold has long been an article of native commerce. It is also found in various parts of the Anglo-Egyptian Sudan and along the western shore of the Red Sea. Diamonds are found in large quantities in a series of beds known as the Kimberley shales, the principal mines being at Kimberley, Cape Colony. Diamonds are also found in Orange River Colony, while one of the richest diamond mines in the world—the Premier—is situated in the Transvaal near Pretoria. Some 80% of the world's production of diamonds comes from South Africa. Copper is found in the west of Cape Colony, in German South-West Africa, and in the Katanga country in the southern Congo basin, where vast beds of copper ore exist. There are also extensive deposits of copper in the Broken Hill district of Northern Rhodesia. It also occurs in Morocco, Algeria, the Bahr-el-Ghazal, &c. Rich tin deposits have been found in the southern Congo basin and in Northern Rhodesia. Iron is found in Morocco, Algeria (whence there is an export trade), and is widely diffused, and worked by the natives, in the tropical zone. But the deposits are generally not rich. Coal is worked, principally for home consumption, in Cape Colony, Natal, the Transvaal, Orange River Colony, and in Rhodesia in the neighbourhood of the Zambezi. Coal deposits also exist in the German territory north of Lake Nyasa. Phosphates are exported from Algeria and Tunisia. Of other minerals which occur, but are little worked, zinc, lead and antimony are found in Algeria, lead and manganese in Cape Colony, plumbago in Sierra Leone.

The imports from foreign countries into Africa consist chiefly of manufactured goods, varying in character according to the development of the different countries in civilization. In Egypt, Algeria and South Africa they include most of the necessaries and luxuries of civilized life, manufactured cotton and woollen goods, especially the former, taking the first place, but various food stuffs, metal goods, coal and miscellaneous articles being also included. In tropical Africa, and generally where few Europeans have settled, the great bulk of the imports consists as a rule of cotton goods, articles for which there is a constant native demand.

No continent has in the past been so lacking in means of

Development of means of communication.

communication as Africa, and it was only in the last decade of the 19th century that decided steps were taken to remedy these defects. The African rivers, with the exception of the middle Congo and its affluents, and the middle course of the three other chief rivers, are generally unfavourable to navigation, and throughout the tropical region almost the sole routes have been native footpaths, admitting the passage of a single file of porters, on whose heads all goods have been carried from place to place. Certain of these native trade routes are, however, much frequented, and lead for hundreds of miles from the coast to the interior. In the desert regions of the north transport is by caravans of camels, and in the south ox-wagons, before the advent of railways, supplied the general means of locomotion. The native trade routes led generally from the centres of greatest population or production to the seaports by the nearest route, but to this rule there was a striking exception. The dense forests of Upper Guinea and the upper Congo proved a barrier which kept the peoples of the Sudan from direct access to the sea, and from Timbuktu to Darfur the great trade routes were either west to east or south to north across the Sahara. The principal caravan routes across the desert lead from different points in Morocco and Algeria to Timbuktu; from Tripoli to Timbuktu, Kano and other great marts of the western and central Sudan; from Bengazi to Wadai; and from Assiut on the Nile through the Great Oasis and the Libyan desert to Darfur. South of the equator the principal long-established routes are those from Loanda to the Lunda and Baluba countries; from Benguella via Bihé to Urua and the upper Zambezi; from Mossamedes across the Kunene to the upper Zambezi; and from Bagamoyo, opposite Zanzibar, to Tanganyika. Many of the native routes have been superseded by the improved communications introduced by Europeans in the utilization of waterways and the construction of roads and railways. Steamers have been conveyed overland in sections and launched on the interior waterways above the obstructions to navigation. On the upper Nile and Albert Nyanza their introduction was due to Sir S. Baker and General C. G. Gordon (1871-1876); on the middle Congo and its affluents to Sir H. M. Stanley and the officials of the Congo Free State, as well as to the Baptist missionaries on the river; and on Lake Nyasa to the supporters of the Scottish mission. A small vessel was launched on Victoria Nyanza in 1896 by a British mercantile firm, and a British government steamer made its first trip in November 1900. On the other great lakes and on most of the navigable rivers steamers were plying regularly before the close of the 19th century. However, the shallowness of the water in the Niger and Zambezi renders their navigation possible only to light-draught steamers. Roads suitable for wheeled traffic are few. The first attempt at road-making in Central Africa on a large scale was that of Sir T. Fowell Buxton and Mr (afterwards Sir W.) Mackinnon, who completed the first section of a track leading into the interior from Dar-es-Salaam (1879). A still more important undertaking was the "Stevenson road," begun in 1881 from the head of Lake Nyasa to the south end of Tanganyika, and constructed mainly at the expense of Mr James Stevenson, a director of the African Lakes Company—a company which helped materially in the opening up of Nyasaland. The Stevenson road forms a link in the "Lakes route" into the heart of the continent. In British East Africa a road connecting Mombasa with Victoria Nyanza was completed in 1897, but has since been in great measure superseded by the railway. Good roads have also been made in German East Africa and Cameroon and in Madagascar.

Railways, the chief means of affording easy access to the interior of the continent, were for many years after their first introduction to Africa almost entirely confined to the extreme north and south (Egypt, Algeria, Cape Colony and Natal). Apart from short lines in Senegal, Angola and at Lourenço Marques, the rest of the continent was in 1890 without a railway system. In Egypt the Alexandria and Cairo railway dates from 1855, while in 1877 the lines open reached about 1100 miles, and in 1890, in addition to the lines traversing the delta, the Nile had been ascended to Assiut. In Algeria the construction of an inter-provincial railway was decreed in 1857, but was still incomplete twenty years later, when the total length of the lines open hardly exceeded 300 miles. Before 1890 an extension to Tunis had been opened, while the plateau had been crossed by the lines to Ain Sefra in the west and Biskra in the east. In Senegal the railway from Dakar to St Louis had been commenced and completed during the 'eighties, while the first section of the Senegal-Niger railway, that from Kayes to Bafulabe, was also constructed during the same decade. In Cape Colony, where in about 1880 the railways were limited to the neighbourhood of Cape Town, Port Elizabeth and East London, the next decade saw the completion of the trunk-line from Cape Town to Kimberley, with a junction at De Aar with that from Port Elizabeth. The northern frontier had, however, nowhere been crossed. In Natal, also, the main line had not advanced beyond Ladysmith. The settlement, *c.* 1890, of the main lines of the partition of the continent was followed by many projects for the opening up of the possessions and spheres of influence of the various powers by the building of railways; several of these schemes being carried through in a comparatively short time. The building of railways was undertaken by the governments concerned, nearly all the African lines being state-owned. In the Congo Free State a railway, which took some ten years to build, connecting the navigable waters of the lower and middle Congo, was completed in 1898, while in 1906 the middle and upper courses of the river were linked by the opening of a line past Stanley Falls. Thus the vast basin of the Congo was rendered easily accessible to commercial enterprise. In North Africa the Algerian and Tunisian railways were largely extended, and proposals were made for a great trunk-line from Tangier to Alexandria. The railway from Ain Sefra was continued southward towards Tuat, the project of a trans-Saharan line having occupied the attention of French engineers since 1880. In French West Africa railway communication between the upper Senegal and the upper Niger was completed in 1904; from the Guinea coast at Konakry another line runs north-east to the upper Niger, while from Dahomey a third line goes to the Niger at Garu. In the British colonies on the same coast the building of railways was begun in 1896. A line to Kumasi was completed in 1903, and the line from Lagos to the lower Niger had reached Illorin in 1908. Thence the railway was continued to the Niger at Jebba. From Baro, a port on the lower Niger which can be reached by steamers all the year round, another railway, begun in 1907, goes via Bida, Zungeru and Zaria to Kano, a total distance of 400 miles. A line from Jebba to Zungeru affords connexion with the Lagos railway.

But the greatest development of the railway systems was in the south and east of the continent. In British East Africa a survey for a railway from Mombasa to Victoria Nyanza was made in 1892. The first rails were laid in 1896 and the line reached the lake in December 1901. Meanwhile, there had been a great extension of railways in South Africa. Lines from Cape Town, Port Elizabeth, East London, Durban and Delagoa Bay all converged on the newly risen city of Johannesburg, the centre of the Rand gold mines. A more ambitious project was that identified with the name of Cecil Rhodes, namely, the extension northward of the railway from Kimberley with the object of effecting a continuous railway connexion from Cape Town to Cairo. The line from Kimberley reached Bulawayo in 1897. (Bulawayo is also reached from Beira on the east coast by another line, completed in 1902, which goes through Portuguese territory and Mashonaland.) The extension of the line northward from Bulawayo was begun in 1899, the Zambezi being bridged, immediately below the Victoria Falls, in 1905. From this point the railway goes north to the Katanga district of the Congo State. In the north of the continent a step towards the completion of the Cape to Cairo route was taken in the opening in 1899 of the railway from Wadi Halfa to Khartum. A line of greater economic importance than the last named is the railway (completed in 1905) from Port Sudan on the Red Sea to the Nile a little south of Berber, thus placing the Anglo-

Egyptian Sudan within easy reach of the markets of the world. A west to east connexion across the continent by rail and steamer, from the mouth of the Congo to Port Sudan, was arranged in 1906 when an agreement was entered into by the Congo and Sudan governments for the building of a railway from Lado, on the Nile, to the Congo frontier, there to meet a railway starting from the river Congo near Stanley Falls. A railway of considerable importance is that from Jibuti in the Gulf of Aden to Harrar, giving access to the markets of southern Abyssinia.

Besides the railways mentioned there are several others of less importance. Lines run from Loanda and other ports of Angola towards the Congo State frontier, and from Tanga and Dar-es-Salaam on the coast of German East Africa towards the great lakes. In British Central Africa a railway connects Lake Nyasa with the navigable waters of the Shiré, and various lines have been built by the French in Madagascar.

All the main railways in South Africa, the lines in British West Africa, in the Anglo-Egyptian Sudan and in Egypt south of Luxor are of 3 ft. 6 in. gauge. The main lines in Lower Egypt and in Algeria and Tunisia are of 4 ft. 8½ in. gauge. Elsewhere as in French West and British East Africa the lines are of metre (3·28 ft.) gauge.

The telegraphic system of Africa is on the whole older than that of the railways, the newer European possessions having in most cases been provided with telegraph lines before railway projects had been set on foot. In Algeria, Egypt and Cape Colony the systems date back to the middle of the 19th century, before the end of which the lines had in each country reached some thousands of miles. In tropical Africa the systems of French West Africa, where the line from Dakar to St Louis was begun in 1862, were the first to be fully developed, lines having been carried from different points on the coast of Senegal and Guinea towards the Niger, the main line being prolonged north-west to Timbuktu, and west and south to the coast of Dahomey. The route for a telegraph line to connect Timbuktu with Algeria was surveyed in 1905. The Congo region is furnished with several telegraphic systems, the longest going from the mouth of the river to Lake Tanganyika. From Ujiji on the east coast of that lake there is telegraphic communication via Tabora with Dar-es-Salaam and via Nyasa and Rhodesia with Cape Town. The last-named line is the longest link in the trans-continental line first suggested in 1876 by Sir (then Mr) Edwin Arnold and afterwards taken up by Cecil Rhodes. The northern link from Egypt to Khartum has been continued southward to Uganda, while another line connects Uganda with Mombasa. At the principal seaports the inland systems are connected with submarine cables which place Africa in telegraphic communication with the rest of the world.

Numerous steamship lines run from Great Britain, Germany, France and other countries to the African seaports, the journey from any place in western Europe to any port on the African coast occupying, by the shortest route, not more than three weeks. (E. He., F. R. C.)

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AFRICA, ROMAN. The Romans gave the name of Africa to that part of the world which the Greeks called Libya (Λιβύη). It comprised the whole of the portion of the African continent known to the ancients, except Egypt and Ethiopia. But besides this general sense, which occurs in Pliny (iii. 3), Pomponius Mela (i. 8) and other authors, the official and administrative language used the word Africa in a narrower sense, which is noticed below. The term was certainly borrowed by the Romans from the language of the natives. In Latin literature it was employed for the first time by the poet Ennius, who wrote in the interval between the First and Second Punic Wars (*Ann.* vi.; *Sat.* iii.). By him the term was confined to the territory of

Carthage and the regions composing the eastern group of the Atlas. Among the numerous conjectures which have been made as to the etymology of the term Africa (Ἀφρική) may be quoted that which derives it from the Semitic radical פרק (“separate”), Africa being considered, in this connexion, as a Phoenician settlement “separated” from the mother country, Asiatic Phoenicia. It has also been held that the word Africa comes from *friqi, farikia* (the country of fruit). The best hypothesis in the writer's opinion is that maintained by Charles Tissot, who sees in the word “Africa” the name of the great Berber tribe, the Aourigha (whose name would have been pronounced Afarika), the modern Aouraghen, now driven back into the Sahara, but in ancient times the principal indigenous element of the African empire of Carthage (Tissot, *Géogr. comp.* i. 389). Thus Africa was originally, in the eyes of the Romans and Carthaginians alike, the country inhabited by the great tribe of Berbers or Numidians called Afarik. Cyrenaica, on the east, attached to Egypt, was then excluded from it, and, similarly, Mauretania, on the west.

At the time of the Third Punic War the Africa of the Carthaginians was but a fragment of their ancient native empire. It comprised the territory bounded by a vague line running from the mouth of the Tusca (Wad el Kebir), opposite the island of Tabraca (Tabarca), as far as the town of Thenae (Tina), at the mouth of the Gulf of Gabes. The rest of Africa had passed into the hands of the kings of Numidia, who were allies of the Romans.

After the capture of Carthage by Scipio (146 B.C.) this territory was erected into a Roman province, and a trench, the *fossa regia*, was dug to mark the boundary of the Roman province of Africa and the dominions of the Numidian princes. There have been discovered (1907) the remains of this ditch protected by a low wall or a stone dyke; some of the boundary stones which marked its course, and inscriptions mentioning it, have also been found. From Testur on the Mejerda the *fossa regia* can be followed by these indications for several miles along the Jebel esh-Sheid. The ditch ran northward to Tabarca and southward to Tina. The importance of the discoveries lies in the fact that the ditch which in later times divided the provinces of Africa *vetus* and Africa *nova* was at the time of the Third Punic War the boundary of Carthaginian territory (R. Cagnat, “Le fossé des frontières romaines” in *Mélanges Boissier*, 1905, p. 227; L. Poinssot in *Comptes rendus de l'Acad. des Inscript. et Belles Lettres*, 1907, p. 466; *Classical Review*, 1907, December, p. 255). The government of the Roman province thus delimited was entrusted to a *praetor* or *propraetor*, of whom several are now known, *e.g.* P. Sextilius, *propraetor Africae*, according to coins of Hadrumetum of the year 94 B.C. The towns which had fought on the side of the Romans during the Third Punic War were declared *civitates liberae*, and became exceedingly prosperous. They were Utica (Bu Shatir), Hadrumetum (Susa), Thapsus (Dimas), Leptis Minor (Lemta), Achulla (Badria), Uzalis (about 11 m. from Utica) and Theudalis. Those towns, however, which had remained faithful to Carthage were destroyed, like Carthage itself.

After the Jugurthine war in 106, the whole of the *regio Tripolitana*, comprising Leptis Magna (Lebda), Oea (Tripoli), Sabrata, and the other towns on the littoral of the two Syrtes, appears to have been annexed to the Roman province in a more or less regular manner (Tissot ii. 21). The battle of Thapsus in 46 made the Romans definitely masters of Numidia, and the spheres of administration were clearly marked out. Numidia was converted into a new province called “Africa Nova,” and of this province the historian Sallust was appointed proconsul and invested with the *imperium*. From that time the old province of Africa was known as “Africa Vetus” or “Africa Propria.”

This state of affairs, however, lasted but a short time. In 31 B.C. Octavius gave up Numidia, or Africa Nova, to King Juba II. Five years later Augustus gave Mauretania and some Gaetulian districts to Juba, and received in exchange Numidia, which thus reverted to direct Roman control. Numidia, however, no longer formed a distinct government, but was attached to the old province of Africa. From 25 B.C. the Roman province of Africa comprised the whole of the region between the mouth of the Ampsaga (Wad Rummel, Wad el Kebir) on the west, and the two tumuli called the altars of the Philaeni, the immutable boundary between Tripolitana and Cyrenaica, on the east (Tissot ii. 261). In the partition of the government of the provinces of the Roman empire between the senate and the emperor, Africa fell to the senate, and was henceforth administered by a proconsul. Subordinate to him were the *legati pro consule*, who were placed at the head of districts called dioceses. At first there were only three dioceses: *Carthaginiensis*, *Hipponiensis* (headquarters Hippo Diarrhytus, now Bizerta), and *Numidica* (headquarters Cirta, now Constantine). At a later date the *diocesis Hadrumetina* was formed, and perhaps at some date unknown the *diocesis Tripolitana*.

The province of Africa was the only senatorial province whose governor had originally been invested with military powers. The proconsul of Africa, in fact, had command of the *legio III. Augusta* and the auxiliary corps. But in A.D. 37 Caligula deprived the proconsul of his military powers and gave them to the imperial legate (*legatus Augusti pro praetore provinciae Africae*), who was nominated directly by the emperor, and whose special duty it was to guard the frontier zone (Tacitus, *Hist.* iv. 48; Dio Cass. lix. 20). The headquarters of the imperial legate were originally at Cirta and afterwards at Lambaesa (Lambessa). The military posts were drawn up in échelon along the frontier of the desert, especially along the southern slopes of the Aurès, as far as Ad Majores (Besseriani), and on the Tripolitan frontier as far as Cydamus (Ghadamès), forming an immense arc extending from Cyrenaica to Mauretania. A network of military routes, constructed and kept in repair by the soldiers, led from Lambaesa in all directions, and stretched along the frontier as far as Leptis Magna, passing Theveste (Tebessa), Thenae and Tacape (Gabès). The powers of the proconsul, however, extended scarcely beyond the ancient Africa Vetus and the towns on the littoral. Towards 194 Septimius Severus completed the reform of Caligula by detaching from the province of Africa the greater part of Numidia to constitute a special province governed by a *procurator*, subordinate to the imperial legate and resident at Cirta (Tissot ii. 34). This province was called Numidia Cirtensis, as opposed to Numidia Inferior or proconsular Numidia.

In Diocletian's great reform of the administrative system of the empire, the whole of Roman Africa, with the exception of Mauretania Tingitana (which was attached to the province of Spain), constituted a single diocese subdivided into six provinces: Zeugitana (Carthage), Byzacium (Hadrumetum, now Susa), Numidia Cirtensis (Cirta, Constantine), Tripolitana (Tripolis), Mauretania Sitifensis (Sitifis, Setif), and Mauretania Caesariensis (Caesarea, now Cherchel). These provinces were administered, according to circumstances, by a *praeses* of senatorial rank, a *legatus pro praetore*, or a *vir clarissimus consularis*. Some changes were eventually necessitated by the wars with the Moors and the Vandals. By a treaty concluded in 476, the emperor Zeno recognized Genseric as master of all Africa. Reconquered by Belisarius in 534, Africa formed, under the name of *praefectura Africae*, one of the great administrative districts of the Byzantine empire. It was subdivided into six provinces, which were placed under the authority of the praetorian prefect of Africa. These provinces were Zeugitana (the former Proconsularis), Carthage, Byzacium, Tripolitana, Numidia and Mauretania. The civil government was carried on by *consulares* or *praesides*, while the military government was in the hands of four *duces militum*, who made strenuous efforts to drive out the barbarians. The country was studded thickly with *burgi* (small forts) and *clausurae* (long walls), the ruins of which still subsist. In 647 the Arabs penetrated into *Ifrikia*, which was destined to fall for ever out of the grasp of the Romans. In 697 Carthage was taken.

The bulk of the population of Roman Africa was invariably composed of three chief elements: the indigenous Berber tribes, the ancient Carthaginians of Phoenician origin and the Roman colonists. The Berber tribes, whose racial unity is attested by their common spoken language and by the comparatively numerous Berber inscriptions that have come down to us, bore in ancient times the generic names of Numidians, Gaetulians and Moors or Maurusiani. Herodotus mentions a great number of these tribes. During the Roman period, according to Pliny, there were settlements of 26 indigenous tribes extending from the Ampsaga as far as Cyrenaica. The much more detailed list of Ptolemy enumerates 39 indigenous tribes in the province of Africa and 25 in Mauretania Caesariensis. Ammianus Marcellinus, Procopius and Flavius Cresconius Corippus give still further names. Besides the Afri (Aourigha) of the territory of Carthage, the principal tribes that took part in the wars against the Romans were the Lotophagi, the Garamantes, the Maces, the Nasamones in the regions of the S.E., the Misulani or Musulamii (whence the name Mussulman), the Massyli and the Massaesyli in the E., who were neighbours of the Moors. The non-nomads of these Libyan tribes dwelt in huts made of stakes supporting plaited mats of rush or asphodel. These dwellings, which were called *mapalia*, are the modern *gourbis*. African epigraphy has revealed the names of some of their deities: *deus invictus Aulisva*; the god Motmanius, associated with Mercury; the god Lilleus; *Baldir Augustus; Kautus pater*; the goddess Gilva, identified with Tellus, and *Ifru Augustus* (Tissot i. 486). The *Johannis* of Corippus mentions three native divinities: Sinifere, Mastiman and Gurzil. There were also local divinities in all the principal districts. The rock bas-reliefs and other monuments showing native divinities are rare, and give only very summary representations. Dolmens, however, occur in great numbers in Tunisia and the province of Constantine. Tumuli, too, are found throughout northern Africa, the most celebrated being that near Cherchel, the Kubr-er-Rumia (" tomb of the Christian lady "), which was regarded by Pomponius Mela as the royal burying-place of the kings of Numidia.

During the Roman period the ancient Carthaginians of Phoenician origin and the bastard population termed by ancient authors Libyo-Phoenicians, like the modern Maltese, invariably formed the predominant population of the towns on the littoral, and retained the Punic language until the 6th century of the Christian era. The municipal magistrates took the title of *suffetes* in place of that of *duumvirs*, and in certain towns the Christian bishops were obliged to know the *lingua Punica*, since it was the only language that the people understood. Nevertheless, the Roman functionaries, the army and the colonists from Italy soon brought the Latin element into Africa, where it flourished with such vigour that, in the 3rd century, Carthage became the centre of a Romano-African civilization of extraordinary literary brilliancy, which numbered among its leaders such men as Apuleius, Tertullian, Arnobius, Cyprian, Augustine and many others.

Carthage regained its rank of capital of Africa under Augustus, when thousands of Roman colonists flocked to the town. Utica became a Roman colony under Hadrian, and the *civitates liberae*, *municipia*, *castella*, *pagi* and *turres* were peopled with Latins. The towns of the ancient province of Africa which received *coloniae* were very numerous: Abitensis (*civitas Avittensis Bibba*), Bisica Lucana (Tastour), Byzacium, Capsa (Gafsa), Carthage, Cuina, Curubis (Kurba), Hadrumetum (Susa), Hippo Diarrhytus or Zarytus (Bizerta), Leptis Magna (Lebda), Maxula (Ghades, Rades or Gades), Neapolis (Nabel, Nebeul), Oea (Tripoli), Sabrata (Zoara), *colonia Scillitana* (Ghasrin), Sufes (Sbiba), Tacape (Gabes), Thaenae or Thenae (Tina), Thelepte (Medinet Kedima), Thugga (Dugga), Thuburbo maius (Kasbat), Thysdrus (El Jem), Uthina (Wadna) and Vallis (Median). Of the *municipia* may be mentioned Gigthis or Gigthi (Bu Grara), Thibussicensium Bure (Tebursuk), Zita and the *turris Tamalleni* (Telmin).

The province of Numidia was at first colonized principally by the military settlements of the Romans. Cirta (Constantine) and Bulla Regia (Hammam Darraj), its chief towns, received *coloniae* of soldiers and veterans, as well as Theveste (Tebessa) and Thamugas (Timgad). The fine ruins which have been discovered at the last-mentioned place have earned for it the surname of the African Pompeii (see below).

Archaeology.—Roman Africa has been the subject of innumerable historical and archaeological researches, especially since the conquest of Algeria and Tunisia by the French. The country is covered with Roman and Byzantine remains. Each of these ruins has been visited by archaeologists who have copied inscriptions, described the temples, triumphal arches, porticos, mausoleums and the other monuments which are still standing, collected statues or other antiquities; and in many cases they have actually excavated. The results of all these labours have been published, from about 1850 onwards, annually, and, indeed, almost from day to day, in various scientific periodicals. Among the principal of these are:—*Mémoires de la Société archéologique de Constantine*, *Bulletin de la Société géographique et archéologique d'Oran*, *Revue africaine* of Algiers, to which we should add the *Revue archéologique* of Paris, the *Archives des missions scientifiques* and the *Bulletin archéologique du Comité des travaux historiques* and the *Mélanges* of the French School at Rome. In all the towns of Algeria and Tunisia museums have been founded for storing the antiquities of the region; the most important of these are the museums of St Louis, Carthage and the palace of Bardo (musée Alaoui) near Tunis, those of Susa, Constantine, Lambessa, Timgad, Tebessa, Philippeville, Cherchel and Oran. Under the title of *Musées et collections archéologiques de l'Algérie et de la Tunisie*, the Ministry of Public Instruction publishes from time to time illustrated descriptions of all these archaeological treasures. In this collection have already appeared descriptions of the museums of Algiers by G. Doublet; of Constantine by G. Doublet and P. Gauckler; of Oran by R. de La Blanchère; of Cherchel by P. Gauckler; of Lambessa by R. Cagnat; of Philippeville by S. Gsell and Bertrand; of the Bardo by R. de La Blanchère and P. Gauckler; of Carthage by R. P. Delattre; of Tebessa by S. Gsell; of Susa by P. Gauckler; of Timgad by R. Cagnat and A. Ballu.

The archaeological exploration of Algeria has kept pace with the expansion of French dominion. From 1846 to 1854 Delamarre published his *Exploration archéologique de l'Algérie*, in collaboration with the French officers. In 1850 Léon Renier was officially instructed to collect all the inscriptions in Algeria which should be found by the military expeditionary columns. This scholar examined first the ruins of Lambessa, an account of which he published in 1854 in his *Mélanges d'épigraphie*; subsequently he made his important collection of *Inscriptions romaines de l'Algérie* (1855–1858) which formed the groundwork of the volume of the *Corpus Inscr. Lat.* of the Academy of Berlin, devoted to Roman Africa. A little later General Faidherbe published his *Collection complète des inscriptions numidiques* (1870). Apart from the province of Constantine, Algeria is less rich in Roman remains than Tunisia; mention must, however, be made of the excavations of Victor Waille at Cherchel, where were found fine statues in the Greek style of the time of King Juba II.; of P. Gavault at Tigzirt (Rusuccuru), and finally of those of Stéphane Gsell at Tipasa (basilica of St Salsa) and throughout the district of Setif and at Khamissa (Thuburticum Numidarum). In the department of Constantine, which is peculiarly rich in Roman remains, Tebessa has been most carefully explored by M. Héron de Villefosse, who has laid bare a beautiful temple of Jupiter, a triumphal arch of Caracalla, a Byzantine basilica and the gate of the Byzantine general Solomon. But all these ruins fade into insignificance in comparison with the majestic grandeur of those of Timgad which are almost entirely laid bare; they are described in *Timgad, une cité africaine sous l'empire romain*, by R. Cagnat, G. Boeswillwald and A. Ballu.

In Tunisia, Carthage early became the object of archaeological investigation. Major Humbert was sent there by Napoleon in 1808 and his notes are still preserved in the museum of Leiden. Chateaubriand visited and described the ruins; the Dane Falbe, the Englishman Nathan Davis, Beulé, P. de Sainte-Marie and others also have carried out researches; for more than twenty years Père Delattre has explored the ruins of Carthage (*q.v.*) with extraordinary success. For the rest of Tunisia, the first explorer interested in archaeology was Victor Guérin in 1860; his results are contained in his remarkable *Voyage archéologique dans la Régence de Tunis* (1862, 2 vols.). A. Daux, in the years preceding 1869, explored the sites of the ancient harbours of Utica, Hadrumetum, Thapsus (Dimas). But it was the occupation of Tunisia by the French in 1881 which really gave the impetus to modern investigations in this district of ruined cities. They were put on a solid foundation by the publication of the *Géographie comparée* of Charles Tissot (1884). Trained scholars were sent there annually by the French government: Cagnat, Saladin, Poinssot, La Blanchère, S. Reinach, E. Babelon, Carton, Audollent, Stéph. Gsell, J. Toutain, Espérandieu, Gauckler, Merlin, Homo and many others, to say nothing of German scholars, such as Willmans and Schulten, and especially of a great number of enthusiastic officers of the army of occupation, who explored all the ancient sites, and in many cases excavated with great success (for their results see the works quoted above). It would be impossible to enumerate here all the monographs describing, for example, the ruins of Carthage, those of the temple of the waters at Mount Zaghuan, the amphitheatre of El Jem (Thysdrus), the temple of Saturn, the royal tomb and the theatre of Dugga (Thugga), the bridge of Chemtu (Simitthu), the ruins and cemeteries of Tebursuk and Medeina (*Althiburus*), the rich villa of the Laberii at Wadna (*Uthina*), the sanctuary of Saturn Balcaranensis on the hill called Bu-Kornain, the ruins of the district of Enfida (Aphrodisium, Uppenna, Segermes), those of Leptis minor (Lemta), of Thenae (near Sfax), those of the island of Meninx (Jerba), of the peninsula of Zarzis, of Mactar, Sbeitla (Sufetula), Gigthis (Bu-Grara), Gafsa (Capsa), Kef (Sicca Veneria), Bulla Regia, &c.

From this accumulation of results most valuable evidence as to the history and more especially the internal administration of Africa under the Romans has been derived. In particular we know how rural life was there developed, and with what care the water necessary for the growing of cereals was everywhere provided. Sculpture throughout the district is very provincial and of minor importance; the only exceptions are certain statues found at Carthage and Cherchel, the capital of the Mauretanian kings.

AUTHORITIES.—Among general works on the subject may be mentioned: Morcelli, *Africa christiana* (1816); Gustave Boissière, *L'Algérie romaine* (2nd ed., 1883); E. Mercier, *Histoire de l'Afrique septentrionale* (1888); Charles Tissot, *Géographie comparée de la province romaine d'Afrique* (1884–1888), with atlas; Vivien de Saint-Martin, *Le Nord de l'Afrique dans l'antiquité grecque et romaine* (1883); Gaston Boissier, *L'Afrique romaine* (1895); Cl. Pallu de Lessert, *Fastes des provinces africaines* (*Proconsulaire, Numidie, Maurétanie*) *sous la domination romaine* (1896–1901); R. Cagnat, *L'Armée romaine d'Afrique* (1892); A. Daux, *Les Emporia phéniciens dans le Zeugis et le Byzacium* (1869); Ludwig Muller, *Numismatique de l'ancienne Afrique* (1860–1862; Supplement, 1874); Ch. Diehl, *L'Afrique byzantine* (1896); Stéphane Gsell, *Recherches archéologiques en Afrique* (1893); Paul Monceaux, *Histoire littéraire de l'Afrique chrétienne* (1901–1905); J. Toutain, *Les Cités romaines de la Tunisie* (1895); *Atlas archéologique de la Tunisie*, published by the Ministry of Public Instruction (1895 foll.); *Atlas archéologique de l'Algérie*, published by Stéphane Gsell (1900 foll.); Toulotte, *Géographie de l'Afrique chrétienne* (1892–1894); *Corpus inscriptionum latinarum*, vol. viii. and Supplement (1881). Cf. also articles CARTHAGE, NUMIDIA, &c., JUGURTHA, and articles relating to Roman History. (E. B.*)

AFRICAN LILY (*Agapanthus umbellatus*), a member of the natural order Liliaceae, a native of the Cape of Good Hope, whence it was introduced at the close of the 17th century. It is a handsome greenhouse plant, which is hardy in the south of England and Ireland if protected from severe frosts. It has a short stem bearing a tuft of long, narrow, arching leaves, ½ to 2 ft. long, and a central flower-stalk, 2 to 3 ft. high, ending in an umbel of bright blue, funnel-shaped flowers. The plants are easy to cultivate, and are generally grown in large pots or tubs which can be protected from frost in winter. During the summer they require plenty of water, and are very effective on the margins of lakes or running streams, where they thrive admirably. They increase by offsets, or may be propagated by dividing the root-stock in early spring or autumn. A number of forms are known in cultivation; such are *albidus*, with white flowers, *aureus*, with leaves striped with yellow, and *variegatus*, with leaves almost entirely white with a few green bands. There are also double-flowered and larger and smaller flowered forms.

AFRICANUS, SEXTUS JULIUS, a Christian traveller and historian of the 3rd century, was probably born in Libya, and may have served under Septimius Severus against the Osrhoenians in A.D. 195. Little is known of his personal history, except that he lived at Emmaus, and that he went on an embassy to the emperor Heliogabalus[1] to ask for the restoration of the town, which had fallen into ruins. His mission succeeded, and Emmaus was henceforward known as Nicopolis. Dionysius bar-Salibi makes him a bishop, but probably he was not even a presbyter. He wrote a history of the world (*Χρονογραφίαι*, in five books) from the creation to the year A.D. 221, a period, according to his computation, of 5723 years. He calculated the period between the creation and the birth of Christ as 5499 years, and ante-dated the latter event by three years. This method of reckoning became known as the Alexandrian era, and was adopted by almost all the eastern churches. The history, which had an apologetic aim, is no longer extant, but copious extracts from it are to be found in the *Chronicon* of Eusebius, who used it extensively in compiling the early episcopal lists. There are also fragments in Syncellus, Cedrenus and the *Paschale Chronicon*. Eusebius (*Hist. Ecc.* i. 7, cf. vi. 31) gives some extracts from his letter to one Aristides, reconciling the apparent discrepancy between Matthew and Luke in the genealogy of Christ by a reference to the Jewish law, which compelled a man to marry the widow of his deceased brother, if the latter died without issue. His terse and pertinent letter to Origen, impugning the authority of the apocryphal book of Susanna, and Origen's wordy and uncritical answer, are both extant. The ascription to Africanus of an encyclopaedic work entitled *Κεστοί* (embroidered girdles), treating of agriculture, natural history, military science, &c., has been needlessly disputed on account of its secular and often credulous character. Neander suggests that it was written by Africanus before he had devoted himself to religious subjects. For a new fragment of this work see *Oxyrhynchus Papyri* (Grenfell and Hunt), iii. 36 ff.

AUTHORITIES.—Edition in M. J. Routh, *Rel. Sac.* ii. 219-509; translation in *Ante-Nicene Fathers* (S. D. F. Salmond) vi. 125-140. See H. Gelzer, *Sex. Jul. Africanus und die byzant. Chronographie*, 2 vols. (Leipzig, 1880–1885); G. Krüger, *Early Christian Literature*, 248–253; A. Harnack, *Altchristl. Litt. Gesch.* i. 507, ii. 70.

AFRIDI, a Pathan tribe inhabiting the mountains on the Peshawar border of the North-West Frontier province of India. The Afridis are the most powerful and independent tribe on the border, and the largest with the exception of the Waziris. Their special country is the lower and easternmost spurs of the Safed Koh range, to the west and south of the Peshawar district, including the Bazar and Bara valleys. On their east they are bounded by British districts, on the north by the Mohmands, on the west by the Shinwaris and on the south by the Orakzai and Bangash tribes. Their origin is obscure, but they are said to have Israelitish blood in their veins, and they have a decidedly Semitic cast of features. They are possibly the Aparytai of Herodotus, the names and positions being identical. If this theory is correct, they were then a powerful people, and held a large tract of country, but have been gradually driven back by the encroachments of other tribes. The tribe is divided into the following eight clans:—Kuki Khel, Malikdin Khel, Kambar Khel, Kamar Khel, Zakka Khel (the most numerous and the most turbulent), Sipah, Aka Khel and Adam Khel. The first seven clans live in the vicinity of the Khyber Pass, and migrate to Tirah in the summer months. The Adam Khel (5000 fighting men) live round the Kohat Pass, and are more settled and less migratory in their habits. In appearance the Afridi is a fine, tall, athletic highlander with a long, gaunt face, high nose and cheek-bones, and a fair complexion. On his own hillside he is one of the finest skirmishers in the world, and in the Indian army makes a first-rate soldier, but he is apt to be home-sick when removed from the air of his native mountains. In character the Afridi has obtained an evil name for ferocity, craft and treachery, but Colonel Sir Robert Warburton, who lived eighteen years in charge of the Khyber Pass and knew the Afridi better than any other Englishman, says:—"The Afridi lad from his earliest childhood is taught by the circumstances of his existence and life to distrust all mankind, and very often his near relations, heirs to his small plot of land by right of inheritance, are his deadliest enemies. Distrust of all mankind, and readiness to strike the first blow for the safety of his own life, have therefore become the maxims of the Afridi. If you can overcome this mistrust, and be kind in words to him, he will repay you by a great devotion, and he will put up with any treatment you like to give him except abuse." In short the Afridi has the vices and virtues of all Pathans in an enhanced degree. The fighting strength of the Afridis is said to be 27,000, but this estimate is excessive, judged by the number and size of their villages. They derive their importance from their geographical position, which gives them command of the Khyber and Kohat roads, and the history of the British connexion with them has been almost entirely with reference to these two passes.

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[1] So Eusebius. Syncellus says Alexander Severus.

There have been several British expeditions against the separate clans:—

(1) Expedition against the Kohat Pass Afridis under Sir Colin Campbell in 1850. The British connexion with the Adam Khel Afridis commenced immediately after the annexation of the Peshawar and Kohat districts. Following the example of all previous rulers of the country, the British agreed to pay the tribe a subsidy to protect the pass. But in 1850 a thousand Afridis attacked a body of sappers engaged in making the road, killing twelve and wounding six. It was supposed that they disliked the making of a road which would lay open their fastnesses to regular troops. An expedition of 3200 British troops was despatched, which traversed the country and punished them.

(2) Expedition against the Jowaki Afridis of the Bori villages in 1853. When the Afridis of the Kohat Pass misbehaved in 1850, the Jowaki Afridis offered the use of their route instead; but they turned out worse than the others, and in 1853 a force of 1700 British traversed their country and destroyed their stronghold at Bori. The Jowaki Afridis are a clan of the Adam Khel, who inhabit the country lying between the Kohat Pass and the river Indus.

(3) Expedition against the Aka Khel Afridis under Colonel Craigie in 1855. In 1854 the Aka Khels, not finding themselves admitted to a share of the allowances of the Kohat Pass, commenced a series of raids on the Peshawar border and attacked a British camp. An expedition of 1500 troops entered the country and inflicted severe punishment on the tribe, who made their submission and paid a fine.

(4) Expedition against the Jowaki Afridis under Colonel Mocatta in 1877. In that year the government proposed to reduce the Jowaki allowance for guarding the Kohat Pass, and the tribesmen resented this by cutting the telegraph wire and raiding into British territory. A force of 1500 troops penetrated their country in three columns, and did considerable damage by way of punishment.

(5) Expedition against the Jowaki Afridis under Brigadier-General Keyes in 1877–78. The punishment inflicted by the previous expedition did not prove sufficiently severe, the attitude of the Jowakis continued the same and their raids into British territory went on. A much stronger force, therefore, of 7400 British troops, divided into three columns, destroyed their principal villages and occupied their country for some time, until the tribe submitted and accepted government terms. The Kohat Pass was afterwards practically undisturbed.

(6) Expedition against the Zakka Khel Afridis of the Bazar Valley under Brigadier-General Tytler in 1878. At the time of the British advance into Afghanistan, during the second Afghan War, the Zakka Khel opposed the British advance and attacked their outposts. A force of 2500 British troops traversed their country, and the tribesmen made their submission.

(7) Expedition against the Zakka Khel Afridis of the Bazar Valley under Lieutenant-General Maude in 1879. After the previous expedition the Afridis of the Khyber Pass continued to give trouble during the progress of the second Afghan War, so another force of 3750 British troops traversed their country, and after suffering some loss the tribesmen made their submission. After this both the Khyber and Kohat Passes were put on a stable footing, and no further trouble of any consequence occurred in either down to the time of the frontier risings of 1897, when the Afridis attacked the Khyber Pass, which was defended by Afridi levies.

(8) For the Tirah Campaign of 1897 see TIRAH CAMPAIGN.

(9) In the February of 1908 the restlessness of the Zakka Khel again made a British expedition necessary, under Sir James Willcocks; but the campaign was speedily ended, though in the following April he had again to proceed against the Mohmands, the situation being complicated by an incursion from Afghanistan.

See also Paget and Mason's *Frontier Expeditions* (1884); Warburton's *Eighteen Years in the Khyber* (1900). (C. L.)

AFTERGLOW, a broad high arch of whitish or rosy light appearing occasionally in the sky above the highest clouds in the hour of deepening twilight, or reflected from the high snowfields in mountain regions long after sunset. The phenomenon is due to very fine particles of dust suspended in the high regions of the atmosphere that produce a scattering effect upon the component parts of white light. After the eruption of Krakatoa in 1883, a remarkable series of red sunsets appeared all over the world. These were due to an enormous amount of exceedingly fine dust blown to a great height by that terrific explosion, and then universally diffused by the high atmospheric currents.

AFZELIUS, ADAM (1750–1837), Swedish botanist, was born at Larf, Vestergötland, in 1750. He was appointed teacher of oriental languages at Upsala in 1777, and in 1785 demonstrator of botany. From 1792 he spent some years on the west coast of Africa, and in 1797–1798 acted as secretary of the Swedish embassy in London. Returning to Sweden, he founded the Linnaean institute at Upsala in 1802, and in 1812 became professor of materia medica at the university. He died at Upsala in 1836. In addition to various botanical writings, he published the autobiography of Linnaeus in 1823.

His brother, JOHAN AFZELIUS (1753–1837), known as ARVIDSON, was professor of chemistry at Upsala; and another brother, PER AF (1760–1843), who became professor of medicine at Upsala in 1801, was distinguished as a medical teacher and practitioner.

AFZELIUS, ARVID AUGUST (1785–1871), Swedish pastor, poet, historian and mythologist, was born on the 8th of October 1785. From 1828 till his death on the 25th of September 1871 he was parish priest of Enköping. He is mainly known as a collaborator with the learned historian, Erik Gustaf Geijer, in the great collection of Swedish folk-songs, *Stenske folkirsor från forntiden*, 3 vols. (Stockholm, 1814–1816). He published also translations of the *Sämunder Edda* and *Herwara-Saga*, and a history of Sweden to Charles XII. (of which a German translation was published in 1842), as well as original poems.

AGA, or AGHA, a word, said to be of Tatar origin, signifying a dignitary or lord. Among the Turks it is applied to the chief of the janissaries, to the commanders of the artillery, cavalry and infantry, and to the eunuchs in charge of the seraglio. It is also employed generally as a term of respect in addressing wealthy men of leisure, landowners, &c.

AGAIAMBO, or AGAUMBU, a race of dwarf marsh-dwellers in British New Guinea, now almost extinct. In his annual report for 1904 the acting administrator of British New Guinea stated that on a visit he paid to their district he saw six males and four females. The Agaiambo live in huts erected on piles in the lakes and marshes. Dwarfish in stature but broadly built, they are remarkable for the shortness of their legs. They live almost entirely in their "dug-outs" or canoes, or actually wading in the water. Their food consists of sago, the roots of the water-lily and fish. The Agaiambo are believed to have been formerly numerous, but within the last few years have suffered from the raids of their cannibalistic Papuan neighbours. In features, colour and hair they closely resemble the true Papuans.

AGA KHAN I., HIS HIGHNESS THE (1800–1881), the title accorded by general consent to HASAN ALI SHAH (born in Persia, 1800), when, in early life, he first settled in Bombay under the protection of the British government. He was believed to have descended in direct line from Ali by his wife Fatima, the daughter of the Prophet Mahomet. Ali's son, Hosain, having married a daughter of one of the rulers of Persia before the time of Mahomet, the Aga Khan traced his descent from the royal house of Persia from the most remote, almost prehistoric, times. His ancestors had also ruled in Egypt as caliphs of the Beni-Fatimites for a number of years, at a period coeval with the Crusades. Before the Aga Khan emigrated from Persia, he was appointed by the emperor Fateh Ali Shah to be governor-general of the extensive and important province of Kerman. His rule was noted for firmness, moderation and high political sagacity, and he succeeded for a long time in retaining the friendship and confidence of his master the shah, although his career was beset with political intrigues and jealousy on the part of rival and court favourites, and with internal turbulence. At last, however, the fate usual to statesmen in oriental countries overtook him, and he incurred the mortal displeasure of Fateh Ali Shah. He fled from Persia and sought protection in British territory, preferring to settle down eventually in India, making Bombay his headquarters. At that period the first Afghan War was at its height, and in crossing over from Persia through Afghanistan the Aga Khan found opportunities of rendering valuable services to the British army, and thus cast in his lot for ever with the British. A few years later he rendered similar conspicuous services in the course of the Sind campaign, when his help was utilized by Napier in the process of subduing the frontier tribes, a large number of whom acknowledged the Aga's authority as their spiritual head. Napier held his Moslem ally in great esteem, and entertained a very high opinion of his political acumen and chivalry as a leader and soldier. The Aga Khan reciprocated the British commander's confidence and friendship by giving repeated proofs of his devotion and attachment to the British government, and when he finally settled down in India, his position as the leader of the large Ismailiah section of Mahommedan British subjects was recognized by the government, and the title of His Highness was conferred on him, with a large pension. From that time until his death in 1881 the Aga Khan, while leading the life of a peaceful and peacemaking citizen, under the protection of British rule, continued to discharge his sacerdotal functions, not only among his followers in India, but towards the more numerous communities which acknowledged his religious sway in distant countries, such as Afghanistan, Khorasan, Persia, Arabia, Central Asia, and even distant Syria and Morocco. He remained throughout unflinchingly loyal to the British *Raj*, and by his vast and unquestioned influence among the frontier tribes on the northern borders of India he exercised a control over their unruly passions in times of trouble, which proved of invaluable service in the several expeditions led by British arms on the north-west frontier of India. He was also the means of checking the fanaticism of the more turbulent Mahommedans in British India, which in times of internal troubles and misunderstandings finds vent in the shape of religious or political riots.

He was succeeded by his eldest son, Aga Khan II. This prince continued the traditions and work of his father in a manner that won the approbation of the local government, and earned for him the distinction of a knighthood of the Order of the Indian Empire and a seat in the legislative council of Bombay.

Aga Khan III. (Sultan Mahommed Shah), only son of the foregoing, succeeded him on his death in 1885, and became the head of the family and its devotees. He was born in 1877, and, under the care of his mother, a daughter of the ruling house of Persia, was given not only that religious and oriental education which his position as the religious leader of the Ismailiahs made indispensable, but a sound European training, a boon denied to his father and grandfather. This blending of the two systems of education produced the happy result of fitting this Moslem chief in an eminent degree both for the sacerdotal functions which appertain to his spiritual position, and for those social duties of a great and enlightened leader which he was called upon to discharge by virtue of that position. He travelled in distant parts of the world to receive the homage of his followers, and with the object either of settling differences or of advancing their welfare by pecuniary help and personal advice and guidance. The distinction of a knight commander of the Indian Empire was conferred upon him by Queen Victoria in 1897, and he received like recognition for his public services from the German emperor, the sultan of Turkey, the shah of Persia and other potentates.

See Naoroji M. Dumasia, *A Brief History of the Aga Khan* (1903). (M. M. Bh.)

AGALMATOLITE (from Gr. ἄγαλμα, statue, and λίθος, stone), a soft species of mineral, also called *pagodite*, used by the Chinese for carving, especially into grotesque figures (whence called "figure-stone").

AGAMEDES, in Greek legend, son of Erginus, king of Orchomenus in Boeotia. He is always associated with his brother Trophonius as a wonderful architect, the constructor of underground shrines and grottos for the reception of hidden treasure. When building a treasure-house for Hyrieus, the brothers fixed one of the stones in the wall so that they could remove it whenever they pleased, and from time to time carried off some of the treasure. Hyrieus thereupon set a trap in which Agamedes was caught; Trophonius, to prevent discovery, cut off his brother's head and fled with it. He was pursued by Hyrieus, and swallowed up by the earth in the grove of Lebadeia. On this spot was the oracle of Trophonius in an underground cave; those who wished to consult it first offered the sacrifice of a ram and called upon the name of Agamedes. A similar story is told of Rhampsinitus by Herodotus (ii. 121). According to Pindar (*apud* Plutarch), the brothers built the temple of Apollo at Delphi; when they asked for a reward, the god promised them one in seven days; on the seventh day they died.

Pausanias ix. 37; Plutarch, *Consolatio ad Apollonium*, 14; Cicero, *Tusc. Disp.* i. 47.

AGAMEMNON, one of the most distinguished of the Greek heroes, was the son of Atreus (king of Mycenae) and Aërope, grandson of Pelops, great-grandson of Tantalus and brother of Menelaus. Another account makes him the son of Pleisthenes (the son or father of Atreus), who is said to have been Aërope's first husband. Atreus was murdered by Aegisthus (*q.v.*), who took possession of the throne of Mycenae and ruled jointly with his father Thyestes. During this period Agamemnon and Menelaus took refuge with Tyndareus, king of Sparta, whose daughters Clytaemnestra (more correctly Clytaemestra) and Helen they respectively married. By Clytaemnestra, Agamemnon had three daughters, Iphigeneia (Iphianassa), Electra (Laodice), Chrysothemis, and a son, Orestes. Menelaus succeeded Tyndareus, and Agamemnon, with his brother's assistance, drove out Aegisthus and Thyestes, and recovered his father's kingdom. He extended his dominion by conquest and became the most powerful prince in Greece. When Paris (Alexander), son of Priam, had carried off his brother's wife, he went round to the princes of the country and called upon them to unite in a war of revenge against the Trojans. He himself furnished 100 ships, and was chosen commander-in-chief of the combined forces. The fleet, numbering 1200 ships, assembled at the port of Aulis in Boeotia. But Agamemnon had offended the goddess Artemis by slaying a hind sacred to her, and boasting himself a better hunter. The army was visited by a plague, and the fleet was prevented from sailing by the total absence of wind. Calchas announced that the wrath of the goddess could only be appeased by the sacrifice of Iphigeneia (*q.v.*). The fleet then set sail. Little is heard of Agamemnon until his quarrel with Achilles (*q.v.*). After the capture of Troy, Cassandra, the daughter of Priam, fell to his lot in the distribution of the prizes of war. On his return, after a stormy voyage, he landed in Argolis. His kinsman, Aegisthus, who in the interval had seduced his wife Clytaemnestra, invited him to a banquet at which he was treacherously slain, Cassandra also being put to death by Clytaemnestra. According to the account given by Pindar and the tragedians, Agamemnon was slain by his wife alone in a bath, a piece of cloth or a net having first been thrown over him to prevent resistance. Her wrath at the sacrifice of Iphigeneia, and her jealousy of Cassandra, are said to have been the motives of her crime. The murder of Agamemnon was avenged by his son Orestes (*q.v.*). Although not the equal of

Achilles in bravery, Agamemnon is a dignified representative of kingly authority. As commander-in-chief, he summons the princes to the council and leads the army in battle. He takes the field himself, and performs many heroic deeds until he is wounded and forced to withdraw to his tent. His chief fault is his overweening haughtiness, due to an over-exalted opinion of his position, which leads him to insult Chryses and Achilles, thereby bringing great disaster upon the Greeks. But his family had been marked out for misfortune from the outset. His kingly office had come to him from Pelops through the blood-stained hands of Atreus and Thyestes, and had brought with it a certain fatality which explained the hostile destiny which pursued him. The fortunes of Agamemnon have formed the subject of numerous tragedies, ancient and modern, the most famous being the *Oresteia* of Aeschylus. In the legends of Peloponnesus, Agamemnon was regarded as the highest type of a powerful monarch, and in Sparta he was worshipped under the title of Zeus Agamemnon. His tomb was pointed out among the ruins of Mycenae and at Amyclae.

In works of art there is considerable resemblance between the representations of Zeus, king of the gods, and Agamemnon, king of men. He is generally characterized by the sceptre and diadem, the usual attributes of kings.

See articles in Pauly-Wissowa's *Realencyclopädie* and Roscher's *Lexikon der Mythologie*.

AGAPĒ (Gr. ἀγάπη, "Love"), the early Christian love-feast. The word seems to be used in this sense in the epistle of Jude 12: "These are they who are hidden rocks in your love-feasts when they banquet with you." But this is not certain, for in 2 Pet. ii. 13 the verse is cited, but reading ἀπάταις ("deceits") for ἀγάπαις, and the oldest MSS. hesitate. The history of the *agapē* coincides, until the end of the 2nd century, with that of the eucharist (*q.v.*), and it is doubtful whether the following detailed account of the *agapē* given in Tertullian's *Apology* (c. 39) is to be regarded as exclusive of an accompanying eucharist: "It is the banquet (*triclinium*) alone of the Christians that is criticised. Our supper (*coena*) shows its character by its name. It is called by a word which in Greek signifies love (*i.e. agapē*). Whatever it costs, it is anyhow a clear gain that it is incurred on the score of piety, seeing that we succour the poorest by such entertainments (*refrigerio*). We do not lie down at table until prayer has been offered to God, as it were a first taste. We eat only to appease our hunger, we drink only so much as it is good for temperate persons to do. If we satisfy our appetites, we do so without forgetting that throughout the night we must say our prayers to God. If we converse, it is with the knowledge that the Lord is listening. After washing our hands and lighting the lamps, each is invited to sing a hymn before all to God, either taken from holy writ or of his own composition. So we prove him, and see how well he has drunk. Prayer ends, as it began, the banquet; and we break up not in bands of brigands, nor in groups of vagabonds, nor do we burst out into debauchery. . . . This meeting of Christians we admit deserves to be made illicit, if it resembles illicit acts; it deserves to be condemned, if any complain of it on the same score on which complaints are levelled at factious meetings. But to do harm to whom do we ever thus come together?"

The evidence of Tertullian is good for Africa. But in Egypt about the same time (180–210), Clement of Alexandria in his *Pedagogus* (ii. 1) condemns the "little suppers which were called, not without presumption, *agapē*." This word, he complains, should denote the heavenly food, the reasonable feast alone, and the Lord never used it of mere junketings. Clement wished the name to be reserved for the eucharist, because the love-feasts of the church had degenerated, as Tertullian too discovered, as soon as he turned Motanist. For in his tract on fasting (ch. xvii.) he complains that the young men misbehaved with the sisters after the *agapē*.

Among the spurious works of Athanasius is printed a tract entitled *About Virginity*, ch. xiii. of which directs how the sisters after the *synaxis* of the ninth hour (3 P.M.) are to dine: "When you sit down at a table and come to break bread, seal it thrice with the sign of the cross and thus give thanks: 'We thank thee, our Father, for thy holy resurrection; for through Jesus thy servant thou hast shewn it unto us. And as this bread on this table was scattered, but has been brought together and become one, so may thy church be brought together into thy kingdom. For thine is the power and the glory, for ever and ever, Amen.' This prayer as you break the bread, and are about to eat, you must say. And when you lay it on the table and desire to eat it, repeat the 'Our Father' entire. But after dinner (or breakfast), and when we rise from table, we use the prayer given above, viz. 'Blessed be God, who hath pity and nourisheth us from our infancy, who giveth food to all flesh. Fill our hearts with joy and gladness, that ever having of all things a sufficiency, we may superabound in all good works, in Christ Jesus our Lord, &c.'" The writer then enjoins that, "if two or three other virgins are present, they also shall give thanks over the bread set out, and join in the prayers. But if a catechumen be found at the table, she shall not be suffered to join with the full believers in their prayers, nor shall the latter sit with her to eat the morsel" (ψωμόν, used specially of the sanctified bread). "Nor shall they sit with frivolous and joking women, if they can help it, for they are sanctified to God, and their food and drink have been hallowed by the prayers and holy words used over them. . . . If a rich woman sits down with them at table, and they see a poor woman, they shall invite her also to eat with them, and not put her to shame because of the rich one." The last words echo 1 Cor. x., and the prayer is nearly the same as that which the teaching of the Apostles assigns for the eucharistic rite. Here, then, we have pictured as late as the 4th century a Lord's supper, which like the one described in 1 Cor. x. is *agapē* and eucharist in one, and it is held in a private house and not in church, and the celebrants are holy women!

The historian Socrates (*Hist. Eccl.* v. 22) testifies to the survival in Egypt of such Lord's suppers as were love-feasts and eucharists in one. Around Alexandria and in the Thebaid, he says, they hold services on the sabbath, and unlike other Christians partake of the mysteries (*i.e.* sacrament). For after holding good cheer and filling themselves with meats of all kinds, they at eventide make the offering (προσφορά) and partake of it. So Basil of Cappadocia (Epistle 93), about the year 350, records that in Egypt the laity, as a rule, celebrated the communion in their own houses, and partook of the sacrament by themselves whenever they chose. In the old Egyptian church order, known as the *Canons of Hippolytus*, there are numerous directions for the service of the *agapē*, held on Sundays, saints' days or at commemorations of the dead. The 74th canon of the council of Trullo (A.D. 692) forbade the holding of symposia known as *agapēs* in church. In his 54th homily (tom. v. p. 365) Chrysostom describes how after the eucharistic synaxis was over, the faithful remained in church, while the rich brought out meats and drink from their houses, and invited the poor, and furnished "common tables, common banquets, common symposia in the church itself." The council of Gangra (A.D. 355) anathematized the over-ascetic people who despised "the *agapēs* based on faith." Only a few years later, however, the council of Laodicea forbade the holding of *agapēs* in churches. The 42nd canon of the council of Carthage under Aurelius likewise forbade them, but these were only local councils. In the age of Chrysostom and Augustine the *agapē* was frequent.

In the east Syrian, the Armenian and the Georgian churches, respectively Nestorian, Monophysite and Greek Orthodox in their tenets, the *agapē* was from the first a survival, under Christian and Jewish forms, of the old sacrificial systems of a pre-Christian age. Sheep, rams, bullocks, fowls are given sacrificial salt to lick, and then sacrificed by the priest and deacon, who has the levitical portions of the victim as his perquisite. In Armenia the Greek word *agapē* has been used ever since the 4th century to indicate these sacrificial meals, which either began or ended with a eucharistic celebration. The earlier usage of the Armenians is expressed in the two following rules recorded against them by a renegade Armenian prelate named Isaac, who in the 8th century went over to the Byzantine church: "Christ did not hand down to us the teaching to celebrate the mystery of the offering of the bread in church, but in an ordinary house, and sitting at a common table. So then let them not sacrifice the offering of bread in churches. It was after supper, when his disciples were thoroughly sated, that Christ gave them of his own body to eat. Therefore let them first eat meats and be sated, and then let them partake of the mysteries." These old canons are adduced by way of ridiculing the Armenians, yet they reflect old usage. They are given in the *Historia Monothelitarum* of Combefisius, col. 317. Older MSS. of the Greek Euchologion contain numerous prayers to be offered over animals sacrificed; and in the form of *agapē* such sacrifices were common in Italy and Gaul on the *natalis dies* of a saint, and Paulinus of Nola, the friend of Augustine, in his Latin poems, describes them (*c.* 400) in detail. Gregory the Great sent to Mellitus, bishop of London, a written rite of sacrificing bulls for use in the English church of the early 7th century. In Augustine's work against Faustus the Manichean (xx. 4), the latter taxes the Catholics with having turned the sacrifices of the heathen into *agapēs*, their idols into martyrs, whom they worship with similar rites. "You appease," he says, "the shades of the dead with wines and banquets, you celebrate the feast-days of the heathen along with them . . . in their way of living you have certainly changed nothing." This was true enough, but there is truth also in the remark of Prof. Sanday ("Eucharist" in Hastings' *Dictionary of the Bible*) that Providence even in its revolutions is conservative. The world could only be christianized on condition that old holy days and customs were continued. The early Christian *agapē* admitted of adaptation to the older funeral and sacrificial feasts, and was so adapted. The association in the synoptics of the earliest eucharist with the paschal sacrifice provided a model, and long after the eucharist was separated with the *agapē* on other days of the year, we still find celebrated on the evening of Maundy Thursday the sacrifice of the paschal lamb, immediately followed by an eucharist. The 41st canon of the council of Carthage enacted that the sacraments of the altar should be received fasting, except on the anniversary of the Lord's supper. It is clear that at an earlier date the *agapē* preceded the eucharist.

Pagan Analogues.—In ancient states common meals called *sussitia* (συσσίτια) were instituted, particularly in the Doric states, *e.g.* in Lacaedemon and in Crete. Plato advocated them, and perhaps the later Jews imitated the Spartan community. Trade and other gilds in antiquity held subscription suppers or ἔρανοι, similar to those of the early Corinthian church, usually to support the needs of the poorer members. These *hetairiae* or clubs were forbidden (except in cities formally allied to Rome) by Trajan and other emperors, as being likely to be centres of disaffection; and on this ground Pliny forbade the *agapē* of the Bithynian churches, Christianity not being a lawful religion licensed for such gatherings. The custom which most resembles the eucharist and *agapē* was that known as *charistia* described by Valerius Maximus ii. 1. 8. It was a solemn feast attended only by members of one clan, at which those who had quarrelled were at the sacrament of the table (*apud sacra mensae*) reconciled. It was held on the 20th of February. Ovid in his *Fasti*, ii. 617, alludes to it—

Proxima cognati dixere charistia cari,
Et venit ad socios turba propinqua deos.

Authorities.—"The Canons of Hippolytus," in Duchesne's *Origines du culte chrétien* (Paris, 1898); A. Allen, *Christian Institutions* (London, 1898); P. Batiffol, *Études d'histoire* (Paris, 1902 and 1905); F. X. Funk, "L'Agapé," in the *Revue de l'histoire ecclésiastique* (Louvain, Jan. 1903); Ad. Harnack, "Brod und Wasser" (*Texte und Untersuch.* vii. 2, Leipzig, 1891); J. F. Keating, *The Agapé and the Eucharist* (London, 1901); F. X. Kraus, arts. "Agapen" and "Mahle" in the *Realencyklop. d. christl. Altertümer*; P. Ladeuze, "L'Eucharistie et les repas communs" in the *Revue de l'orient chrétien*, No. 3, 1902; Sir W. M. Ramsay, *The Church in the Roman Empire* (London, 1894); A. Spitta, *Zur Geschichte und Litteratur* (Göttingen, 1893); E. von der Goltz, *Das Gebet in ältesten Christianheit* (Leipzig, 1901); F. E. Warren, *The Liturgy and Ritual of the Antenicene Church* (London, 1897); T. Zahn, art. "Agapen" in Hauck's *Realencyklop.*; F. C. Conybeare, *Rituale Armenorum* (Oxford, 1905; it contains the oldest Latin and Greek forms), *The Key of Truth* (Oxford, 1898), and art. on "The Survival of Animal Sacrifices" in the *American Journal of Theology* (Chicago, Jan. 1903); F. X. Funk, *Didascalia et Constitutiones Apostolorum* (Paderborn, 1906); V. Ermoni, *L'Agape* (Paris, 1904); G. Horner, *The Statutes of the Apostles*, translated from Ethiopic and Arabic MSS. (London, 1904); Thefr. Drescher, *Diss. de vet. Christianorum Agapis* (Giesse, 1824); L. A. Muratori, *Anecdota Graeca*, "De agapis sublatis" (Patavii, 1709); I. A. Fabricius, *Bibliogr. Ant.* p. 587; Muenter, *Primord. Eccl. Afr.* p. 111; Walafrid Strabo, *De Rebus Eccles.* capita 18, 19; Gregory of Tours, *De miraculis S. Juliani*, xxxi.; Paulini Nolani *Carmen xii. in S. Felicem.* (F. C. C.)

AGAPEMONITES, or Community of the Son of Man. This sect, based upon the theories of various German religious mystics, and having for its primary object the spiritualization of the matrimonial state, was founded in 1846 by the Rev. Henry James Prince, a clergyman of the Church of England (1811-1899). He studied medicine, obtained his qualifications in 1832 and was appointed medical officer to the General Hospital in Bath, his native city. Compelled by ill-health to abandon his profession, he entered himself in 1837 as a student at St. David's Theological College, Lampeter, where he gathered about him a band of earnest religious enthusiasts, known as the Lampeter Brethren, and was eventually ordained to the curacy of Charlinch in Somerset, where he had sole charge in the illness and absence of the rector, the Rev. Samuel Starkey. By that time he had contracted his first "spiritual marriage," and had persuaded himself that he had been absorbed into the personality of God and had become a visible embodiment of the Holy Spirit. During his illness Mr. Starkey read one of his curate's sermons, and was not only "cured" forthwith, but embraced his strange doctrines, and together they procured many conversions in the countryside and the neighbouring towns. In the end the rector was deprived of his living and Prince's licence withdrawn, and together with a few disciples they started the Charlinch Free Church, which had a very brief existence. Prince shortly afterwards became curate of Stoke in Suffolk, where, however, the character of his revivalist zeal caused his departure at the end of twelve months. It was now decided that Prince, Starkey (whose sister Prince had married as his second wife) and the Rev. Lewis Prince should leave the Church of England and preach their own gospel; Prince opened Adullam Chapel, Brighton, and Starkey established himself at Weymouth. The chief success lay in the latter town, and thither Prince soon migrated. A number of followers, estimated by Prince at 500, but by his critics at one-fifth of the number, were got together, and it was given out by "Beloved" or "The Lamb"—the names by which the Agapemonites designated their leader—that his disciples must divest themselves of their possessions and throw them into the common stock. This was done, even by the poor or ill-furnished, all of whom looked forward to the speedy end of the present dispensation, and were content, for the short remainder of this world, to live in common, and, while not repudiating earthly ties, to treat them as purely spiritual. With the money thus obtained the house at Spaxton, which was to become the "Abode of Love," was enlarged and furnished luxuriously, and three sisters, who contributed £6000 each, were immediately married to three of Prince's nearest disciples. Despite the purely spiritual ideas which underlay the Agapemonite view of marriage, a son was born to one of these couples, and when the father endeavoured to carry it away an action was brought which resulted in the affirmation of the mother's right to its custody. The circumstance in which a fourth sister who joined the community was abducted by her brothers led to an inquiry in lunacy and to her final settlement at Spaxton. A few years after the establishment of the "Abode of Love," a peculiarly gross scandal, in which Prince and one of his female followers were involved, led to the secession of some of his most faithful friends, who were unable any longer to endure what they regarded as the amazing mixture of blasphemy and immorality offered for their acceptance. The most prominent of those who remained received such titles as the "Anointed Ones," the "Angel of the Last Trumpet," the "Seven Witnesses" and so forth. In 1862 "Brother Prince" sent "to the kings and people of the earth" letters "making known to all men that flesh is saved from death." At that period the Agapemonites counted their adherents at 600, and it was no doubt a grievous shock to them when their deathless founder died on the 8th of March 1899, four years after he had opened a branch church at Clapton, London, which is said to have cost £20,000. This church, decorated with elaborate symbolism, was styled the "Ark of the Covenant," and in it the elect were to await the coming of the Lord.

On the death of "Brother" Prince, the Rev. T. H. Smyth-Pigott, pastor of the "Ark," became the acknowledged head of the sect. He was born in 1852, of an old Somersetshire county family, and, after a varied career as university man, sailor before the mast, soldier, coffee-planter, curate in the Church of England and evangelist in the Salvation Army, was converted about 1897 to the views of Prince. For five years after this he was not heard of outside his own sect. On the 7th of September 1902, however, the congregation, assembled at the Ark of the Covenant for service, found the communion table replaced by a chair. In this Pigott presently seated himself and proclaimed himself as the Messiah with the words, "God is no longer there," pointing upwards, "but here," pointing to himself. This astonishing announcement was followed by an excellent sermon on Christian love. Pigott's claim was at once admitted by the members of his sect, including even his own wife, as the fulfilment of the promise of Christ to appear in due time in the "Ark." By the outside world the affair was greeted with mingled ridicule and indignation, and the new Messiah had to be protected by the police from the violence of an angry mob. After providing "copy" for the newspapers for a few days, however, the whole thing was forgotten. Pigott retired to the headquarters of the sect, the "Abode of Love" in Somerset, and all efforts to interview him or to obtain details of the life of the community were abortive. At last, in August 1905, the long and mysterious silence was broken by the announcement that a son had been born to Pigott by his "spiritual wife," Miss Ruth Preece, an inmate of the Agapemone. This event by no means disconcerted the believers, who saw in it only another manifestation of Pigott's divinity, and proclaimed it as "an earnest of the total redemption of man." The child was registered as "Glory," and, at the christening service in the chapel of the Abode, hymns were sung in its honour as it lay in a jewelled cradle in the chancel. Another child by Miss Preece, christened "Power," was born on the 20th of August 1908. The publicity given to this event renewed the scandal, and in November an attempt to "tar and feather" Mr Pigott resulted in two men being sent to prison. Later in the month proceedings were instituted against him by the bishop of Bath and Wells under the Clergy Discipline Act.

One outcome of the disclosures connected with the Agapemone deserves passing mention, as throwing some light on the origin of the wealth of the community. Mr Charles Stokes Read, a resident at the Agapemone and director of the V. V. Bread Company, was requested by his fellow-directors to resign, on the ground that his connexion with the sect was damaging the business of the company. He denied this to be the case and refused to resign, pleading religious liberty and the large interests of Agapemonites in the concern. On the 13th of September 1905, a meeting of the shareholders of the company was held, and Read "asked them to believe that it was not in the interests of the company, but because he knew that the Lord Jesus Christ had come again and was now dwelling at the Agapemone, that he was thus cast out by his colleagues." The motion calling on him to resign was carried on a poll being taken by 46,770 votes to 2953. (See *The Times*, 14th of September 1905.)

AGAPETAE, a class of "virgins" who, in the church of the early middle ages, lived with professedly celibate monks to whom they were said to be united by spiritual love. The practice was suppressed by the Lateran Council of 1139.

AGAPETUS, the name of two popes:—

Agapetus I., pope from 535 to 536. He was an enlightened pontiff and collaborated with Cassiodorus in founding at Rome a library of ecclesiastical authors. King Theodahad sent him on an embassy to Constantinople, where he died, after having deposed Anthimus, the monophysite bishop of that town, and ordained Menas his successor.

Agapetus II., pope from 946 to 955, at the time when Alberic, son of Marozia, was governing the independent republic of Rome under the title of "prince and senator of the Romans." Agapetus, a man of some force of character, did his best to put a stop to the degradation into which the papacy had fallen, the so-called "Pornocracy," which lasted from the accession of Sergius III. in 904 to the deposition of John XII. in 963. His appeal to Otto the Great to intervene in Rome remained without immediate effect, since Alberic's position was too strong to be attacked, but it bore fruit after his death. Agapetus died on the 8th of November 955.

AGAPETUS, a deacon of the church of St Sophia at Constantinople. He presented to the emperor Justinian, on his accession in 527, a work entitled *Scheda regia sive de officio regis*, which contained advice on the duties of a Christian prince. The work was often reprinted and is included in Dom Anselme Banduri's *Imperium Orientale* (Paris, 1711). There is an English translation by Thomas Paynell (1550) and a French translation, executed in 1612 from a Latin version by Louis XIII., with the assistance of his tutor, David Rivault.

AGARDE, ARTHUR (1540–1615), English antiquary, was born at Foston, Derbyshire, in 1540. He was trained as a lawyer, but entered the exchequer as a clerk. On the authority of Anthony à Wood it has been stated that he was appointed by Sir Nicholas Throckmorton to be deputy-chamberlain in 1570, and that he held this office for forty-five years. His patent of appointment, however, preserved in the Rolls Office, proves that he succeeded one Thomas Reve in the post on the 11th of July 1603. With his friends, Sir Robert Cotton and Camden, he was one of the original members of the Society of Antiquaries. He spent much labour in cataloguing the records and state papers, and made a special study of the Domesday Book, preparing an explanation of its more obscure terms. Thomas Hearne, in his *Collection of Curious Discourses written by Eminent Antiquaries* (Oxford, 1720), includes six by Agarde on such subjects as the origin of parliament, the antiquity of shires, the authority and privileges of heralds, &c. Agarde died on the 22nd of August 1615 and was buried in the cloister of Westminster Abbey, on his tomb being inscribed "*Recordorum regiorum hic prope depositorum diligens scrutator.*" He bequeathed to the exchequer all his papers relating to that court, and to his friend Sir Robert Cotton his other manuscripts, amounting to twenty volumes, most of which are now in the British Museum.

AGAS, RADULPH, or Ralph (*c.* 1540–1621), English land-surveyor, was born at Stoke-by-Nayland, Suffolk, about 1540, and entered upon the practice of his profession in 1566. Letters which he wrote to Lord Burghley, describing the methods of surveying, are extant, and a kind of advertising prospectus of his abilities, in which he describes himself as clever at arithmetic and "skilled in writing smaule, after the skantelinge & proportion of copiynge the Oulde & New Testamentes seven tymes in one skinne of partchmente without anie woorde abreviate or contracted, which maie also serve for drawinge discriptions of contries into volumes portable in verie little cases." He is best known for his maps of Oxford (1578), Cambridge (1502) and London. Copies of the first two are preserved in the Bodleian Library. Of the map of London and Westminster, which was probably prepared about 1591, two copies have been preserved, one by the Corporation of London and the other in the Pepysian collection at Magdalene College, Cambridge. The map is over six feet long, printed from wooden blocks, and gives a valuable picture of the London of Elizabeth's time. Agas died on the 26th of November 1621.

AGASIAS. There were two Greek sculptors of this name. Agasias, son of Dositheus, has signed the remarkable statue called the Borghese Warrior, in the Louvre. Agasias, son of Menophilus, is the author of another striking figure of a warrior in the museum of Athens. Both belonged to the school of Ephesus and flourished about 100 B.C.

See E. A. Gardner, *Handbook of Greek Sculpture*, ii. p. 475.

AGASSIZ, ALEXANDER EMANUEL (1835–1910), American man of science, son of J. L. R. Agassiz, was born in Neuchâtel, Switzerland, on the 17th of December 1835. He came to the

United States with his father in 1846; graduated at Harvard in 1855, subsequently studying engineering and chemistry, and taking the degree of bachelor of science at the Lawrence scientific school of the same institution in 1857; and in 1859 became an assistant in the United States Coast Survey. Thenceforward he became a specialist in marine ichthyology, but devoted much time to the investigation, superintendence and exploitation of mines, being superintendent of the Calumet and Hecla copper mines, Lake Superior, from 1866 to 1869, and afterwards, as a stockholder, acquiring a fortune, out of which he gave to Harvard, for the museum of comparative zoology and other purposes, some $500,000. In 1875 he surveyed Lake Titicaca, Peru, examined the copper mines of Peru and Chile, and made a collection of Peruvian antiquities for that museum, of which he was curator from 1874 to 1885. He assisted Sir Wyville Thomson in the examination and classification of the collections of the "Challenger" exploring expedition, and wrote the *Review of the Echini* (2 vols., 1872–1874) in the reports. Between 1877 and 1880 he took part in the three dredging expeditions of the steamer "Blake," of the United States Coast Survey, and presented a full account of them in two volumes (1888). Of his other writings on marine zoology, most are contained in the bulletins and memoirs of the museum of comparative zoology; but he published in 1865 (with Elizabeth Cary Agassiz, his stepmother) *Seaside Studies in Natural History*, a work at once exact and stimulating, and in 1871 *Marine Animals of Massachusetts Bay.*

AGASSIZ, JEAN LOUIS RODOLPHE (1807–1873), Swiss naturalist and geologist, was the son of the Protestant pastor of the parish of Motier, on the north-eastern shore of the Lake of Morat (Murten See), and not far from the eastern extremity of the Lake of Neuchâtel. Agassiz was born at this retired place on the 28th of May 1807. Educated first at home, then spending four years at the gymnasium of Bienne, he completed his elementary studies at the academy of Lausanne. Having adopted medicine as his profession, he studied successively at the universities of Zurich, Heidelberg and Munich; and he availed himself of the advantages afforded by these universities for extending his knowledge of natural history, especially of botany. After completing his academical course, he took in 1829 his degree of doctor of philosophy at Erlangen, and in 1830 that of doctor of medicine at Munich.

Up to this time he had paid no special attention to the study of ichthyology, which soon afterwards became the great occupation of his life. Agassiz always declared that he was led into ichthyological pursuits through the following circumstances:—In 1819-1820, J. B. Spix and C. F. P. von Martius were engaged in their celebrated Brazilian tour, and on their return to Europe, amongst other collections of natural objects they brought home an important set of the freshwater fishes of Brazil, and especially of the Amazon river. Spix, who died in 1826, did not live long enough to work out the history of these fishes; and Agassiz, though little more than a youth just liberated from his academic studies, was selected by Prof. Martius for this purpose. He at once threw himself into the work with that earnestness of spirit which characterized him to the end of his busy life, and the task of describing and figuring the Brazilian fishes was completed and published in 1829. This was followed by an elaborate research into the history of the fishes found in the Lake of Neuchâtel. Enlarging his plans, he issued in 1830 a prospectus of a *History of the Freshwater Fishes of Central Europe.* It was only in 1839, however, that the first part of this publication appeared, and it was completed in 1842. In 1832 he was appointed professor of natural history in the university of Neuchâtel. Having become a professed ichthyologist, it was impossible that the fossil fishes should fail to attract his attention. The rich stores furnished by the slates of Glarus and the limestones of Monte Bolca were already well known; but very little had been accomplished in the way of scientific study of them. Agassiz, as early as 1829, with his wonted enthusiasm, planned the publication of the work which, more than any other, laid the foundation of his world-wide fame. Five volumes of his *Recherches sur les poissons fossiles* appeared at intervals from 1833 to 1843 [1844]. They were magnificently illustrated, chiefly through the labours of Joseph Dinkel, an artist of remarkable power in delineating natural objects. In gathering materials for this great work Agassiz visited the principal museums in Europe, and meeting Cuvier in Paris, he received much encouragement and assistance from him.

Agassiz found that his palaeontological labours rendered necessary a new basis of ichthyological classification. The fossils rarely exhibited any traces of the soft tissues of fishes. They consisted chiefly of the teeth, scales and fins, even the bones being perfectly preserved in comparatively few instances. He therefore adopted his well-known classification, which divided fishes into four groups—viz. Ganoids, Placoids, Cycloids and Ctenoids, based on the nature of the scales and other dermal appendages. While Agassiz did much to place the subject on a scientific basis, his classification has not been found to meet the requirements of modern research. As remarked by Dr A. Smith Woodward, he sought to interpret the past structures by too rigorous a comparison with those of living forms. (See *Catalogue of Fossil Fishes in the British Natural History Museum.*)

As the important descriptive work of Agassiz proceeded, it became obvious that it would over-tax his resources, unless assistance could be afforded. The British Association came to his aid, and the earl of Ellesmere—then Lord Francis Egerton—gave him yet more efficient help. The original drawings made for the work, chiefly by Dinkel, amounted to 1290 in number. These were purchased by the Earl, and presented by him to the Geological Society of London. In 1836 the Wollaston medal was awarded by the council of that society to Agassiz for his work on fossil ichthyology; and in 1838 he was elected a foreign member of the Royal Society. Meanwhile the invertebrate animals engaged his attention. In 1837 he issued the "Prodrome" of a monograph on the recent and fossil Echinodermata, the first part of which appeared in 1838; in 1839–1840 he published two quarto volumes on the fossil Echinoderms of Switzerland; and in 1840-1845 he issued his *Études critiques sur les mollusques fossiles.*

Subsequently to his first visit to England in 1834, the labours of Hugh Miller and other geologists brought to light the remarkable fishes of the Old Red Sandstone of the north-east of Scotland. The strange forms of the *Pterichthys*, the *Coccosteus* and other genera were then made known to geologists for the first time. They naturally were of intense interest to Agassiz, and formed the subject of a special monograph by him published in 1844–1845: *Monographie des poissons fossiles du Vieux Grès Rouge, ou Système Dévonien (Old Red Sandstone) des Iles Britanniques et de Russie.*

The year 1836 witnessed the inauguration of a new investigation, which proved to be of the utmost importance to geological science. Previously to this date de Saussure, Venetz, Charpentier and others had made the glaciers of the Alps the subjects of special study, and Charpentier had even arrived at the conclusion that the erratic blocks of alpine rocks scattered over the slopes and summits of the Jura mountains had been conveyed thither by glaciers. The question having attracted the attention of Agassiz, he not only made successive journeys to the alpine regions in company with Charpentier, but he had a hut constructed upon one of the Aar glaciers, which for a time he made his home, in order to investigate thoroughly the structure and movements of the ice. These labours resulted in the publication of his grand work in two volumes entitled *Études sur les glaciers,* 1840. Therein he discussed the movements of the glaciers, their moraines, their influence in grooving and rounding the rocks over which they travelled, and in producing the striations and *roches moutonnées* with which we are now so familiar. He not only accepted Charpentier's idea that some of the alpine glaciers had extended across the wide plains and valleys drained by the Aar and the Rhone, and thus landed parts of their remains upon the uplands of the Jura, but he went still farther. He concluded that, at a period geologically recent, Switzerland had been another Greenland; that instead of a few glaciers stretching across the areas referred to, one vast sheet of ice, originating in the higher Alps, had extended over the entire valley of north-western Switzerland until it reached the southern slopes of the Jura, which, though they checked and deflected its further extension, did not prevent the ice from reaching in many places the summit of the range. The publication of this work gave a fresh impetus to the study of glacial phenomena in all parts of the world.

Thus familiarized with the phenomena attendant on the movements of recent glaciers, Agassiz was prepared for a discovery which he made in 1840, in conjunction with William Buckland. These two *savants* visited the mountains of Scotland together, and found in different localities clear evidence of ancient glacial action. The discovery was announced to the Geological Society of London in successive communications from the two distinguished observers. The mountainous districts of England and Wales and Ireland were also considered to constitute centres for the dispersion of glacial débris; and Agassiz remarked "that great sheets of ice, resembling those now existing in Greenland, once covered all the countries in which unstratified gravel (boulder drift) is found; that this gravel was in general produced by the trituration of the sheets of ice upon the subjacent surface, &c."

In 1842–1846 he issued his *Nomenclator Zoologicus*, a classified list, with references, of all names employed in zoology for genera and groups—a work of great labour and research. With the aid of a grant of money from the king of Prussia, Agassiz, in the autumn of 1846, crossed the Atlantic, with the twofold design of investigating the natural history and geology of the United States and delivering a course of lectures on zoology, by invitation from J. A. Lowell, at the Lowell Institute at Boston; the tempting advantages, pecuniary and scientific, presented to him in the New World induced him to settle in the United States, where he remained to the end of his life. He was appointed professor of zoology and geology in the university of Cambridge, U.S., in 1847. In 1852 he accepted a medical professorship of comparative anatomy at Charlestown, but this he resigned in two years.

The transfer to a new field and the association with fresh objects of interest gave his energies an increased stimulus. Volume after volume now proceeded from his pen: some of his writings were popular, but most of them dealt with the higher departments of scientific research. His work on Lake Superior, and his four volumes of *Contributions to the Natural History of the United States*, 1857–1862, were of this latter character. We must not overlook the valuable service he rendered to science by the formation, for his own use, of a catalogue of scientific memoirs—an extraordinary work for a man whose hands were already so full. This catalogue, edited and materially enlarged by the late Hugh E. Strickland, was published by the Ray Society under the title of *Bibliographia Zoologiae et Geologiae*, in 4 vols., 1848–1854. Nor must we forget that he was building up another magnificent monument of his industry in the Museum of Natural History, which rose under his fostering care, at Cambridge. But at length the great strain on his physical powers began to tell. His early labours among the fishes of Brazil had often caused him to cast a longing glance towards that country, and he now resolved to combine the pursuit of health with the gratification of his long-cherished desires. In April 1865 he started for Brazil, with his wife and class of qualified assistants. An interesting account of this expedition, entitled *A Journey in Brazil* (1868), was published by Mrs Agassiz and himself after they returned home in August 1866.

In 1871 he made a second excursion, visiting the southern shores of the North American continent, both on its Atlantic and its Pacific sea-boards. He had for many years yearned after the establishment of a permanent school where zoological science could be pursued amidst the haunts of the living subjects of study. The last, and possibly the most influential, of the labours of his life was the establishment of such an institution, which he was enabled to effect through the liberality of Mr John Anderson, a citizen of New York. That gentleman, in 1873, not only handed over to Agassiz the island of Penikese, in Buzzard's Bay, on the east coast, but also presented him with $50,000 wherewith permanently to endow it as a practical school of natural science, especially devoted to the study of marine zoology. Unfortunately he did not long survive the establishment of this institution. The disease with which he had struggled for some years proved fatal on the 14th of December 1873. He was buried at Mount Auburn. His monument is a boulder selected from the moraine of the glacier of the Aar near the site of the old Hôtel des Neuchâtelois, not far from the spot where his hut once stood; and the pine-trees which shelter his grave were sent from his old home in Switzerland. His extensive knowledge of natural history makes it somewhat remarkable to find that from first to last he steadily rejected the doctrine of evolution, and affirmed his belief in independent creations. When studying the superficial deposits of the Brazilian plains in 1865, his vivid imagination covered even that wide tropical area, as it had covered Switzerland before, with one vast glacier, extending from the Andes to the sea. This view, however, has not been generally accepted. His daring conceptions were only equalled by the unwearied industry and genuine enthusiasm with which he worked them out; and if in details his labours were somewhat defective, it was only because he had ventured to attempt what was too much for any one man to accomplish.

It may be interesting to mention that the charming verses written by Longfellow on "The fiftieth birthday of Agassiz" were read by the author at a dinner given to Agassiz by the Saturday Club in Cambridge, Mass., in 1857.

Louis Agassiz was twice married, and by his first wife he had an only son, Alexander Agassiz (*q.v.*), born in 1835; in 1850, after her death, he married his second wife, Elizabeth Cabot Cary of Boston, Mass., afterwards well known as a writer and as an active promoter of educational work in connexion with Radcliffe College (see an article on Radcliffe College, by Helen Leah Reed in the *New England Magazine* for January 1895).

AUTHORITIES.—*L. Agassiz, His Life and Correspondence*, 2 vols., by E. C. (Mrs) Agassiz (London, 1885); *Louis Agassiz, His Life and Work*, by C. F. Holder (New York and London, 1893). (H. B. Wo.)

AGATE, a term applied not to a distinct mineral species, but to an aggregate of various forms of silica, chiefly *Chalcedony* (*q.v.*). According to Theophrastus the agate (ἀχάτης) was named from the river Achates, now the Drillo, in Sicily, where the stone was originally found. Most agates occur as nodules in eruptive rocks, or ancient lavas, where they represent cavities originally produced by the disengagement of vapour in the molten mass, and since filled, wholly or partially, by siliceous matter deposited in regular layers upon the walls. Such agates, when cut transversely, exhibit a succession of parallel lines, often of extreme tenuity, giving a banded appearance to the section, whence such stones are known as banded agate, riband agate and striped agate. Certain agates also occur, to a limited extent, in veins, of which a notable example is the beautiful brecciated agate of Schlottwitz, near Wesenstein in Saxony—a stone mostly composed of angular fragments of agate cemented with amethystine quartz.

In the formation of an ordinary agate, it is probable that waters containing silica in solution—derived, perhaps, from the decomposition of some of the silicates in the lava itself—percolated through the rock, and deposited a siliceous coating on the interior of the vapour-vesicles. Variations in the character of the solution, or in the conditions of deposit, may have caused corresponding variation in the successive layers, so that bands of chalcedony often alternate with layers of crystalline quartz, and occasionally of opaline silica. By movement of the lava, when originally viscous, the vesicles were in many cases drawn out and compressed, whence the mineral matter with which they became filled assumed an elongated form, having the longer axis in the direction in which the magma flowed. From the fact that these kernels are more or less almond-shaped they are called amygdales, whilst the rock which encloses them is known as an amygdaloid. Several vapour-vesicles may unite while the rock is viscous, and thus form a large cavity which may become the home of an agate of exceptional size; thus a Brazilian geode, lined with amethyst, of the weight of 35 tons, was exhibited at the Düsseldorf Exhibition of 1902.

The first deposit on the wall of a cavity, forming the "skin" of the agate, is generally a dark greenish mineral substance, like celadonite, delessite or "green earth," which are hydrous silicates rich in iron, derived probably from the decomposition of the augite in the mother-rock. This green silicate may give rise by alteration to a brown oxide of iron (limonite), producing a rusty appearance on the outside of the agate-nodule. The outer surface of an agate, freed from its matrix, is often pitted and rough, apparently in consequence of the removal of the original coating. The first layer spread over the wall of the cavity has been called the "priming," and upon this basis zeolitic minerals may be deposited, as was pointed out by Dr M. F. Heddle. Chalcedony is generally one of the earlier deposits and crystallized quartz one of later formation. Tubular channels, usually choked with siliceous deposits, are often visible in sections of agate, and were formerly regarded, especially by L. von Buch and J. Nöggerath, as inlets of infiltration, by which the siliceous solutions gained access to the interior of the amygdaloidal cavity. It seems likely, however, that the solution transuded through the walls generally, penetrating the chalcedonic layers, as Heddle maintained, by osmotic action. Much of the chalcedony in an agate is known, from the method of artificially staining the stone, to be readily permeable. It was argued by E. Reusch that the cavities were alternately filled and emptied by means of intermittent hot springs carrying silica; while G. Lange, of Idar, suggested that the tension of the confined steam might pierce an outlet through some weak point in the coating of gelatinous silica, deposited on the walls, so that the tubes would be channels of egress rather than of ingress—a view supported by Heddle, who described them as "tubes of escape."

It sometimes happens that horizontal deposits, or strata usually opaline in character, are formed on the floor of a cavity after the walls have been lined with successive layers of chalcedony. Many agates are hollow, since deposition has not proceeded far enough to fill the cavity, and in such cases the last deposit commonly consists of quartz, often amethystine, having the apices of the crystals directed towards the free space, so as to form a crystal-lined cavity or geode.

When the deposits in an agate have been formed on a crop of crystals, or on a rugose base, the cross-section presents a zigzag pattern, rather like the plan of a fortress with salient and retiring angles, whence the stone is termed fortification agate. If the section shows concentric circles, due either to stalactitic growth or to deposition in the form of bosses and beads on the floor, the stone is known as ring agate or eye agate. A Mexican agate, showing only a single eye, has received the name of "cyclops." Included matter of a green colour, like fragments of "green earth," embedded in the chalcedony and disposed in filaments and other forms suggestive of vegetable growth, gives rise to moss agate. These inorganic enclosures in the agate have been sometimes described, even after microscopic examination, as true vegetable structures. Dendritic markings of black or brown colour, due to infiltration of oxides of manganese and iron, produce the variety of agate known as Mocha stone. Agates of exceptional beauty often pass in trade under the name of Oriental agate. Certain stones, when examined in thin sections by transmitted light, show a diffraction spectrum, due to the extreme delicacy of the successive bands, whence they are termed rainbow agates.

On the disintegration of the matrix in which the agates are embedded, they are set free, and, being by their siliceous nature extremely resistant to the action of air and water, remain as nodules in the soil and gravel, or become rolled as pebbles in the streams. Such is the origin of the "Scotch pebbles," used as ornamental stones. They are agates derived from the andesitic lavas of Old Red Sandstone age, chiefly in the Ochils and the Sidlaws. In like manner, the South American agates, so largely cut and polished at the present time, are found mostly as boulders in the beds of rivers.

An enormous trade in agate-working is carried on in a small district in Germany, around Oberstein on the Nahe, a tributary of the Rhine at Bingen. Here the industry was located many centuries ago, in consequence of the abundant occurrence of agates in the amygdaloidal melaphyre of the district, notably in the Galgenberg, or Steinkaulenberg, overlooking the village of Idar, on the Idar Bach, about two miles from Oberstein. The abundant water-power in the neighbourhood had also a share in the determination of the industrial site. At the present time, however, steam power and even electricity are employed in the mills of the Oberstein district. Although the agate-industry is still carried on there, especially at Idar, the stones operated on are not of indigenous origin, but are imported mostly from Brazil (Rio Grande do Sul) and from Uruguay, where they were discovered in 1827. Agate-working is also carried on to a limited extent at Waldkirch in the Black Forest.

Most commercial agate is artificially stained, so that stones naturally unattractive by their dull grey tints come to be valuable for ornamental purposes. The art of staining the stone is believed to be very ancient. Possibly referred to by Pliny (bk. xxxvii. cap. 75), it was certainly practised at an early date by the Italian cameo-workers, and from Italy a knowledge of the art—long kept secret and practised traditionally—passed in the early part of the 19th century to the agate-workers in Germany, by whom it has since been greatly developed. The colouring matter is absorbed by the porosity of the stone, but different stones and even different layers in the same stone exhibit great variation in absorptive power. The Brazilian agates lend themselves readily to coloration, while the German agates are much less receptive.

To produce a dark brown or black colour, the stone is kept perhaps for two or three weeks in a saccharine solution, or in olive oil, at a moderate temperature. After removal from this medium, the agate is well washed and then digested for a short time in sulphuric acid, which entering the pores chars or carbonizes the absorbed sugar or oil. Certain layers of chalcedony are practically impermeable, and these consequently remain uncoloured, so that an alternation of dark and white bands is obtained, thus giving rise to an onyx. If stained too dark, the colour may be "drawn," or lightened, by the action of nitric acid.

Agate is stained red, so as to form carnelian and sardonyx, by means of ferric oxide. This may be derived from any iron compound naturally present in the stone, especially from limonite by dehydration on baking. Some stones are "burnt" by mere exposure to the heat of the sun, whereby the brown colour passes to red. Usually, however, an iron-salt, like ferrous sulphate, is artificially introduced in solution and then decomposed by heat, so as to form in the pores a rich red pigment.

A blue colour, supposed to render the agate rather like lapis lazuli, is produced by using first an iron salt and then a solution of ferrocyanide or ferricyanide of potassium; a green colour, like that of chrysoprase, is obtained by means of salts of nickel or of chromium; and a yellow tint is developed by the action of hydrochloric acid.

Among the uses to which agate is applied may be mentioned the formation of knife-edges of delicate balances, small mortars and pestles for chemical work, burnishers and writing styles, umbrella-handles, paper-knives, seals, brooches and other trivial ornaments. Most of these are cut and polished in the Oberstein district, at a very cheap rate, from South American stones.

Numerous localities in the United States and Canada yield agates, as described by Dr G. F. Kunz. They are abundant in the trap rocks of the Lake Superior region, some of the finest coming from Michipicoten Island, Ontario. A locality on the shore of the lake is called Agate Bay. Wood agate, or agatized wood, is not infrequently found in Colorado, California and elsewhere in the West, the most notable locality being the famous "silicified forest" known as Chalcedony Park, in Apache county, Arizona. Here there are vast numbers of water-rolled logs of silicified wood, in rocks of Triassic age, but only a small quantity of the wood is fine enough for ornamental purposes. The cellular tissue of the vegetable matter is filled, or even replaced, by various siliceous minerals like chalcedony, jasper, crystalline quartz and semi-opal, the silica having probably been introduced by thermal waters. Some of the agate shows the microscopic structure of araucarian wood. The agatized wood is sometimes known by the Indian name of shinarump.

In India agates occur abundantly in the amygdaloidal varieties of the Deccan and Rájmahál traps, and as pebbles in the detritus derived from these rocks. Some of the finest are found in the agate-gravels near Ratanpur, in Rájpipla. The trade in agates has been carried on from early times at Cambay, where the stones are cut and polished. Agates are also worked at Jubbulpore.

In many parts of New South Wales, agates, resulting from the disintegration of trap rocks, are common in the river-beds and old drifts. They occur also in Queensland, as at Agate Creek, running into the Gilbert river. South Africa likewise yields numerous agates, especially in the gravels of the Orange and Vaal rivers.

It should be noted that in England agates are found not only in old lavas, like the andesites of the Cheviots, but also to a limited extent in the Dolomitic Conglomerate, an old beach-deposit of Triassic age in the Mendips and the neighbourhood of Bristol. They are also found as weathered pebbles in the drift of Lichfield in Staffordshire.

For Scottish agates see M. F. Heddle, "On the Structure of Agates," *Trans. Geolog. Soc. Glasgow*, vol. xi. part ii., 1900, p. 153; and *Mineralogy of Scotland* (1901), vol. i. p. 58; J. G. Goodchild, *Proc. Phys. Soc. Edinburgh*, vol. xiv., 1899, p. 191. For the agate-industry see G. Lange, *Die Halbedelsteine* (Kreuznach, 1868). For American agates, G. F. Kunz, *Gems and Precious Stones of North America* (1890), p. 128. For agates in general see Max Bauer's *Precious Stones*, translated by L. J. Spencer (London, 1904). (F. W. R.*)

AGATHA, SAINT, the patron saint of Catania, Sicily, where her festival is celebrated on the 5th of February. The legend is that she was a native of Sicily (probably of Catania, though Palermo also claims her), of noble birth and great beauty. She repelled the advances of the Roman prefect sent by the emperor Decius to govern Sicily, and was by his orders brutally tortured and finally sent to the stake. As soon as the fire was lighted, an earthquake occurred, and the people insisted on her release. She died in prison on the 5th of February 251. The rescue of Catania from fire during an eruption of Mount Etna was later attributed to St Agatha's veil.

AGATHANGELUS, AGATHANGE or AKATHANKELOS, Armenian historian, lived during the 4th century, and wrote a *History of the Reign of Dertad, or Tiridates, and of the Preaching of St Gregory the Illuminator.* The text of this history has been considerably altered, but it has always been in high favour with the Armenians. It has been translated into several languages, and Greek and Latin translations are found in the *Acta Sanctorum Bollandistarum*, tome viii. As known to us the history consists of three parts, a history of St Gregory and his companions, the doctrine of Gregory, and the conversion of Armenia to Christianity.

See V. Langlois, *Collection des historiens anciens et modernes de l'Arménie* (Paris, 1868).

AGATHARCHIDES, or AGATHARCHUS, of Cnidus, Greek historian and geographer, lived in the time of Ptolemy Philometor (181–146 B.C.) and his successors. Amongst other works, he wrote treatises on *Asia*, *Europe* and *The Red Sea*. Interesting extracts from the last, of some length, are preserved in Photius (cod. 213), who praises the style of the author, which was modelled on that of Thucydides.

See H. Leopoldi, *De Agatharchide Cnidio Dissertatio* (1892); C. W. Müller, *Fragmenta Historicorum Graecorum*, iii., and *Geographi Graeci Minores*, i.; E. H. Bunbury, *Hist. of Ancient Geography*, ii. (1879).

AGATHARCHUS, an Athenian painter of the 5th century B.C. He is said by Vitruvius to have been the first to paint a scene for the acting of tragedies. Hence some writers, such as Karl Woermann, have supposed that he introduced perspective and illusion into painting. This is a mistaken view, for ancient writers know nothing of canvas scenes; the background painted by Agatharchus was the wooden front of the stage building, and it was painted, not with reference to any particular play, but as a permanent decorative background, representing no doubt a palace or temple. Agatharchus is said to have been seized by Alcibiades and compelled by him to paint the interior of his house, which shows that at the time (about 435 B.C.) decorative painting of rooms was the fashion.

AGATHIAS (*c.* A.D. 536–582), of Myrina in Aeolis, Greek poet and historian. He studied law at Alexandria, completed his training at Constantinople and practised as an advocate (*scholasticus*) in the courts. Literature, however, was his favourite pursuit. He wrote a number of short love-poems in epic metre, called *Daphniaca*. He next put together a kind of anthology, containing epigrams by earlier and contemporary poets and himself, under the title of a *Cycle of New Epigrams*. About a hundred epigrams by Agathias have been preserved in the *Greek Anthology* and show considerable taste and elegance. After the death of Justinian (565), some of Agathias's friends persuaded him to write the history of his own times. This work, in five books, begins where Procopius ends, and is the chief authority for the period 552–558. It deals chiefly with the struggles of the Byzantine army, under the command of the eunuch Narses, against the Goths, Vandals, Franks and Persians. The author prides himself on his honesty and impartiality, but he is lacking in judgment and knowledge of facts; the work, however, is valuable from the importance of the events of which it treats. Gibbon contrasts Agathias as "a poet and rhetorician" with Procopius "a statesman and soldier."

AUTHORITIES.—Editio princeps, by B. Vulcanius (1594); in the Bonn *Corpus Scriptorum Byz. Hist.*, by B. G. Niebuhr (1828); in Migne, *Patrologia Graeca*, lxxxviii.; L. Dindorf, *Historici Graeci Minores* (1871); W. S. Teuffel, "Agathias von Myrine," in *Philologus* (i. 1846); C. Krumbacher, *Geschichte der byzantinischen Litteratur* (2nd ed. 1897).

AGATHO, pope from 678 to 681, was born in Sicily. He is noteworthy as the pope who ordered St Wilfrid to be restored to his bishopric at York in 679, and as the first to cease payment of the tribute hitherto paid on election to the emperor at Constantinople. It was during his pontificate that the 6th oecumenical council was held at Constantinople, to which he sent his legates and those from a Roman council held in 679. Agatho died on the 10th of January 681.

AGATHOCLES (361–289 B.C.), tyrant of Syracuse, was born at Thermae Himeraeae (mod. *Termini Imerese*) in Sicily. The son of a potter who had removed to Syracuse, he learned his father's trade, but afterwards entered the army. In 333 he married the widow of his patron Damas, a distinguished and wealthy citizen. He was twice banished for attempting to overthrow the oligarchical party in Syracuse (*q.v.*); in 317 he returned with an army of mercenaries under a solemn oath to observe the democratic constitution which was then set up. Having banished or murdered some 10,000 citizens, and thus made himself master of Syracuse, he created a strong army and fleet and subdued the greater part of Sicily. War with Carthage followed. In 310 Agathocles, defeated and besieged in Syracuse, took the desperate resolve of breaking through the blockade and attacking the enemy in Africa. After several victories he was at last completely defeated (306) and fled secretly to Sicily. After concluding peace with Carthage, Agathocles styled himself king of Sicily, and established his rule over the Greek cities of the island more firmly than ever. Even in his old age he displayed the same restless energy, and is said to have been meditating a fresh attack on Carthage at the time of his death. His last years were harassed by ill-health and the turbulence of his grandson Archagathus, at whose instigation he is said to have been poisoned; according to others, he died a natural death. He was a born leader of mercenaries, and, although he did not shrink from cruelty to gain his ends, he afterwards showed himself a mild and popular "tyrant."

See Justin xxii., xxiii.; Diodorus Siculus xix., xxi., xxii. (follows generally Timaeus who had a special grudge against Agathocles); Polybius ix. 23; Schubert, *Geschichte des Agathokles* (1887); Grote, *History of Greece*, ch. 97; also SICILY, *History*.

AGATHODAEMON, in Greek mythology, the "good spirit" of cornfields and vineyards. It was the custom of the Greeks to drink a cup of pure wine in his honour at the end of each meal (Aristophanes, *Equites*, 106). He was also regarded as the protecting spirit of the state and of individuals. He was often accompanied by Ἀγαθὴ Τύχη (good fortune), and in this aspect may be compared with the Roman Bonus Eventus (Pliny, *Nat Hist.* xxxvi. 23), and Genius. He is represented in works of art in the form of a serpent, or of a young man with a cornucopia and a bowl in one hand, and a poppy and ears of corn in the other.

See Gerhard, *Über Agathodämon und Bona Dea* (Berlin, 1849).

AGATHODAEMON, of Alexandria, map designer, probably lived in the 2nd century A.D. Some MSS. of the *Geography* of Ptolemy contain twenty-seven maps, which are stated to have been drawn by Agathodaemon of Alexandria, who "delineated the whole world according to the eight books of Ptolemy's geography." As Ptolemy speaks of Πίνακες to accompany his treatise, these maps were probably the work of a contemporary acting under his instructions. About 1470 Nicolaus Doris, a Benedictine monk, brought out a revised edition of them, the names being inserted in Latin instead of Greek.

See Bunbury, *History of Ancient Geography*, ii.

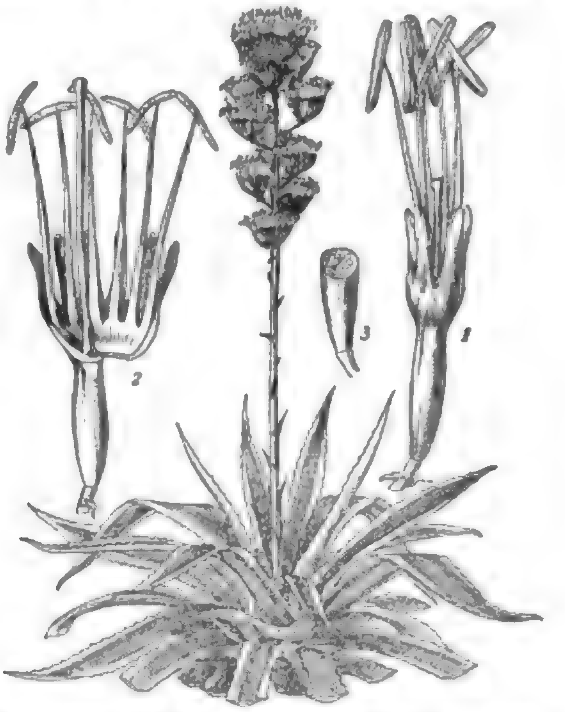
AGATHON (*c.* 448–400 B.C.), Athenian tragic poet, friend of Euripides and Plato, best known from his mention by Aristophanes (*Thesmophoriazusae*) and in Plato's *Symposium*, which describes the banquet given to celebrate his obtaining a prize for a tragedy (416). He probably died at the court of Archelaus, king of Macedonia. He introduced certain innovations, and Aristotle (*Poetica*, 9) tells us that the plot of his Ἄνθος was original, not, as usually, borrowed from mythological subjects.

See Aristophanes, *Thesmoph.* 59, 106, *Eccles.* 100; Plato, *Symp.* 198 c; Plutarch, *Symp.* 3; Aelian, *Var. Hist.* xiv. 13; Ritsch, *Opuscula*, i.; fragments in Nauck, *Tragicorum Graecorum Fragmenta*.

AGATHYRSI, a people of Thracian origin, who in the earliest historical times occupied the plain of the Maris (Maros), in the region now known as Transylvania. Thyrsi is supposed to be a Scythian form of Τραυσοί (Trausi), a Thracian tribe mentioned by Stephanus of Byzantium. They are described by Herodotus (iv. 104) as of luxurious habits, wearing gold ornaments (the district is still auriferous) and having wives in common. They tattooed their bodies (*picti*, *Aeneid* iv. 136), degrees of rank being indicated by the manner in which this was done, and coloured their hair dark blue. Like the Gallic Druids, they recited their laws in a kind of sing-song to prevent their being forgotten, a practice still in existence in the days of Aristotle (*Problemata*, xix. 28). Valerius Flaccus (*Argonautica*, vi. 135) calls them Thyrsagetae, probably in reference to their celebration of orgiastic rites in honour of some divinity akin to the Thracian Dionysus. In later times the Agathyrsi were driven farther north, and their name was unknown to the Romans in their original home.

See Ammianus Marcellinus xxxi. 2. 17; Pliny, *Nat. Hist.* iv. 12 [26]. 88; Pomponius Mela ii. 1. 10; W. Tomaschek, "Die alten Thraker," in *Sitzungsber. der philosophisch-historischen Klasse der kaiserl. Akad. der Wiss.* cxxviii. (Vienna, 1893).

AGAVE, a large botanical genus of the natural order Amaryllidaceae, chiefly Mexican, but occurring also in the southern and western United States and in central and tropical South America. The plants have a large rosette of thick fleshy leaves generally ending in a sharp point and with a spiny margin; the stout stem is usually short, the leaves apparently springing from the root. They grow slowly and flower but once after a number of years, when a tall stem or "mast" grows from the centre of the leaf-rosette and bears a large number of shortly tubular flowers. After development of fruit the plant dies down, but suckers are frequently produced from the base of the stem which become new plants. The most familiar species is *Agave americana* (see fig.), a native of tropical America, the so-called century plant or American aloe (the maguey of Mexico). The number of years before flowering occurs depends on the vigour of the individual, the richness of the soil and the climate; during these years the plant is storing in its fleshy leaves the nourishment required for the effort of flowering. During the development of the inflorescence there is a rush of sap to the base of the young flower stalk. In the case of *A. americana* and other species this is used by the Mexicans to make their national beverage, *pulque*; the flower shoot is cut out and the sap collected and subsequently fermented. By distillation a spirit called mescal is prepared. The leaves of several species yield fibre, as for instance, *A. rigida* var. *sisalana*, sisal hemp (*q.v.*), *A. decipiens*, false sisal hemp; *A. americana* is the source of *pita* fibre, and is used as a fibre plant in Mexico, the West Indies and southern Europe. The flowering stem of the last named, dried and cut in slices, forms natural razor strops, and the expressed juice of the leaves will lather in water like soap. In the Madras Presidency the plant is extensively used for hedges along railroads. *Agave americana*, century plant, was introduced into Europe about the middle of the 16th century and is now widely cultivated for its handsome appearance; in the variegated forms the leaf has a white or yellow marginal or central stripe from base to apex. As the leaves unfold from the centre of the rosette the impression of the marginal spines is very conspicuous on the still erect younger leaves. The plants are usually grown in tubs and put out in the summer months, but in the winter require to be protected from frost. They mature very slowly and die after flowering, but are easily propagated by the offsets from the base of the stem.



Agave americana, Century plant or American aloe. About $\frac{1}{40}$ nat. size. 1, Flower; 2, same flower split open above the ovary; 3, ovary cut across; 1, 2, and 3, about ⅓ nat. size.

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AGDE, a town of southern France, in the department of Hérault, on the left bank of the river of that name, 2½ m. from the Mediterranean Sea and 32 m. S.W. of Montpellier on the Southern railway. Pop. (1906) 7146. The town lies at the foot of an extinct volcano, the Montagne St Loup, and is built of black volcanic basalt, which gives it a gloomy appearance. Overlooking the river is the church of St André, which dates partly from the 12th century, and, till the Revolution, was a cathedral. It is a plain and massive structure with crenelated walls, and has the aspect of a fortress rather than of a church. The exterior is diversified by arched recesses forming machicolations, and the same architectural feature is reproduced in the square tower which rises like a donjon above the building. The *Canal du Midi*, or Languedoc canal, uniting the Garonne with the Mediterranean, passes under the walls of the town, and the mouth of the Hérault forms a harbour which is protected by a fort. The maritime commerce of the town has declined, owing partly to the neighbourhood of Cette, partly to the shallowness of the Hérault. The fishing industry is, however, still active. The chief public institutions are the tribunal of commerce and the communal college.

Agde is a place of great antiquity and is said to have been founded under the name of *ἀγαθὴ πόλις* (Good City) by the Phocaeans. The bishopric was established about the year 400 and was suppressed in 1790.

SYNOD OF AGDE (*Concilium Agathense*).—With the permission of the West Goth Alaric II. thirty-five bishops of southern Gaul assembled in person or sent deputies to Agde on the 11th of September 506. Caesarius, bishop of Arles, presided. The forty-seven genuine canons of the synod deal with discipline, church life, the alienation of ecclesiastical property and the treatment of Jews. While favouring sacerdotal celibacy the council laid rather rigid restrictions on monasticism. It commanded that the laity communicate at Christmas, Easter and Whitsuntide. The canons of Agde are based in part on earlier Gallic, African and Spanish legislation; and some of them were re-enacted by later councils, and found their way into collections such as the Hispana, Pseudo-Isidore and Gratian.

See Mansi viii. 319 ff.; Hefele, *Conciliengeschichte*, 2nd edition, ii. 649 ff. (English translation, iv. 76 ff.); Herzog-Hauck, *Realencyklopädie*, i. 242.

AGE (Fr. *âge*, through late Lat. *aetaticum*, from *aetas*), a term used (1) of the divisions into which it is suggested that human history may be divided, whether regarded from the geological, cultural or moral aspects, *e.g.* the palaeolithic age, the bronze age, the dark ages; (2) of an historic epoch or generation; (3) of any period or stage in the physical life of a person, animal or thing; (4) of that time of life at which the law attributes full responsibility for his or her acts to the individual.

(1) From the earliest times there would appear to have been the belief that the history of the earth and of mankind falls naturally into periods or ages. Classical mythology popularized the idea. Hesiod, for example, in his poem *Works and Days*, describes minutely five successive ages, during each of which the earth was peopled by an entirely distinct race. The first or *golden* race lived in perfect happiness on the fruits of the untilled earth, suffered from no bodily infirmity, passed away in a gentle sleep, and became after death guardian daemons of this world. The second or *silver* race was degenerate, and refusing to worship the immortal gods, was buried by Jove in the earth. The third or *brazen* race, still more degraded, was warlike and cruel, and perished at last by internal violence. The fourth or *heroic* race was a marked advance upon the preceding, its members being the heroes or demi-gods who fought at Troy and Thebes, and who were rewarded after death by being permitted to reap thrice a year the free produce of the earth. The fifth or *iron* race, to which the poet supposes himself to belong, is the most degenerate of all, sunk so low in every vice that any new change must be for the better. Ovid, in his *Metamorphoses*, follows Hesiod exactly as to nomenclature and very closely as to substance. He makes the degeneracy continuous, however, by omitting the heroic race or age, which, as Grote points out, was probably introduced by Hesiod, not as part of his didactic plan, but from a desire to conciliate popular feeling by including in his poem the chief myths that were already current among the Greeks. Varro recognized three ages: (1) from the beginning of mankind to the Deluge, a quite indefinite period; (2) from the Deluge to the First Olympiad, called the Mythical Period; (3) from the First Olympiad to his own time, called the Historic Period. Lucretius divided man's history into three cultural periods: (1) the Age of Stone; (2) the Age of Bronze; (3) the Age of Iron. He thus anticipated the conclusions of some of the greatest of modern archaeologists.

(2) A definite period in history, distinguished by some special characteristic, such as great literary activity, is generally styled, with some appropriate epithet, an age. It is usual, for example, to speak of the Age of Pericles, the Augustan, the Elizabethan or the Victorian Ages; of the Age of the Crusades, the Dark Ages, the Middle Ages, the Age of Steam. Such isolated periods, with no continuity or necessary connexion of any kind, are obviously quite distinct from the ages or organically related periods into which philosophers have divided the whole course of human history. Auguste Comte, for instance, distinguishes three ages according to the state of knowledge in each, and he supposes that we are now entering upon the third of these. In the first age of his scheme knowledge is *supernatural* or fictitious; in the second it is *metaphysical* or abstract; in the third it is *positive* or scientific. Schemes somewhat similar have been proposed by other philosophers, chiefly of France and Germany, and seem to be regarded by them as essential to any complete science of history.

(3) The subject of the duration of human and animal life does not fall within the scope of this article, and the reader is referred to LONGEVITY. But the word "age" has been used by physiologists to express certain natural divisions in human development and decay. These are usually regarded as numbering five, viz. *infancy*, lasting to the seventh year; *childhood* to the fourteenth; *youth* to the twenty-first; *adult life* till fifty; and *old age*.

(4) The division of human life into periods for legal purposes is naturally more sharp and definite than in physiology. It would be unscientific in the physiologist to name any precise year for the transition from one of his stages to another, inasmuch as that differs very considerably among different nations, and even to some extent among different individuals of the same nation. But the law must necessarily be fixed and uniform, and even where it professes to proceed according to nature, must be more precise than nature. The Roman law divided human life for its purposes into four chief periods, which had their subdivisions—(1) *infantia*, lasting till the close of the seventh year; (2) the period between *infantia* and *pubertas*, males becoming *puberes* at fourteen and females at twelve; (3) *adolescentia*, the period between puberty and majority; and (4) the period after the twenty-fifth year, when males became *majores*. The first period was one of total legal incapacity; in the second period a person could lawfully do certain specified acts, but only with the sanction of his tutor or guardian; in the third the restrictions were fewer, males being permitted to manage their own property, contract marriage and make a will; but majority was not reached until the age of twenty-five. By English law there are two great periods into which life is divided—*infancy*, which lasts in both sexes until the twenty-first year, and manhood or womanhood The period of infancy, again, is divided into several stages, marked by the growing development both of rights and obligations. Thus at twelve years of age a male may take the oath of allegiance; at fourteen both sexes are held to have arrived at years of discretion, and may therefore choose guardians, give evidence and consent or disagree to a marriage. A female has the last privilege from the twelfth year, but the marriage cannot be celebrated until the majority of the parties without the consent of parents or guardians. At fourteen, too, both sexes are fully responsible to the criminal law. Between seven and fourteen there is responsibility only if the accused be proved *doli capax*, capable of discerning between right and wrong, the principle in that case being that *malitia supplet aetatem*. At twenty-one both males and females obtain their full legal rights, and become liable to all legal obligations. A seat in the British parliament may be taken at twenty-one. Certain professions, however, demand as a qualification in entrants a more advanced age than that of legal manhood. In the Church of England a candidate for deacon's orders must be twenty-three (in the Roman Catholic Church, twenty-two) and for priest's orders twenty-four years of age; and no clergyman is eligible for a bishopric under thirty. In Scotland infancy is not a legal term. The time previous to majority, which, as in England, is reached by both sexes at twenty-one, is divided into two stages: *pupilage* lasts until the attainment of puberty, which the law fixes at fourteen in males and twelve in females; *minority* lasts from these ages respectively until twenty-one. *Minority* obviously corresponds in some degree to the English *years of discretion*, but a Scottish minor has more personal rights than an English infant in the last stage of his infancy, *e.g.*

he may dispose by will of movable property, make contracts, carry on trade, and, as a necessary consequence, is liable to be declared a bankrupt. In France the year of majority is twenty-one, and the nubile age eighteen for males and fifteen for females, with a restriction as to the consent of guardians. Age qualification for the chamber of deputies is twenty-five and for the senate forty years. In Germany, majority is reached at twenty-one, the nubile age is twenty for males and sixteen for females, subject to the consent of parents. Without the consent of parents, the age is twenty-five for males and twenty-four for females. The age qualification for the Reichstag is twenty-five. In Austria the age of majority is twenty-four, and the nubile age fourteen for either sex, subject to the consent of the parents. In Denmark, qualified majority is reached at eighteen and full majority at twenty-five. The nubile age is twenty for males and sixteen for females. In Spain, majority is reached at twenty-three; the nubile age is eighteen for males and sixteen for females. In Greece the age of majority is twenty-one, and the nubile age sixteen for males and fourteen for females. In Holland the age of majority is twenty-one, and the nubile age eighteen for males and sixteen for females. In Italy, majority is reached at twenty-one; the nubile age is eighteen for males and fifteen for females. In Switzerland the age of majority is twenty, and the nubile age is eighteen for males and sixteen for females. In the United States the age qualification for a president is thirty-five, for a senator thirty and for a representative twenty-five.

AGELADAS, or (as the name is spelt in an inscription) HAGELAIDAS, a great Argive sculptor, who flourished in the latter part of the 6th and the early part of the 5th century B.C. He was specially noted for his statues of Olympic victors (of 520, 516, 508 B.C.); also for a statue at Messene of Zeus, copied on the coins of that city. Ageladas was said to have been the teacher of Myron, Phidias and Polyclitus; this tradition is a testimony to his wide fame, though historically doubtful. We have no work of Ageladas surviving; but we have an inscription which contains the name of his son Argeiadas.

AGEN, a city of south-western France, capital of the department of Lot-et-Garonne, 84 m. S.E. of Bordeaux by the Southern railway between Bordeaux and Toulouse. Pop. (1906) 18,640. It is skirted on the west by the Garonne itself, and on the north by its lateral canal. The river is crossed by a stone bridge, by a suspension bridge for foot-passengers, and by a fine canal-bridge, carrying the lateral canal. Pleasant promenades stretch for some distance along the right bank. The town is a medley of old narrow streets contrasting with the wide modern boulevards which cross it at intervals. The chief building in Agen is the cathedral of St Caprais, the most interesting portion of which is the apse of the 12th century with its three apse-chapels; the transept dates from the 12th and 13th centuries, the nave from the 14th to the 16th centuries; the tower flanking the south façade is modern. The interior is decorated with modern paintings and frescoes. There are several other churches, among them the church of the Jacobins, a brick building of the 13th century, and the church of St Hilaire of the 16th century, which has a modern tower. In the prefecture, a building of the 18th century, once the bishop's palace, is a collection of historical portraits. The hôtel de ville occupies the former Hôtel du Présidial, an obsolete tribunal, and contains the municipal library. Two houses of the 16th century, the Hôtel d'Estrades and the Hôtel de Vaurs, are used as the museum, which has a rich collection of fossils, prehistoric and Roman remains, and other antiquities and curiosities. The poet Jacques Jasmin was a native of the town, which has erected a statue to him. Through its excellent water communication it affords an outlet for the agricultural produce of the district, and forms an *entrepôt* of trade between Bordeaux and Toulouse. Agen is the seat of a bishop. It is the seat of a court of appeal and a court of assizes, and has tribunals of first instance and of commerce and a chamber of commerce. There are also ecclesiastical seminaries, lycées for boys and girls, training-colleges, a school of commerce and industry, and a branch of the Bank of France. Agen is the market for a rich agricultural region. The chief articles of commerce are fattened poultry, prunes (*pruneaux d'Agen*) and other fruit, cork, wine, vegetables and cattle. Manufactures include flour, dried plums, *pâté de foie gras* and other delicacies, hardware, manures, brooms, drugs, woven goods tiles.

Agen (Aginnum) was the capital of the Celtic tribe of the Nitiobroges, and the discovery of extensive ruins attests its importance under the Romans. In later times it was the capital of the Agenais. Its bishopric was founded in the 4th century. Agen changed hands more than once in the course of the Albigensian wars, and at their close a tribunal of inquisition was established in the town and inflicted cruel persecution on the heretics. During the religious wars of the 16th century Agen took the part of the Catholics and openly joined the League in 1580.

See Labenazie, *Histoire de la ville d'Agen et pays d'Agenois*, ed. by A.-G. de Dampierre (1888); A. Ducom, *La Commune d'Agen: essai sur son histoire et son organisation depuis son origine jusqu'au traité de Brétigny* (1892).

AGENAIS, or AGENOIS, a former province of France. In ancient Gaul it was the country of the Nitiobroges with *Aginnum* for its capital, and in the 4th century it was the *Civitas Agennensium* which was a part of *Aquitania Secunda* and which formed the diocese of Agen. Having in general shared the fortunes of Aquitaine during the Merovingian and Carolingian periods, Agenais next became an hereditary countship in the part of the country now called Gascony (*Vasconia*). In 1038 this countship was purchased by the dukes of Aquitaine and counts of Poitiers. The marriage of Eleanor of Aquitaine with Henry Plantagenet in 1152 brought it under the sway of England; but when Richard Cœur-de-Lion married his sister Joan to Raymund VI., count of Toulouse, in 1196, Agenais formed part of the princess's dowry; and with the other estates of the last independent count of Toulouse it lapsed to the crown of France in 1271. This, however, was not for long; the king of France had to recognize the prior rights of the king of England to the possession of the countship, and restored it to him in 1279. During the wars between the English and the French in the 14th and 15th centuries, Agenais was frequently taken and retaken, the final retreat of the English in 1453 at last leaving the king of France in peaceable possession. Thenceforth Agenais was no more than an administrative term. At the end of the *ancien régime* it formed part of the "Gouvernement" of Guienne, and at the Revolution it was incorporated in the département of Lot-et-Garonne, of which it constitutes nearly the whole. The title of count of Agenais, which the kings of England had allowed to fall into desuetude, was revived by the kings of France, and in 1789 was held by the family of the dukes of Richelieu.

There is no good history of Agenais; that published by Jules Andrieu in 1893 (*Histoire de l'Agenais*, 2 vols.) being quite inadequate. The *Bibliographie générale de l'Agenais*, by the same author (1886–1891, 3 vols.), may be found useful. (C. B.*)

AGENT (from Lat. *agere*, to act), a name applied generally to any person who acts for another. It has probably been adopted from France, as its function in modern civil law was otherwise expressed in Roman jurisprudence. Ducange (s.v. *Agentes*) tells us that in the later Roman empire the officers who collected the grain in the provinces for the troops and the household, and afterwards extended their functions so as to include those of government postmasters or spies, came to be called *agentes in rebus*, their earlier name having been *frumentarii*. In law an agent is a person authorized, expressedly or impliedly, to act for another, who is thence called the principal, and who is, in consequence of, and to the extent of, the authority delegated by him, bound by the acts of his agent. (See PRINCIPAL AND AGENT; FACTOR, &c.)

In Scotland the procurators or solicitors who act in the preparation of cases in the various law-courts are called agents. (See SOLICITOR.)

In France the *agents de change* were formerly the class generally licensed for conducting all negotiations, as they were termed, whether in commerce or the money market. The term has, however, become practically limited to those who conduct transactions in public stock. The laws and regulations as to *courtiers*, or those whose functions were more distinctly confined to transactions in merchandise, have been mixed up with those applicable to *agents de change*. Down to the year 1572 both functions were free; but at that period, partly for financial reasons, a system of licensing was adopted at the suggestion of the chancellor, l'Hôpital. Among the other revolutionary measures of the year 1791, the professions of agent and *courtier* were again opened to the public. Many of the financial convulsions of the ensuing years, which were due to more serious causes, were attributed to this indiscriminate removal of restrictions, and they were reimposed in 1801. From that period regulations have been made from time to time as to the qualifications of agents, the security to be found by them and the like. They are now regarded as public officers, appointed, with certain privileges and duties, by the government to act as intermediaries in negotiating transfers of public funds and commercial stocks and for dealing in metallic currency. (See Stock Exchange: *France*.)

In diplomacy the term "agent" was originally applied to all "diplomatic agents," including ambassadors. With the evolution of the diplomatic hierarchy, however, the term gradually sank until it was technically applied only to the lowest class of "diplomatic agents," without a representative character and of a status and character so dubious that, by the regulation of the congress of Vienna, they were wholly excluded from the immunities of the diplomatic service. (See Diplomacy.)

AGENT-GENERAL, the term given to a representative in England of one of the self-governing British colonies. Agents-general may be said to hold a position mid-way between agents of provinces and ambassadors of foreign countries. They are appointed, and their expenses and salaries provided, by the governments of the colonies they represent, viz. Cape of Good Hope, Natal, the Transvaal, New South Wales, Queensland, South Australia, Tasmania, Victoria, Western Australia, New Zealand and Canada (whose representatives are termed high commissioners). Their duties are to look after the political and economic interests of their colonies in London, to assist in all financial and commercial matters in which their colonies may be concerned, such as shipping arrangements and rates of freight, cable communications and rates, tenders for public works, &c., and to make known the products of their colonies. Those colonies which are not under responsible government are represented in London by crown agents.

AGESANDER, a Rhodian sculptor, whose title to fame is that he is mentioned by Pliny (*Nat. Hist.* xxxvi. 37) as author (with Polydorus and Athenodorus) of the group of the Laocoon. Inscriptions recently found at Lindus in Rhodes date Agesander and Athenodorus to the period 42–21 B.C. The date of the Laocoon seems thus finally settled, after long controversy. It represents the culmination of a sentimental or pathetic tendency in art, which is prominent in the somewhat earlier sculpture of Pergamum. (See Greek Art.)

AGESILAUS II., king of Sparta, of the Eurypontid family, was the son of Archidamus II. and Eupolia, and younger step-brother of Agis II., whom he succeeded about 401 B.C. Agis had, indeed, a son Leotychides, but he was set aside as illegitimate, current rumour representing him as the son of Alcibiades. Agesilaus' success was largely due to Lysander, who hoped to find in him a willing tool for the furtherance of his political designs; in this hope, however, Lysander was disappointed, and the increasing power of Agesilaus soon led to his downfall. In 396 Agesilaus was sent to Asia with a force of 2000 Neodamodes (enfranchized Helots) and 6000 allies to secure the Greek cities against a Persian attack. On the eve of sailing from Aulis he attempted to offer a sacrifice, as Agamemnon had done before the Trojan expedition, but the Thebans intervened to prevent it, an insult for which he never forgave them. On his arrival at Ephesus a three months' truce was concluded with Tissaphernes, the satrap of Lydia and Caria, but negotiations conducted during that time proved fruitless, and on its termination Agesilaus raided Phrygia, where he easily won immense booty since Tissaphernes had concentrated his troops in Caria. After spending the winter in organizing a cavalry force, he made a successful incursion into Lydia in the spring of 395. Tithraustes was thereupon sent to replace Tissaphernes, who paid with his life for his continued failure. An armistice was concluded between Tithraustes and Agesilaus, who left the southern satrapy and again invaded Phrygia, which he ravaged until the following spring. He then came to an agreement with the satrap Pharnabazus and once more turned southward. It was said that he was planning a campaign in the interior, or even an attack on Artaxerxes himself, when he was recalled to Greece owing to the war between Sparta and the combined forces of Athens, Thebes, Corinth, Argos and several minor states. A rapid march through Thrace and Macedonia brought him to Thessaly, where he repulsed the Thessalian cavalry who tried to impede him. Reinforced by Phocian and Orchomenian troops and a Spartan army, he met the confederate forces at Coronea in Boeotia, and in a hotly contested battle was technically victorious, but the success was a barren one and he had to retire by way of Delphi to the Peloponnese. Shortly before this battle the Spartan navy, of which he had received the supreme command, was totally defeated off Cnidus by a powerful Persian fleet under Conon and Pharnabazus.

Subsequently Agesilaus took a prominent part in the Corinthian war, making several successful expeditions into Corinthian territory and capturing Lechaeum and Piraeum. The loss, however, of a *mora*, which was destroyed by Iphicrates, neutralized these successes, and Agesilaus returned to Sparta. In 389 he conducted a campaign in Acarnania, but two years later the Peace of Antalcidas, which was warmly supported by Agesilaus, put an end to hostilities. When war broke out afresh with Thebes the king twice invaded Boeotia (378, 377), and it was on his advice that Cleombrotus was ordered to march against Thebes in 371. Cleombrotus was defeated at Leuctra and the Spartan supremacy overthrown. In 370 Agesilaus tried to restore Spartan prestige by an invasion of Mantinean territory, and his prudence and heroism saved Sparta when her enemies, led by Epaminondas, penetrated Laconia that same year, and again in 362 when they all but succeeded in seizing the city by a rapid and unexpected march. The battle of Mantinea (362), in which Agesilaus took no part, was followed by a general peace: Sparta, however, stood aloof, hoping even yet to recover her supremacy. In order to gain money for prosecuting the war Agesilaus had supported the revolted satraps, and in 361 he went to Egypt at the head of a mercenary force to aid Tachos against Persia. He soon transferred his services to Tachos's cousin and rival Nectanabis, who, in return for his help, gave him a sum of over 200 talents. On his way home Agesilaus died at the age of 84, after a reign of some 41 years.

A man of small stature and unimpressive appearance, he was somewhat lame from birth, a fact which was used as an argument against his succession, an oracle having warned Sparta against a "lame reign." He was a successful leader in guerilla warfare, alert and quick, yet cautious—a man, moreover, whose personal bravery was unquestioned. As a statesman he won himself both enthusiastic adherents and bitter enemies, but of his patriotism there can be no doubt. He lived in the most frugal style alike at home and in the field, and though his campaigns were undertaken largely to secure booty, he was content to enrich the state and his friends and to return as poor as he had set forth. The worst trait in his character is his implacable hatred of Thebes, which led directly to the battle of Leuctra and Sparta's fall from her position of supremacy.

See lives of Agesilaus by Xenophon (the panegyric of a friend), Cornelius Nepos and Plutarch; Xenophon's *Hellenica* and Diodorus xiv., xv. Among modern authorities, besides the general histories of Greece, J. C. F. Manso, *Sparta*, iii. 39 ff.; G. F. Hertzberg, *Das Leben des Königs Agesilaos II. von Sparta* (1856); Buttmann, *Agesilaus Sohn des Archidamus* (1872); C. Haupt, *Agesilaus in Asien* (1874); E. von Stern, *Geschichte der spartanischen und thebanischen Hegemonie* (1884). (M. N. T.)

AGGLOMERATE (from the Lat. *agglomerare*, to form into a ball, *glomus, glomeris*), a term used in botany, meaning crowded in a close cluster or head, and, in geology, applied to the accumulations of coarse volcanic ejectamenta such as frequently occur near extinct or active volcanoes. Agglomerates in the geological sense, with which this article is concerned, consist typically of blocks of various igneous rocks, mixed often with more or less material of rudimentary origin and embedded in a finer-grained matrix, similar in nature to the coarser fragments. As distinguished from ordinary ash beds or tuffs, they are essentially coarser, less frequently well-bedded; they are less persistent and tend to occur locally, but may attain a very great thickness. Showers of fine ash may be distributed over a wide area of country and will form thin layers of great extent. Coarser accumulations gather only near the actual foci of eruption (craters, fissures, &c.). When the activity of a volcanic vent comes to an end, the orifice is often choked by masses of débris, which will in time become compacted into firm agglomerates. Hence rocks of this type very commonly mark the sites of necks, the remains of once-active volcanic craters. In this connexion they are of especial interest to geologists, as it is always important to be able to locate the exact points at which volcanic products, such as lavas and ash-beds, were emitted.

The blocks in agglomerates vary greatly in size. Some are thirty or forty feet in diameter, and weigh many tons; these are usually pieces of the strata through which the volcano has forced an outlet. They are never far from the crater; most of them, in fact, lie within its boundaries, and cases are known in which enormous masses of this kind (half an acre in area) have been found in such situations. They are masses which have been dislodged, by fissures and landslides, from the crater's walls and have tumbled into the cavity. Pieces of sandstone, limestone and shale occur in the agglomerates mixed with volcanic materials, and very often have been baked and partly recrystallized by contact with the hot igneous rocks and the gases discharged by the volcano. At Vesuvius such blocks of altered limestone are rich in new minerals and are well known to collectors.

Agglomerates also are usually full of volcanic bombs. These are spongy globular masses of lava which have been shot from the crater at a time when liquid molten lava was exposed in it, and was frequently shattered by the sudden outbursts of steam. These bombs were more or less viscous at the moment of ejection and by rotation in the air acquired their spheroidal form. They are commonly one or two feet in diameter, but specimens as large as nine or twelve feet have been observed. There is less variety in their composition at any volcanic centre than in the case of the foreign blocks above described. They correspond in nature to the lava which at the time fills the crater of the volcano, and as this varies only very slowly the bombs belong mostly to only a few kinds of rock and are similar in composition to the lava flows.

Crystalline masses of a different kind occur in some numbers in certain agglomerates. They consist of volcanic minerals very much the same as those formed in the lavas, but exhibiting certain peculiarities which indicate that they have formed slowly under pressure at considerable depths. Hence they bear a resemblance to plutonic igneous rocks, but are more correctly to be regarded as agglomerations of crystals formed within the liquid lava as it slowly rose towards the surface, and at a subsequent period cast out by violent steam explosions. The sanidinites of the Eifel belong to this group. At Vesuvius, Ascension, St Vincent and many other volcanoes, they form a not inconsiderable part of the coarser ash-beds. Their commonest minerals are olivine, anorthite, hornblende, augite, biotite and leucite.

Agglomerates occur wherever volcanoes are known. In many parts of Britain they attain a great development either in beds alternating with lavas or as the material occupying necks. In the latter case they are often penetrated by dikes. They also show a steep, angular, funnel-shaped dip (*e.g.* Arthur's Seat, Edinburgh), and may contain thin layers of clay or ashy sand-stone, which gathered in the crater during intervals of repose. (J. S. F.)

AGGLUTINATION (Lat. *ad*, and *gluten*, *glutinare*, literally to fasten together with glue), a term used technically in philology for the method of word-formation by which two significant words or roots are joined together in a single word to express a combination of the two meanings each of which retains its force. This juxtaposition or conjoining of roots is characteristic of languages such as the Turkish and Japanese, which are therefore known as agglutinative, as opposed to others, known generically as inflexional, in which differences of termination or combinations in which all separate identity disappears are predominant.

The term was also formerly used by associationist philosophers for those mental associations which were regarded as peculiarly close. Combination in its simplest form has been called Agglutination by W. Wundt.

AGGRAVATION (from Lat. *ad*, increasing, and *gravis*, heavy), the making anything graver or more serious, especially of offences; also used as synonymous with "irritation." In the canon law "aggravation" was a form of ecclesiastical censure, threatening excommunication after three disregarded admonitions.

AGGREGATION (from the Lat. *ad*, to, *gregare*, to collect together), in physics, a collective term for the forms or states in which matter exists. Three primary "states of aggregation" are recognized—gaseous, liquid and solid. Generally, if a solid be heated to a certain temperature, it melts or fuses, assuming the liquid condition (see FUSION); if the heating be continued the liquid boils and becomes a vapour (see VAPORIZATION). On the other hand, if a gas be sufficiently cooled and compressed, it liquefies; this transition is treated theoretically in the article CONDENSATION OF GASES, and experimentally in the article LIQUID GASES.

AGGTELEK, a village of Hungary, in the county of Gömör, situated to the south of Rozsnyó, on the road from Budapest to Dobsina. Pop. (1900) 557. In the neighbourhood is the celebrated Aggtelek or Baradla cavern, one of the largest and most remarkable stalactite grottos in Europe. It has a length, together with its ramifications, of over 5 miles, and is formed of two caverns—one known for several centuries, and another discovered by the naturalist Adolf Schmidl in 1856. Two entrances give access to the grotto, an old one extremely narrow, and a new one, made in 1890, through which the exploration of the cavern can be made in about 8 hours, half the time it took before. The cavern is composed of a labyrinth of passages and large and small halls, and is traversed by a stream. In these caverns there are numerous stalactite structures, which, from their curious and fantastic shapes, have received such names as the Image of the Virgin, the Mosaic Altar, &c. The principal parts are the Paradies with the finest stalactites, the Astronomical Tower and the Beinhaus. Rats, frogs and bats form actually the only animal life in the caves, but a great number of antediluvian animal bones have been found here, as well as human bones and numerous remains of prehistoric human settlements.

AGINCOURT (AZINCOURT), a village of northern France in the department of Pas de Calais, 14 m. N.W. of St Pol by road, famous on account of the victory, on the 25th of October 1415, of Henry V. of England over the French. The battle was fought in the defile formed by the wood of Agincourt and that of Tramecourt, at the northern exit of which the army under d'Albret, constable of France, had placed itself so as to bar the way to Calais against the English forces which had been campaigning on the Somme. The night of the 24th of October was spent by the two armies on the ground, and the English had but little shelter from the heavy rain which fell. Early on the 25th, St Crispin's day, Henry arrayed his little army (about 1000 men-at-arms, 6000 archers, and a few thousands of other foot). It is probable that the usual three "battles" were drawn up in line, each with its archers on the flanks and the dismounted men-at-arms in the centre; the archers being thrown forward in wedge-shaped salients, almost exactly as at Crécy (*q.v.*). The French, on the other hand, were drawn up in three lines, each line formed in deep masses. They were at least four times more numerous than the English, but restricted by the nature of the ground to the same extent of front, they were unable to use their full weight (cf. Bannockburn); further, the deep mud prevented their artillery from taking part, and the crossbowmen were as usual relegated to the rear of the knights and men-at-arms. All were dismounted save a few knights and men-at-arms on the flanks, who were intended to charge the archers of the enemy. For three hours after sunrise there was no fighting; then Henry, finding that the French would not advance, moved his army farther into the defile. The archers fixed the pointed stakes, which they carried to ward off cavalry charges, and opened the engagement with flights of arrows. The chivalry of France, undisciplined and careless of the lesson of Crécy and Poitiers, was quickly stung into action, and the French mounted men charged, only to be driven back in confusion. The constable himself headed the leading line of dismounted men-at-arms; weighted with their armour, and sinking deep into the mud with every step, they yet reached and engaged the English men-at-arms; for a time the fighting was severe. The thin line of the defenders was borne back and King Henry was almost beaten to the ground. But at this moment the archers, taking their hatchets, swords or other weapons, penetrated the gaps in the now disordered French, who could not move to cope with their unarmoured assailants, and were slaughtered or taken prisoners to a man. The second line of the French came on, only to be engulfed in the *mêlée;* its leaders, like those of the first line, were killed or taken, and the commanders of the third sought and found their death in the battle, while their men rode off to safety. The closing scene of the battle was a half-hearted attack made by a body of fugitives, which led merely to the slaughter of the French prisoners, which was ordered by Henry because he had not enough men both to guard them and to meet the attack. The slaughter ceased when the assailants drew off. The total loss of the English is stated at thirteen men-at-arms (including the duke of York, grandson of Edward III.) and about 100 of the foot. The French lost 5000 of noble birth killed, including the constable, 3 dukes, 5 counts and 90 barons; 1000 more were taken prisoners, amongst them the duke of Orleans (the Charles d'Orléans of literature).

See Sir Harris Nicolas, *Battle of Agincourt*; Fortescue, *History of the British Army*, vol. i.; and H. B. George, *Battles of English History*.

AGIO (Ital. *aggio*, exchange, discount, premium), a term used in commerce in three slightly different connexions. (*a*) The variations from fixed pars or rates of exchange in the currencies of different countries. For example, in most of the gold-standard countries, the standard coin is kept up to a uniform point of fineness, so that an English sovereign fresh from the mint will bear the following constant relation to coins of other countries in a similar condition:—£1 = frcs. 25·221 = mks. 20·429 = $4·867, &c. This is what is known as the mint par of exchange. But the mint par of exchange, say, between France and England is not necessarily the market value of French currency in England, or English currency in France. The balance of trade between the various countries is the factor determining the rate of exchange. Should the *balance of trade* (*q.v.*) be against England, money must be remitted to France in payment of the indebtedness, but owing to the cost for the transmission of specie there will be a demand for bills drawn on Paris as a cheaper and more expeditious method of sending money, and it therefore will be necessary, in order to procure the one of the higher current value, to pay a premium for it, called the agio. (*b*) The term is also used to denote the difference in exchange between two currencies in the same country; where silver coinage is the legal tender, agio is sometimes allowed for payment in the more convenient form of gold, or where the paper currency of a country is reduced below the bullion which it professes to represent, an agio is payable on the appreciated currency. (*c*) Lastly, in some states the coinage is so debased, owing to the wear of circulation, that the real is greatly reduced below the nominal value. Supposing that this reduction amounts to 5%, then if 100 sovereigns were offered as payment of a debt in England while such sovereigns were current there at their nominal value, they would be received as just payment; but if they were offered as payment of the same amount of debt in a foreign state, they would be received only at their intrinsic value of £95, the additional £5 constituting the agio. Where the state keeps its coinage up to a standard value no agio is required.

AGIRA (formerly San Filippo d'Argiro), a town of the province of Catania, Sicily, with a railway station 4½ m. to the south of the town, 35 m. W. of Catania. Pop. (1901) 17,738. It occupies the site of *Agyrion*, an ancient Sicel city which was ruled by tyrants, one of whom, Agyris, was the most powerful ruler in the centre of Sicily. He was a contemporary of Dionysius I., and with him successfully resisted the Carthaginians when they invaded the territory of Agyrium in 392 B.C. Agira was not colonized by the Greeks until Timoleon drove out the last tyrant in 339 B.C. and erected various splendid buildings of which no traces remain. Agyrion was the birthplace of the historian Diodorus Siculus.

AGIS, the name of four Spartan kings:—

(1) Son of Eurysthenes, founder of the royal house of the Agiadae (Pausanias iii. 2.1). His genealogy was traced through Aristodemus, Aristomachus, Cleodaeus and Hyllus to Heracles (Herodotus vii. 204), and he belongs rather to mythology than to history. Tradition ascribed to him the capture of the maritime town of Helos, which resisted his attempt to curtail its guaranteed rights, and the institution of the class of serfs called *Helots* (*q.v.*).

Ephorus *ap.* Strabo, viii. p. 365.

(2) Son of Archidamus II., Eurypontid, commonly called Agis I. He succeeded his father, probably in 427 B.C., and from his first invasion of Attica in 425 down to the close of the Peloponnesian war was the chief leader of the Spartan operations on land. After the conclusion of the peace of Nicias (421 B.C.) he marched against the Argives in defence of Epidaurus, and after skilful manoeuvring surrounded the Argive army, and seemed to have victory within his grasp when he unaccountably concluded a four months' truce and withdrew his forces. The Spartans were indignant, and when the Argives and their allies, in flagrant disregard of the truce, took Arcadian Orchomenus and prepared to march on Tegea, their fury knew no bounds, and Agis escaped having his house razed and a fine of 100,000 drachmae imposed only by promising to atone for his error by a signal victory. This promise he brilliantly fulfilled by routing the forces of the Argive confederacy at the battle of Mantinea (418), the moral effect of which was out of all proportion to the losses inflicted on the enemy. In the winter 417–416 a further expedition to Argos resulted in the destruction of the half-finished Long Walls and the capture of Hysiae. In 413, on the suggestion of Alcibiades, he fortified Decelea in Attica, where he remained directing operations until, after the battle of Aegospotami (405), he took the leading part in the blockade of Athens, which was ended in spring 404 by the surrender of the city. Subsequently he invaded and ravaged Elis, forcing the Eleans to acknowledge the freedom of their perioeci and to allow Spartans to take part in the Olympic games and sacrifices. He fell ill on his return from Delphi, where he had gone to dedicate a tithe of the spoils, and, probably in 401, died at Sparta, where he was buried with unparalleled solemnity and pomp.

Thuc. iii. 89, iv. 2. 6, v., vii. 19. 27, viii.; Xenophon, *Hellenica*, i. 1, ii. 2. 3, iii. 2. 3; Diodorus xii. 35, xiii. 72, 73, 107; Pausanias iii. 8. 3-8; Plutarch, *Lysander* ix. 14. 22, *Alcibiades* 23-25, *Lycurgus* 12, *Agesilaus* i. 3, *de Tranquill. Anim.* 6. (See PELOPONNESIAN WAR.)

(3) Son of Archidamus III., of the Eurypontid line, commonly called Agis II. He succeeded his father in 338 B.C., on the very day of the battle of Chaeronea. During Alexander's Asiatic campaign he revolted against Macedonia (333 B.C.) and, with the aid of Persian money and ships and a force of 8000 Greek mercenaries, gained considerable successes in Crete. In the Peloponnese he routed a force under Corragus and, although Athens held aloof, he was joined by Elis, Achaea (except Pellene) and Arcadia, with the exception of Megalopolis, which the allies besieged. Antipater marched rapidly to its relief at the head of a large army, and the allied force was defeated after a desperate struggle (331) and Agis was slain.

Pausanias iii. 10. 5; Diodorus xvii. 48, 62, 63; Justin xii. 1; Quintus Curtius iv. 1, 39, vi. 1; Arrian, *Anabasis*, ii. 13.

(4) Son of Eudamidas II., of the Eurypontid family, commonly called Agis III. He succeeded his father probably in 245 B.C., in his twentieth year. At this time the state had been brought to the brink of ruin by the growth of avarice and luxury; there was a glaring inequality in the distribution of land and wealth, and the number of full citizens had sunk to 700, of whom about 100 practically monopolized the land. Though reared in the height of luxury he at once determined to restore the traditional institutions of Lycurgus, with the aid of Lysander, a descendant of the victor of Aegospotami, and Mandrocleidas, a man of noted prudence and courage; even his mother, the wealthy Agesistrata, threw herself heartily into the cause. A powerful but not disinterested ally was found in the king's uncle, Agesilaus, who hoped to rid himself of his debts without losing his vast estates. Lysander as ephor proposed on behalf of Agis that all debts should be cancelled and that Laconia should be divided into 19,500 lots, of which 4500 should be given to Spartiates, whose number was to be recruited from the best of the perioeci and foreigners, and the remaining 15,000 to perioeci who could bear arms. The Agiad king Leonidas having prevailed on the council to reject this measure, though by a majority of only one, was deposed in favour of his son-in-law Cleombrotus, who assisted Agis in bearing down opposition by the threat of force. The abolition of debts was carried into effect, but the land distribution was put off by Agesilaus on various pretexts. At this point Aratus appealed to Sparta to help the Achaeans in repelling an expected Aetolian attack, and Agis was sent to the Isthmus at the head of an army. In his absence the open violence and extortion of Agesilaus, combined with the popular disappointment at the failure of the agrarian scheme, brought about the restoration of Leonidas and the deposition of Cleombrotus, who took refuge at the temple of Apollo at Taenarum and escaped death only at the entreaty of his wife, Leonidas's daughter Chilonis. On his return Agis fled to the temple of Athene Chalcioecus at Sparta, but soon afterwards he was treacherously induced to leave his asylum and, after a mockery of a trial, was strangled in prison, his mother and grandmother sharing the same fate (241). Though too weak and good-natured to cope with the problem which confronted him, Agis was characterized by a sincerity of purpose and a blend of youthful modesty with royal dignity, which render him perhaps the most attractive figure in the whole of Spartan history.

See Plutarch's biography. Pausanias' accounts (ii. 8. 5, vii. 7. 3, viii. 10. 5-8, 27. 13) of his attack on Megalopolis, his seizure of Pellene and his death at Mantinea fighting against the Arcadians, Achaeans and Sicyonians are without foundation (J. C. F. Manso, *Sparta*, iii. 2. 123-127). See also Manso, *op. cit.* iii. 1. 276-302; B. Niese, *Geschichte der griechischen und makedonischen Staaten*, ii. 299-303. (M. N. T.)

AGISTMENT. To "agist" (from O. Fr. *agister*, derived from *gésir*—Lat. *jacere*—to lie) is, in law, to take cattle to graze, for a remuneration. "Agistment," in the first instance, referred more particularly to the proceeds of pasturage in the king's forests, but now means either (*a*) the contract for taking in and feeding horses or other cattle on pasture land, for the consideration of a weekly payment of money, or (*b*) the profit derived from such pasturing. Agistment is a contract of bailment, and the bailer is bound to take reasonable care of the animals entrusted to him; he is responsible for damages and injury which result from ordinary casualties, if it be proved that such might have been prevented by the exercise of great care. There is no lien on the cattle for the price of the agistment, unless by express agreement. Under the Agricultural Holdings Act 1883, agisted cattle cannot be distrained on for rent if there be other sufficient distress to be found, and if such other distress be not found, and the cattle be distrained, the owner may redeem them on paying the price of their agistment. The tithe of agistment or "tithe of cattle and other produce of grass lands," was formally abolished by the act of union in 1707, on a motion submitted with a view to defeat that measure.

AGITATORS, or ADJUTATORS, the name given to representatives elected in 1647 by the different regiments of the English Parliamentary army. The word really means an agent, but it was confused with "adjutant," often called "agitant," a title familiar to the soldiers, and thus the form "adjutator" came into use. Early in 1647 the Long Parliament wished either to disband many of the regiments or to send them to Ireland. The soldiers, whose pay was largely in arrear, refused to accept either alternative, and eight of the cavalry regiments elected agitators, called at first commissioners, who laid their grievances before the three generals, and whose letter was read in the House of Commons on the 30th of April 1647. The other regiments followed the example of the cavalry, and the agitators, who belonged to the lower ranks of the army, were supported by many of the officers, who showed their sympathy by signing the *Declaration of the army*. Cromwell and other generals succeeded to some extent in pacifying the troops by promising the payment of arrears for eight weeks at once; but before the return of the generals to London parliament had again decided to disband the army, and soon afterwards fixed the 1st of June as the date on which this process was to begin. Again alarmed, the agitators decided to resist; a mutiny occurred in one regiment and the attempt at disbandment failed. Then followed the seizure of the king by Cornet Joyce, Cromwell's definite adherence to the policy of the army, the signing of the manifestoes, a *Humble Representation* and a *Solemn Engagement* and the establishment of the army council composed of officers and agitators. Having, at an assembly on Thriplow Heath, near Royston, virtually refused the offers made by parliament, the agitators demanded a march towards London and the "purging" of the House of Commons. Subsequent events are part of the general history of England. Gradually the agitators ceased to exist, but many of their ideas were adopted by the Levellers (*q.v.*), who may perhaps be regarded as their successors. Gardiner says of them, "Little as it was intended at the time, nothing was more calculated than the existence of this elected body of agitators to give to the army that distinctive political and religious character which it ultimately bore."

See S. R. Gardiner, *History of the Great Civil War*, vols. iii. and iv. (London, 1905).

AGLIARDI, ANTONIO (1832–   ), papal diplomatist, was born at Cologno (Bergamo), Italy, on the 4th of September 1832. He studied theology and canon law, and, after acting as parish priest in his native diocese for twelve years, was sent by the pope to Canada as a bishop's chaplain. On his return he was appointed secretary to the Propaganda. In 1884 he was created by Leo XIII. archbishop of Caesarea *in partibus* and sent to India to report on the establishment of the hierarchy there. In 1887 he again visited India, to carry out the terms of the concordat arranged with Portugal. The same year he was appointed secretary to the Congregation *super negotiis ecclesiae extraordinariis*, in 1889 became papal nuncio at Munich and in 1892 at Vienna. Allowing himself to be involved in the ecclesiastical disputes by which Hungary was divided in 1895, he was made the subject of formal complaint by the Hungarian government and in 1896 was recalled. His services were rewarded by a cardinalate and the archbishopric of Ferrara. In 1903 he was named vice-chancellor of the Roman Church.

AGNANO, LAGO DI, a circular lake, 5 m. W. of Naples, Italy. It was apparently not formed until the middle ages, as it is not mentioned by ancient writers; it was drained in 1870. It occupied the crater of an extinct volcano, 4 m. in circumference. On the south bank are the Stufe di S. Germano, natural sulphureous vapour baths, and close by is the Grotta del Cane, from the floor of which warm carbonic acid gas constantly rises to a height of 18 in., the fumes of which render a dog insensible in a few seconds. It is mentioned by Pliny (*Nat. Hist.* ii. 93). Remains of an extensive Roman building and some statues have been discovered close by.

AGNATES (*Agnati*), in Roman law, persons related through males only, as opposed to cognates. Agnation was founded on the idea of the family held together by the *patria potestas*; *cognatio* involves simply the modern idea of kindred.

AGNES, SAINT, a virgin martyr of the Catholic Church. The legend of St Agnes is that she was a Roman maid, by birth a

Christian, who suffered martyrdom when but thirteen during the reign of the emperor Diocletian, on the 21st of January 304. The prefect Sempronius wished her to marry his son, and on her refusal condemned her to be outraged before her execution, but her honour was miraculously preserved. When led out to die she was tied to a stake, but the faggots would not burn, whereupon the officer in charge of the troops drew his sword and struck off her head. St Agnes is the patron saint of young girls, who, in rural districts, formerly indulged in all sorts of quaint country magic on St Agnes' Eve (20th–21st January) with a view to discovering their future husbands. This superstition has been immortalized in Keats's poem, "The Eve of St Agnes." St Agnes's bones are supposed to rest in the church of her name at Rome, originally built by Constantine and repaired by Pope Honorius in the 7th century. Here on her festival (21st of January) two lambs are specially blessed after pontifical high mass, and their wool is later woven into pallia (see PALLIUM).

AGNES OF MERAN (d. 1201), queen of France, was the daughter of Bertold IV., duke of Meran in Tirol. She is called Marie by some of the chroniclers. In June 1196 she married Philip II., king of France, who had repudiated Ingeborg of Denmark in 1193. The pope espoused the cause of Ingeborg; but Philip did not submit until 1200, when, interdict having been added to excommunication, he consented to a separation from Agnes. She died in July of the next year, at the castle of Poissy, and was buried in the church of St Corentin, near Nantes. Her two children by Philip II., Philip, count of Clermont (d. 1234), and Mary, who married Philip, count of Namur, were legitimized by Innocent III. in 1201 on the demand of the king. Little is known of the personality of Agnes, beyond the remarkable influence which she exercised over Philip II. She has been made the heroine of a tragedy by François Ponsard, *Agnes de Méranie*.

See the notes of Robert Davidsohn in *Philipp. II. August von Frankreich und Ingeborg* (Stuttgart, 1888). A genealogical notice is furnished by the *Chronicon* of the monk Alberic (Aubry) of Trois-Fontaines, (Albericus Trium Fontium) in Pertz, *Scriptores*, vol. xxiii. pp. 872 f., and by the *Genealogia Wettinensis*, ibid. p. 229.

AGNESI, MARIA GAETANA (1718–1799), Italian mathematician, linguist and philosopher, was born at Milan on the 16th of May 1718, her father being professor of mathematics in the university of Bologna. When only nine years old she had such command of Latin as to be able to publish an elaborate address in that language, maintaining that the pursuit of liberal studies was not improper for her sex. By her thirteenth year she had acquired Greek, Hebrew, French, Spanish, German and other languages. Two years later her father began to assemble in his house at stated intervals a circle of the most learned men in Bologna, before whom she read and maintained a series of theses on the most abstruse philosophical questions. Records of these meetings are given in de Brosse's *Lettres sur l'Italie* and in the *Propositiones Philosophicae*, which her father caused to be published in 1738. These displays, being probably not altogether congenial to Maria, who was of a retiring disposition, ceased in her twentieth year, and it is even said that she had at that age a strong desire to enter a convent. Though the wish was not gratified, she lived from that time in a retirement almost conventual, avoiding all society and devoting herself entirely to the study of mathematics. The most valuable result of her labours was the *Instituzioni analitiche ad uso della gioventu italiana*, a work of great merit, which was published at Milan in 1748. The first volume treats of the analysis of finite quantities, and the second of the analysis of infinitesimals. A French translation of the second volume by P. T. d'Antelmy, with additions by Charles Bossut (1730–1814), appeared at Paris in 1775; and an English translation of the whole work by John Colson (1680–1760), the Lucasian professor of mathematics at Cambridge, was published in 1801 at the expense of Baron Masères. Madame Agnesi also wrote a commentary on the *Traité analytique des sections coniques* of the marquis de l'Hôpital, which, though highly praised by those who saw it in manuscript, was never published. She invented and discussed the curve known as the "witch of Agnesi" (*q.v.*) or versiera. In 1750, on the illness of her father, she was appointed by Pope Benedict XIV. to the chair of mathematics and natural philosophy at Bologna. After the death of her father in 1752 she carried out a long-cherished purpose by giving herself to the study of theology, and especially of the Fathers. After holding for some years the office of directress of the Hospice Trivulzio for Blue Nuns at Milan, she herself joined the sisterhood, and in this austere order ended her days on the 9th of January 1799.

Her sister, MARIA TERESA AGNESI (1724–1780), a well-known Italian pianist and composer, was born at Milan in 1724. She composed several cantatas, two pianoforte concertos and five operas, *Sofonisbe*, *Ciro in Armenia*, *Nitocri*, *Il Re Pastore* and *Insubria consolata*.

See Antonio Francesco Frisi, *Éloge historique de Mademoiselle Agnesi*, translated by Boulard (Paris, 1807); Milesi-Mojon, *Vita di M. G. Agnesi* (Milan, 1836); J. Boyer, "La Mathématicienne Agnesi," in the *Revue Catholique des revues françaises et étrangères* (Paris, 1897).

AGNEW, DAVID HAYES (1818–1892), American surgeon, was born in Lancaster county, Pennsylvania, on the 24th of November 1818. He graduated from the medical department of the university of Pennsylvania in 1838, and a few years later set up in practice at Philadelphia and became a lecturer at the Philadelphia School of Anatomy. He was appointed surgeon at the Philadelphia Hospital in 1854 and was the founder of its pathological museum. For twenty-six years (1863–1889) he was connected with the medical faculty of the university of Pennsylvania, being elected professor of operative surgery in 1870 and professor of the principles and practice of surgery in the following year. From 1865 to 1884—except for a brief interval—he was a surgeon at the Pennsylvania Hospital. During the American Civil War he was consulting surgeon in the Mower Army Hospital, near Philadelphia, and acquired considerable reputation for his operations in cases of gun-shot wounds. He attended as operating surgeon when President Garfield was fatally wounded by the bullet of an assassin in 1881. He was the author of several works, the most important being *The Principles and Practice of Surgery* (1878–1883). He died at Philadelphia on the 22nd of March 1892.

AGNI, the Hindu God of Fire, second only to Indra in the power and importance attributed to him in Vedic mythology. His name is the first word of the first hymn of the Rig-veda: "Agni, I entreat, divine appointed priest of sacrifice." The sacrifices made to Agni pass to the gods, for Agni is a messenger from and to the gods; but, at the same time, he is more than a mere messenger, he is an immortal, for another hymn runs: "No god indeed, no mortal is beyond the might of thee, the mighty One. . . ." He is a god who lives among men, miraculously reborn each day by the fire-drill, by the friction of the two sticks which are regarded as his parents; he is the supreme director of religious ceremonies and duties,and even has the power of influencing the lot of man in the future world. He is worshipped under a threefold form, fire on earth, lightning and the sun. His cult survived the metamorphosis of the ancient Vedic nature-worship into modern Hinduism, and there still are in India fire-priests (*agnihotri*) whose duty is to superintend his worship. The sacred fire-drill for procuring the temple-fire by friction—symbolic of Agni's daily miraculous birth—is still used. In pictorial art Agni is always represented as red, two-faced, suggesting his destructive and beneficent qualities, and with three legs and seven arms.

See W. J. Wilkins, *Hindu Mythology* (London, 1900); A. A. Macdonell, *Vedic Mythology* (Strassburg, 1897).

AGNOETAE (Gr. ἀγνοέω, to be ignorant of), a monophysite sect who maintained that Christ's human nature was like other men's in all respects, including limited knowledge. Its founder was Themistius, a deacon in Alexandria in the 6th century. The sect was anathematized by Gregory the Great.

AGNOIOLOGY (from Gr. ἄγνοια, ignorance), the science or study of ignorance, which determines its quality and conditions.

AGNOSTICISM. The term "agnostic" was invented by Huxley in 1869 to describe the philosophical and religious attitude of those who hold that we can have scientific or real knowledge of phenomena only, and that so far as what may lie behind phenomena is concerned—God, immortality, &c.—there is no evidence which entitles us either to deny or affirm anything. The attitude itself is as old as Scepticism (*q.v.*); but the expressions "agnostic" and "agnosticism" were applied by Huxley to sum up his deductions from those contemporary developments of metaphysics with which the names of Hamilton ("the Unconditioned") and Herbert Spencer ("the Unknowable") were associated; and it is important, therefore, to fix precisely his own intellectual standpoint in the matter. Though Huxley only began to use the term "agnostic" in 1869, his opinions had taken shape some time before that date. In a letter to Charles Kingsley (September 23, 1860) he wrote very fully concerning his beliefs:—

> "I neither affirm nor deny the immortality of man. I see no reason for believing it, but, on the other hand, I have no means of disproving it. I have no *a priori* objections to the doctrine. No man who has to deal daily and hourly with nature can trouble himself about *a priori* difficulties. Give me such evidence as would justify me in believing in anything else, and I will believe that. Why should I not? It is not half so wonderful as the conservation of force or the indestructibility of matter. . . .
>
> "It is no use to talk to me of analogies and probabilities. I know what I mean when I say I believe in the law of the inverse squares, and I will not rest my life and my hopes upon weaker convictions. . . .
>
> "That my personality is the surest thing I know may be true. But the attempt to conceive what it is leads me into mere verbal subtleties. I have champed up all that chaff about the ego and the non-ego, noumena and phenomena, and all the rest of it, too often not to know that in attempting even to think of these questions, the human intellect flounders at once out of its depth."

And again, to the same correspondent, the 5th of May 1863:—

> "I have never had the least sympathy with the *c priori* reasons against orthodoxy, and I have by nature and disposition the greatest possible antipathy to all the atheistic and infidel school. Nevertheless I know that I am, in spite of myself, exactly what the Christian would call, and, so far as I can see, is justified in calling, atheist and infidel. I cannot see one shadow or tittle of evidence that the great unknown underlying the phenomenon of the universe stands to us in the relation of a Father—loves us and cares for us as Christianity asserts. So with regard to the other great Christian dogmas, immortality of soul and future state of rewards and punishments, what possible objection can I—who am compelled perforce to believe in the immortality of what we call Matter and Force, and in a very unmistakable *present* state of rewards and punishments for our deeds—have to these doctrines? Give me a scintilla of evidence, and I am ready to jump at them."

Of the origin of the name "agnostic" to cover this attitude, Huxley gave (*Coll. Ess.* v. pp. 237-239) the following account:—

> "When I reached intellectual maturity, and began to ask myself whether I was an atheist, a theist or a pantheist, a materialist or an idealist, a Christian or a freethinker, I found that the more I learned and reflected, the less ready was the answer. The one thing on which most of these good people were agreed was the one thing in which I differed from them. They were quite sure they had attained a certain 'gnosis'—had more or less successfully solved the problem of existence; while I was quite sure that I had not, and had a pretty strong conviction that the problem was insoluble. This was my situation when I had the good fortune to find a place among the members of that remarkable confraternity of antagonists, the Metaphysical Society. Every variety of philosophical and theological opinion was represented there; most of my colleagues were *-ists* of one sort or another; and I, the man without a rag of a belief to cover himself with, could not fail to have some of the uneasy feelings which must have beset the historical fox when, after leaving the trap in which his tail remained, he presented himself to his normally elongated companions. So I took thought, and invented what I conceived to be the appropriate title of 'agnostic.' It came into my head as suggestively antithetic to the 'gnostic' of Church history, who professed to know so much about the very things of which I was ignorant. To my great satisfaction the term took."

This account is confirmed by R. H. Hutton, who in 1881 wrote that the word "was suggested by Huxley at a meeting held previous to the formation of the now defunct Metaphysical Society at Mr Knowles's house on Clapham Common in 1869, in my hearing. He took it from St Paul's mention of the altar to the Unknown God." Hutton here gives a variant etymology for the word, which may be therefore taken as partly derived from ἄγνωστος (the "unknown" God), and partly from an antithesis to "gnostic"; but the meaning remains the same in either case. The name, as Huxley said, "took"; it was constantly used by Hutton in the *Spectator* and became a fashionable label for contemporary unbelief in Christian dogma. Hutton himself frequently misrepresented the doctrine by describing it as "belief in an unknown and unknowable God"; but agnosticism as defined by Huxley meant not belief, but absence of belief, as much distinct from belief on the one hand as from disbelief on the other; it was the half-way house between the two, where all questions were "open." All that Huxley asked for was evidence, either for or against; but this he believed it impossible to get. Occasionally he too mis-stated the meaning of the word he had invented, and described agnosticism as meaning "that a man shall not say he knows or believes what he has no scientific ground for professing to know or believe." But as the late Rev. A. W. Momerie remarked, this would merely be "a definition of honesty; in that sense we ought all to be agnostics."

Agnosticism really rests on the doctrine of the Unknowable, the assertion that concerning certain objects—among them the Deity—we never can have any "scientific" ground for belief. This way of solving, or passing over, the ultimate problems of thought has had many followers in cultured circles imbued with the new physical science of the day, and with disgust for the dogmatic creeds of contemporary orthodoxy; and its outspoken and even aggressive vindication by physicists of the eminence of Huxley had a potent influence upon the attitude taken towards metaphysics, and upon the form which subsequent Christian apologetics adopted. As a nickname the term "agnostic" was soon misused to cover any and every variation of scepticism, and just as popular preachers confused it with atheism (*q.v.*) in their denunciations, so the callow freethinker—following Tennyson's path of "honest doubt"—classed himself with the agnostics, even while he combined an instinctively Christian theism with a facile rejection of the historical evidences for Christianity.

The term is now less fashionable, though the state of mind persists. Huxley's agnosticism was a natural consequence of the intellectual and philosophical conditions of the 'sixties, when clerical intolerance was trying to excommunicate scientific discovery because it appeared to clash with the book of Genesis. But as the theory of evolution was accepted, a new spirit was gradually introduced into Christian theology, which has turned the controversies between religion and science into other channels and removed the temptation to flaunt a disagreement. A similar effect has been produced by the philosophical reaction against Herbert Spencer, and by the perception that the canons of evidence required in physical science must not be exalted into universal rules of thought. It does not follow that justification by faith must be eliminated in spiritual matters where sight cannot follow, because the physicist's duty and success lie in pinning belief solely on verification by physical phenomena, when they alone are in question; and for mankind generally, though possibly not for an exceptional man like Huxley, an impotent suspension of judgment on such issues as a future life or the Being of God is both unsatisfying and demoralizing.

It is impossible here to do more than indicate the path out of the difficulties raised by Huxley in the letter to Kingsley quoted above. They involve an elaborate discussion, not only of Christian evidences, but of the entire subject-matter alike of Ethics and Metaphysics, of Philosophy as a whole, and of the philosophies of individual writers who have dealt in their different ways with the problems of existence and epistemology. It is, however, permissible to point out that, as has been exhaustively argued by Professor J. Ward in his Gifford lectures for 1896–1898 (*Naturalism and Agnosticism*, 1899), Huxley's challenge ("I know what I mean when I say I believe in the law of the inverse squares, and I will not rest my life and my hopes upon weaker convictions") is one which a spiritualistic philosophy need not shrink from accepting at the hands of naturalistic agnosticism. If, as Huxley admits, even putting it with unnecessary force against himself, "the immortality of man is not half so wonderful as the conservation of force or the indestructibility of matter," the question then is, how far a critical analysis of our belief in the last-named doctrines will leave us in a position to regard them as the last stage in systematic thinking. It is the pitfall of physical science, immersed as its students are apt to be in problems dealing with tangible facts in the world of experience, that there is a tendency among them to claim a superior status of objective reality and finality for the laws to which their data are found to conform. But these generalizations are not ultimate truths, when we have to consider the nature of experience itself. "Because reference to the Deity will not serve for a physical explanation in physics, or a chemical explanation in chemistry, it does not therefore follow," as Professor Ward says (*op. cit.* vol. i. p. 24), "that the sum total of scientific knowledge is equally intelligible whether we accept the theistic hypothesis or not. It is true that every item of scientific knowledge is concerned with some definite relation of definite phenomena, and with nothing else; but, for all that, the systematic organization of such items may quite well yield further knowledge, which transcends the special relations of definite phenomena."

At the opening of the era of modern scientific discovery, with all its fruitful new generalizations, the still more highly generalized laws of epistemology and of the spiritual constitution of man might well baffle the physicist and lead his intellect to "flounder." It is fundamentally necessary, in order to avoid such floundering, that the "knowledge" of things sensible should be kept distinct from the "knowledge" of things spiritual; yet in practice they are constantly confused. When the physicist limits the term "knowledge" to the conclusions from physical apprehensions, his refusal to extend it to conclusions from moral and spiritual apprehensions is merely the consequence of an illegitimate definition. He relies on the validity of his perceptions of physical facts; but the saint and the theologian are no less entitled to rely on the validity of their moral and spiritual experiences. In each case the data rest on an ultimate basis, undemonstrable, indeed, to any one who denies them (even if he be called mad for doing so), except by the continuous process of working out their own proofs, and showing their consistency with, or necessity in, the scheme of things terrestrial on the one hand, or the mind and happiness of man on the other. The tests in each case differ; and it is as irrelevant for the theologian to dispute the "knowledge" of the physicist, by arguments from faith and religion, as it is for the physicist to deny the "knowledge" of the theologian from the point of view of one who ignores the possibility of spiritual apprehension altogether. On the ground of secular history and secular evidence both might reasonably meet, as regards the facts, though not perhaps as to their interpretation; but the reason why they ultimately differ is to be found simply in the difference of their mental attitude towards the nature of "knowledge"—itself a difference of opinion as to the nature of man.

In addition to the literature cited above, see L. Stephen, *An Agnostic's Apology* (1893); R. Flint, *Agnosticism* (1903); T. Bailey Saunders, *The Quest of Faith*, chap. ii. (1899); A. W. Benn, *English Rationalism in the XIXth Century* (London, 1906). (H. Ch.)

AGNUS DEI, the figure of a lamb bearing a cross, symbolical of the Saviour as the "Lamb of God." The device is common in ecclesiastical art, but the name is especially given in the Church of Rome to a small cake made of the wax of the Easter candles and impressed with this figure. Since the 9th century it has been customary for the popes to bless these cakes, and distribute them on the Sunday after Easter among the faithful, by whom they are highly prized as having the power to avert evil. In modern times the distribution has been limited to persons of distinction, and is made by the pope on his accession and every seven years thereafter.

Agnus Dei is also the popular name for the anthem beginning with these words, which is said to have been introduced into the missal by Pope Sergius I. (687–701). Based upon John i. 29, the Latin form is *Agnus Dei, qui tollis peccata mundi, miserere nobis*. In the celebration of the mass it is repeated three times before the communion, and it is also appended to many of the litanies. By the judgment in the case of "Read and others *v.* The Bishop of Lincoln" it was decided in 1890 that the singing of the *Agnus Dei* in English by the choir during the administration of the Holy Communion, provided that the reception of the elements be not delayed till its conclusion, is not illegal in the Church of England.

For the various ceremonies in the blessing of the *Agnus Dei* see A. Vacant, *Dict. de théologie* (cols. 605-613).

AGOBARD (*c.* 779–840), Carolingian prelate and reformer, became coadjutor to Leidrad, archbishop of Lyons, in 813, and on the death of the latter succeeded him in the see (816). We know nothing of his early life nor of his descent. He pursued the same vigorous policy as his predecessor, who had been one of Charlemagne's most active agents in the reformation of the Church. He was strongly opposed to the schemes of the empress Judith for a redivision of the empire in favour of her son Charles the Bald, which he regarded as the cause of all the subsequent evils, and supported Lothair and Pippin against their father the emperor Louis I. Deposed in 835 by the council of Thionville, he made his peace with the emperor and was reinstated in 837. Agobard occupies an important place in the Carolingian renaissance. He wrote extensively not only theological works but also political pamphlets and dissertations directed against popular superstitions. These last works are unique in the literature of the time. He denounced the trial by ordeal of fire and water, the belief in witchcraft, and the ascription of tempests to magic, maintained the Carolingian opposition to image-worship, but carried his logic farther and opposed the adoration of the saints. The basis for this crusade was theological, not scientific; but it reveals a clear intellect and independent judgment. In his purely theological works Agobard was strictly orthodox, except that he denied the verbal inspiration of the Scriptures. Agobard was reverenced as a saint in Lyons, and although his canonization is disputed his life is given by the Bollandists, *Acta Sanctorum*, Jun. ii. 748.

Bibliography.—Agobard's works were lost until 1605, when a manuscript was discovered in Lyons and published by Papirius Masson, again by Baluze in 1666. For later editions see Potthast, *Bibliotheca Historica Medii Aevi*. The life of Agobard in Ebert's *Geschichte der Litteratur des Mittelalters* (1880), Band ii., is still one of the best to consult. For further indications see A. Molinier, *Sources de l'histoire de France*, i. p. 235.

AGONALIA, in ancient Rome, festivals celebrated on the 9th of January, 17th of March, 21st of May, and 11th of December in each year in honour of various divinities (Ovid, *Fasti*, i. 319-332). The word is derived either from *agonia*, "a victim," or from *agonium*, "a festival."

AGONIC LINES (from Gr. ἀ-, privative, and γωνία, an angle), the term given to the imaginary lines on the earth's surface connecting points at which the magnetic needle points to the geographical north and south. (See Magnetism, Terrestrial.)

AGONOTHETES, in ancient Greece, the president or superintendent of the sacred games. At first the person who instituted the games and defrayed the expenses was the Agonothetes; but in the great public games, such as the Olympic and Pythian, these presidents were the representatives of different states, or were chosen from the people in whose country the games were celebrated; thus at the Panathenaic festival at Athens ten *athlothetae* were elected for four years to superintend the various contests. They were variously called αἰσυμνῆται, βραβευταί, ἀγωνάρχαι, ἀγωνοδίκαι, ἀθλοθέται (at Athens), ῥαβδοῦχοι or ῥαβδονόμοι (from the rod or sceptre emblematic of their authority), but their functions were generally the same.

AGORA, originally, in primitive times, the assembly of the Greek people, convoked by the king or one of his nobles. The right of speech and vote was restricted to the nobles, the people being permitted to express their opinion only by signs of applause or disapproval. The word then came to be used for the place where assemblies were held, and thus from its convenience as a meeting-place the agora became in most of the cities of Greece the general resort for public and especially commercial intercourse, corresponding in general with the Roman forum. At Athens, with the increase of commerce and political interest, it was found advisable to call public meetings at the Pnyx or the temple of Dionysus; but the important assemblies, such as meetings for ostracism, were held in the agora. In the best days of Greece the agora was the place where nearly all public traffic was conducted. It was most frequented in the forenoon, and then only by men. Slaves did the greater part of the purchasing, though even the noblest citizens of Athens did not scruple to buy and sell there. Citizens were allowed a free market; foreigners and metics had to pay a toll. Public festivals also were celebrated in the open area of the agora. At Athens the agora of classical times was adorned with trees planted by Cimon; around it numerous public buildings were erected, such as the council chamber and the law courts (for its topography, see Athens). Pausanias (especially vi. 24) is the great architectural authority on the agorae of various Greek cities, and details are also given by Vitruvius (v. 1).

AGORACRITUS, a Parian and Athenian sculptor of the age of Phidias, and said to have been his favourite pupil. His most noted work was the statue at Rhamnus of Nemesis, by some attributed to Phidias himself. Of this statue part of the head is in the British Museum; some fragments of the reliefs which adorned the pedestal are in the museum at Athens.

AGORANOMI, magistrates in the republics of Greece, whose position and duties were in many respects similar to those of the aediles of Rome. In Athens there were ten, chosen annually by lot, five of whom took charge of the city and five of the Peiraeus. They maintained order in the markets, settled disputes, examined the quality of the articles exposed for sale, tested weights and measures, collected the harbour dues and enforced the shipping regulations.

AGORDAT, a town of Eritrea, N.E. Africa, on the route between Massawa and Kassala. At Agordat on the 21st of December 1893 the Italian troops under Colonel Arimondi inflicted a severe defeat on the followers of the khalifa. Agordat is protected by a strong fort. (See Eritrea and Sudan, *History*.)

AGOSTINI, LEONARDO, Italian antiquary of the 17th century, was born at Siena. After being employed for some time to collect works of art for the Barberini palace, he was appointed by Pope Alexander VII. superintendent of antiquities in the Roman states. He issued a new edition of Paruta's *Sicilian Medals*, with engravings of 400 additional specimens; and in conjunction with Giovanni Bellori (1615–1696) he also published a work on antique sculptured gems, which was translated into Latin by Jakob Gronovius (Amsterdam, 1685).

AGOSTINO, or Agostini [Augustinus], **PAOLO** (1593–1629), Italian musician, was born at Valerano, and studied under G. B. Nanini, as we learn from the dedication in the third and fourth books of his masses, subsequently becoming the son-in-law of his master. He succeeded Ugolini as conductor of the pope's orchestra in St. Peter's. His musical compositions are numerous and of great merit, an *Agnus Dei* for eight voices being specially admired.

AGOSTINO and **AGNOLO** (or Angelo) **DA SIENA,** Italian architects and sculptors in the first half of the 14th century. Della Valle and other commentators deny that they were brothers. They certainly studied together under Giovanni Pisano, and in 1317 were jointly appointed architects of their native town, for which they designed the Porto Romana, the church and convent of St Francis, and other buildings. On the recommendation of the celebrated Giotto, who styled them the best sculptors of the time, they executed in 1330 the tomb of Bishop Guido Tarlati in the cathedral of Arezzo, which Giotto had designed. It was esteemed one of the finest artistic works of the 14th century, but unfortunately was destroyed by the French under the duke of Anjou.

AGOULT, MARIE CATHERINE SOPHIE DE FLAVIGNY, Comtesse d'(1805–1876), French author, whose *nom de plume* was "Daniel Stern," was born at Frankfort-on-Main on the 31st of December 1805. Her father was a French officer who had served in the army of the emigrant princes, and her mother was the daughter of a Frankfort banker. She was married in 1827 to the comte Charles d'Agoult. In Paris she gathered round her a brilliant society which included Alfred de Vigny, Sainte-Beuve, Ingres, Chopin, Meyerbeer, Heine and others. She was separated from her husband, and became the mistress of Franz Liszt. During her frequent travels in Switzerland, France and Italy she made the acquaintance of George Sand, and figures in the *Lettres d'un voyageur* as "Arabella." By Liszt she had three children—a son who died young; Blandine, who married M. Émile Ollivier; and Cosima, who married first Hans von Bülow and later Richard Wagner. The story of her breach with Liszt is told under a very slight disguise in her novel *Nélida* (1845). On her return to Paris in 1841 she began to write art criticisms for the *Presse*, and in 1844 she contributed to the *Revue des deux Mondes* articles on Bettina von Arnim and on Heinrich Heine, but her views were not acceptable to the editor, and Daniel Stern withdrew to become a contributor to the *Revue indépendante*. Mme. d'Agoult was an ardent apostle of the ideas of '48, and from this date her *salon*, which had been literary and artistic, took on a more political tone; revolutionists of various nationalities were welcomed by her, and she had an especial friendship and sympathy for Daniele Manin. In 1857 she produced a national drama, *Jeanne Darc*, which was translated into Italian and presented with brilliant success at Turin. The most important section of Daniel Stern's work is her political and historical essays: *Lettres républicaines* (1848), *Esquisses morales et politiques* (1849), *Histoire de la Révolution de* 1848 (3 vols., 1850–1853), *Histoire des commencements de la République aux Pays-Bas* (1872). Mme. d'Agoult died in Paris on the 5th of March 1876. Her daughter Claire Christine (b. 1830), who married Guy de Charnacé, is known as a writer.

See Mme. d'Agoult, *Mes Souvenirs* (1806–1833), 1877; A. Cuvillier Fleury, *Portraits révolutionnaires*, vol. i. (1889); J. Mazzini, *Lettres de Joseph Mazzini à Daniel Stern* (1872); A. Pommier, *Madame la comtesse d'Agoult* (Daniel Stern), 1876; A. Ungherini, "Daniel Stern" in the *Revista repubblicana* (1880, No. 9); S. Rocheblave, *Une Amitié romanesque, George Sand et Madame d'Agoult* (1895).

AGOUTI, or Aguti, the West Indian name of *Dasyprocta aguti*, a terrestrial rodent of the size of a rabbit, common to Trinidad and Guiana, and classed in the family *Caviidae*. Under the same term may be included the other species of *Dasyprocta*, of which there are about half a score in tropical America. Agoutis are slender-limbed rodents, with five front and three hind toes (the first front toe very minute), and very short tails. The hair, especially on the hind-quarters, is coarse and somewhat rough; the colour being generally rufous brown. The molar teeth have cylindrical crowns, with several islands and a single lateral fold of enamel when worn. In habits agoutis are nocturnal, dwelling in forests, where they conceal themselves during the day in hollow tree-trunks, or in burrows among roots. Active and graceful in their movements, their pace is either a kind of trot or a series of springs following one another so rapidly as to look like a gallop. They take readily to water, in which they swim well. Their food comprises leaves, roots, nuts and other fruits. They do much harm to plantations of sugar-cane and bananas. In captivity the females produce only one or two young at a birth.

AGRA, an ancient city of India, which gives its name to a district and division in the United Provinces. It is famous for containing the most perfect specimens of Mogul architecture. Agra, like Delhi, owes much of its importance in both historical and modern times to the commercial and strategical advantages of its position. The river Jumna, which washes the walls of its fort, was the natural highway for the traffic of the rich delta of Bengal to the heart of India, and it formed, moreover, from very ancient times, the frontier defence of the Aryan stock settled in the plain between the Ganges and the Jumna against their western neighbours, hereditary freebooters who occupied the highlands of Central India. No place was better fitted for both an emporium and a frontier fortress. The river formed an unfordable barrier and also a useful means of communication. Jehangir tells us in his autobiography that before his father Akbar built the present fort, the town was defended by a citadel of great antiquity. For three hundred years the Afghans and other tribes came down from the north and founded kingdoms; and their power radiated from Delhi and Agra. It was Sikandar, of the house of Lodi (A.D. 1500), the last of the Afghan dynasties, who realized the strategic importance of Agra as a point for keeping in check his rebellious vassals to the south. He removed his court there, and Agra from being "a mere village of old standing," says a Persian chronicler, became the capital of a kingdom. In 1526 the city was captured by the emperor Baber, the famous Koh-i-noor diamond being part of the loot; and it was here that Baber announced that his invasion was to be a permanent conquest, and not a mere temporary inroad. It was Baber's grandson Akbar that built the present fort, whose strong and lofty walls of red sandstone are a mile and a half in circumference. The building was completed in 1665, when Charles II. was on the throne of England and the plague was devastating London. Another building of much the same date is the red stone palace generally attributed to Akbar, but probably of an earlier time, which is the finest example of pure Hindu architecture; while the Moti Masjid, or Pearl Mosque, is an equally perfect example of the Mahommedan style.

Taj Mahal.

But the glory of Agra, the most splendidly poetic building in the world, is the Taj Mahal, the mausoleum built (A.D. 1632) by the emperor Shah Jahan for the remains of his favourite wife, Mumtaz Mahal, in which he himself also lies buried. The building is built of white marble throughout, crowned with a great white dome in the centre, and with a smaller dome at each of its four corners. From the marble terrace which surrounds it rise four tall minarets of the same material, one at each corner. The Taj has been modelled and painted more frequently than any other building in the world, and the word pictures of it are numberless. But it can only be described as a dream in marble. It amply justifies the saying that the Moguls designed like Titans and finished like jewellers. In regard to colour and design the Taj ranks first in the world for purely decorative workmanship; while the perfect symmetry of its exterior once seen can never be forgotten, nor the aerial grace of its domes, rising like marble bubbles into the azure sky. In his *History of Architecture*, Fergusson says of it:—

> "This building is an early example of that system of inlaying with precious stones which became the great characteristic of the style of the Moghals after the death of Akbar. All the spandrils of the Taj, all the angles and more important architectural details, are heightened by being inlaid with precious stones such as agates, bloodstones, jaspers and the like. These are combined in wreaths, scrolls and frets, as exquisite in design as they are beautiful in colour, and relieved by the pure white marble in which they are inlaid, they form the most beautiful and precious style of ornament ever adopted in architecture. It is lavishly bestowed on the tombs themselves and the screens which surround them, but more sparingly introduced on the mosque that forms one wing of the Taj, and on the fountains and surrounding buildings. The judgment, indeed, with which this style of ornament is apportioned to the various parts, is almost as remarkable as the ornament itself, and conveys a high idea of the taste and skill of the architects of this age."

Of the Taj as a whole Lord Roberts says in his *Forty-one Years in India*:—

> "Neither words nor pencil could give to the most imaginative reader the slightest idea of the all-satisfying beauty and purity of this glorious conception. To those who have not already seen it I would say, 'Go to India. The Taj alone is well worth the journey.'"

The Taj was designed by Ustad Isa, variously described as a Byzantine Turk and a native of Shiraz in Persia. The *pietra dura* work belongs to the Persian school; and the common belief that it was designed by Austin de Bordeaux, a French architect in the service of Shah Jahan, is probably incorrect.

Agra was formerly the capital of the North-West Provinces, but after the Mutiny the seat of government was removed to Allahabad. Situated 841 m. from Calcutta it is now an important railway centre, whence two main lines diverge southwards towards Bombay. In 1901 the population was 188,022, showing an increase of 12% during the decade. The city contains cotton mills, factories for ginning and pressing cotton, a tannery and boot factory and flour mill. There are also two missionary colleges.

The DISTRICT OF AGRA has an area of 1856 sq. m. Its general appearance is that common to the Doab, a level plain intersected by watercourses and ravines. Its general elevation is estimated at from 650 to 700 ft. above the level of the sea. The district is intersected by the Jumna, and is also watered by the Agra canal. The principal crops are millets, pulses, barley, wheat, cotton and a little indigo. The population in 1901 was 1,060,528, showing an increase of 6% during the decade.

The DIVISION OF AGRA has an area of 10,154 sq. m. In 1901 the population was 5,249,542, showing an increase of 10% during the decade, attributed to the extension of irrigation from canals. It comprises the six districts of Muttra, Agra, Farukhabad, Mainpuri, Etawah and Etah.

For an account of the architecture of Agra see Fergusson's *History of Architecture*; *Cities of India* (1903), by G. W. Forrest; *Enchanted India* (1899), by Prince Bojidar Karageorgevitch; and E. B. Havell, *Handbook to Agra and the Taj* (1904). (C. L.)

AGRA CANAL, an important Indian irrigation work, available also for navigation, in Delhi, Gurgaon, Muttra and Agra districts, and Bharatpur state. The canal receives its water from the Jumna river at Okla, about 10 m. below Delhi. The weir across the Jumna was the first attempted in Upper India upon a foundation of fine sand; it is about 800 yds. long, and rises 7 ft. above the summer level of the river. From Okla the canal follows the high land between the Khari-nadi and the Jumna, and finally joins the Banganga river about 20 m. below Agra. Navigable branches connect the canal with Muttra and Agra. It was opened in 1874.

AGRAM (Hungarian *Zágráb*, Croatian *Zagreb*), the capital of Croatia-Slavonia, and a royal free town of Hungary; pleasantly situated between the north bank of the Save and the mountains which culminate in Sljeme (3396 ft.); 187 m. by rail S. of Vienna. Pop. (1890) 38,742; (1900) 57,930, or with garrison 61,002. Agram is the seat of the ban, or viceroy, of Croatia-Slavonia, of the Banal and Septemviral courts, the highest in the land, and of a chamber of commerce. It is also the meeting-place of the parliament; but local affairs are conducted by a municipal council. The city is divided into three districts. The Kapitel-Stadt, sometimes called the Bishop's Town, with the palace of the Roman Catholic archbishop, and his late Gothic cathedral, dating from the 15th century, lies eastward of the Medvešćak, a brook which flows into the Save. The *Upper Town*, on high ground west of the Medvešćak, contains the palace of the ban and the natural history museum. On the south, the *Lower Town* is separated from the other districts by the Ilica, a long street traversed by a cable tramway. In it are the business and industrial quarters; the palace of justice; the academy of science, with picture-galleries, a library and a collection of antiquities; the theatre; the Franz Josef University, founded in 1874 to teach theology, law and philosophy; the synagogue; and the only Protestant church existing in the country at the beginning of the 20th century. Roman Catholic churches and schools are numerous. Besides the large Maximir park and botanical gardens, many of the squares are planted with trees and adorned with statues; while the whole city is surrounded by vineyards and country houses. Tobacco, leather, linen, carpets and war-material are manufactured in Agram, which also contains the works of the Hungarian state railways, and has a brisk trade in grain, wine, potash, honey, silk and porcelain.

In 1094 Agram was founded by Ladislaus I. of Hungary, as the seat of a bishop; and on the expulsion of its Mongol colony, in 1242, it was raised to the rank of a royal free city. For centuries a bitter feud raged between the Kapitel-Stadt and the Upper Town, until these rivals were forced to join hands against the Turks. Agram, already the political centre of Croatia-Slavonia, was selected as the capital in 1867. It suffered severely from earthquake in 1880 and 1901.

AGRAPHA (*i.e.* "unwritten"), the name given to certain utterances ascribed, with some degree of certainty, to Jesus, which have been preserved in documents other than the Gospels, *e.g.* Acts xx. 35; 1 Tim. v. 18; 1 Cor. vii. 10-12, and the Logia (*q.v.*) discovered in 1897 and 1903 at Oxyrhyncus. Two interesting examples of such sayings may be quoted: (1) "That which is weak shall be saved by that which is strong"; (2) "Jesus, on whom be peace, has said: 'The world is merely a bridge; ye are to pass over it, and not to build your dwellings upon it.'" The first of these is from the Apostolic Canons (*c.* A.D. 300), the second was found by the missionary Alexander Duff inscribed in Arabic on the gateway of the mosque at Fatehpur Sikri.

The earliest modern collection of such sayings was by Cotelerius, *Ecclesiae Graecae Monumenta* (1677–1688), followed by J. E. Grabe, *Spicelegium* (1698 and 1700), and J. B. Fabricius, *Codex Apocryph. N. T.* (2nd ed., 1719). See also A. Resch, *Agrapha* (Leipzig, 1889); J. H. Ropes, *Die Sprüche Jesu* (Leipzig, 1896); and the article "Sayings" in J. Hastings' *Dictionary of Christ and the Gospels.*

AGRARIAN LAWS (Lat. *ager*, land). Under this heading we deal with the disposal of the public land (*ager publicus*) of ancient Rome. It was a principle of the Republican constitution that no gratuitous disposition of state property should be made without the consent of the people. Hence many of the ordinances affecting the public land were laws (*leges*) in the strictest sense of that word. It is, however, both justifiable and convenient to consider in this article all the regulations that were made for the administration of the public land by the executive authorities, as well as by the people during the Republic, and by the commands of the emperor, which had the force of law during the Principate.

The existence of public land, first in Italy, and then in the Mediterranean world, was the outcome of two ideas which are very familiar to students of antiquity. This land was the prize of conquest and was one of the means of defraying the current expenses of state-administration. For the latter purpose land is often leased or allowed to be occupied on the condition of the payment of dues. But it may be made to fufil another purpose as well—this purpose being the satisfaction of the individual needs of poorer citizens. To meet this object the land is usually assigned, and on assignment generally ceases to be the property of the state. But it often happens that the state is not wholly disinterested in undertaking such acts of assignment. It gains security and territorial control by planting garrisons in conquered country, and it relieves itself of the necessity of providing for its poorer classes whether by state-aid or by a hazardous tampering with the rights of private property. In this use to which public land could be turned we see at once the connexion between agrarian legislation and colonization—a connexion which was so close that when a Roman spoke of an agrarian law he seems generally to have understood by it a law establishing a colony—and also the two aspects of colonization, the military and the social. These two objects were indissolubly connected throughout the whole of the earlier period of Roman agrarian assignation. They only became separated in the period subsequent to the Gracchi in so far as social motives still continued to be operative when military precautions had ceased to be necessary. It is probable that one of the chief motives which prompted infant Rome to war with her neighbours was the land-hunger of her citizens. This hunger she satisfied after conquest by annexing a portion of the enemy's territory. The amount thus confiscated varied from time to time. It was usually a third, but sometimes a half or even two-thirds, and after the fall of Capua in the Second Punic War the whole territory of the state was annexed. It is possible that by the close of the 2nd century B.C. one-half of the land of Italy belonged to Rome whether in private ownership or as the property of the state. Annexation was carried on in the provinces on a relatively smaller scale; but Rome retained as domain-land much of the territory of communities which had been destroyed, such as Carthage and Corinth, and the estates of former kings, such as the lands of the Attalids in the Chersonese. Other domains in Sicily and Greece, such as the territory of Leontini in the former, or Oropus in the latter case, are also found. This peculiar property of the Roman state in the provinces must be carefully distinguished from the general overlordship which Rome was supposed to hold over all provincial soil, expressed in the statement that provincials had only possession or usufruct of their land (Gaius ii. 7; *Gromatici*, p. 36, Lachmann). This overlordship was probably merely a legal fiction by which the juristic mind assigned a reason for the fact that the provincials paid a land tax from which Italians were exempt.

Such portions of the territories of conquered cities as were not claimed by Rome were as a matter of course left in the undisturbed possession of these cities. If the city was a federate state (*civitas foederata*), his possession was guaranteed by a treaty; if it was a free city, the guarantee was made by charter; if it was neither federate nor free, the abandonment of the territory by Rome must have been taken as a sufficient guarantee of the city's right to possess, although statements relative to the surrender may have been contained in the charter of the province (*lex provinciae*) to which the city belonged. But, whether the states were federate, free or stipendiary, there was only one case in which it was important to specify precisely that land had been restored (*redditus*) to its former occupants. This was the case where Rome had marked out a territory for assignment to her own citizens, but where in or near the limits of the assignment some of the land had been left in the hands of its former proprietors. Such land was noted in the state registers as *redditus veteri possessori*. Sometimes it was found that such an ancient possessor owned pieces of land separated from one another. In such cases an exchange might be effected between him and some other possessor, so that his possessions might be continuous. The fact of such an exchange was symbolized in the registers by the entry of land *redditus et commutatus pro suo*.

When the claims of earlier owners had been satisfied, the state proceeded to deal with such land as it retained. It dealt with it in two ways. It either alienated it, whether in exchange for a price or gratuitously; or it kept it as a source of revenue, whether on a system of lease or on some system of remunerative occupation. We may first consider the cases in which the state decided to alienate. The land might be sold for the benefit of the treasury. Typical instances of this treatment are furnished by the sale of some Campanian land during the Second Punic War (Livy xxviii. 46, xxxii. 7). The censors may have directed the sale, but it was executed by the quaestors as the regular officials of the treasury. Hence such land was described as *ager quaestorius*. The land was sold in definitely marked out plots, and we must suppose that, as a rule, when this sale had been effected, the lots fell under the absolute ownership of their purchasers. Yet there was some period of Roman history when this ownership was (at least in certain cases) conditioned. The Roman writers on agriculture speak of conditions and their neglect (*Gromatici*, p. 115). The conditions were probably those of military service or frontier defence. The epoch of history at which this conditioned ownership was recognized cannot be determined. It is a form of tenure that would be equally appropriate to the needs of the earliest period of Roman history and to those of imperial times.

The second mode of alienation was that by assignation. Lands thus assigned were known as *agri dati assignati*. The gift on the part of the state was gratuitous, and ownership passed wholly to the assignee. The land so given was definitely surveyed, marked out and registered. Such an assignment might take one of two possible forms. It might be the means of establishing a new "plantation" (*colonia*), with some independent political organization of its own, however slight—a settlement, therefore, which could be thought of as an entity separate from the city of Rome and from any other municipality. Or it might be the means of providing allotments for individuals who remained domiciled at Rome or continued to be members of some already existing municipality. It has been frequently held in modern times that this latter method of assignment is the one which our ancient authorities describe as assignment to individuals (*viritim*), and that the antithesis lies between the "colonial" and the "viritane" method of distribution. It is true that the passages which speak of the latter mode of assignation need not, and perhaps cannot, be interpreted as presenting the antithesis (Varro, *de Re Rustica*, i. 2. 7, i. 10. 2; Livy iv. 48, v. 24; Festus, p. 373; *Gromatici*, pp. 154, 160); yet it is not improbable that the antithesis is latent in this specific use of the term. It seems clear that the idea of assignation to, and, therefore, of ownership by, individuals must originally have been developed in contrast to the idea of ownership by some larger group (see Roman Law). When the stage of individual ownership was reached, all assignation was "viritane," but only some assignation was "colonial." "Viritane" was, therefore, the wider term which would cover, and may sometimes have been used specially to denote, the system of non-colonial assignment. The amount granted to individuals in assignments of both types varied from time to time. It was reckoned in terms of the *jugerum*, which was approximately $\frac{5}{8}$ of an English acre. The earliest and smallest assignment was 2 *jugera*—an amount so small that it seems to presuppose on the part of the recipient some share in common or gentile property or some additional private property of his own. Other quotas were 3, $3\frac{5}{12}$, 7, 10+14 *jugera*. The last was the maximum amount granted before the time of Ti. Gracchus (133 B.C.), and it was held by representatives of the old school that 7 *jugera* were as much as any frugal Roman should want (Pliny, *Historia Naturalis*, xviii. 18). The division was carried out by commissions of 3, 5 or 10 men appointed by the people (Cicero, *de Lege Agraria* ii. 7. 17). The land which the state retained as *ager publicus* was always placed in the hands of individuals, who occupied it in some manner remunerative to the state. These individuals (*possessores*) were never regarded as owners of the land thus occupied. It remained the property of the state, was held without a contract (*precario*) and could be resumed by the state at will. But though the possessors had no claim against the state, their ownership could be defended against all other individual claimants; and it seems probable that from an early date the praetor's possessory interdict was used to protect all occupiers, provided their tenure had been acquired neither by force (*vi*) nor by seizure of land in its occupiers' absence (*clam*), nor by mere permission of the previous holder to occupy (*precario alter ab altero*). Moreover, Appian says that possessors of this type could transfer their land by inheritance, and that the land was accepted as security by creditors. This kind of occupation, therefore, though clearly distinguished from ownership (*dominium*), was yet regarded as a perfectly secure form of tenure. All occupiers of public land paid dues to the state through a state contractor (*publicanus*). These dues varied in amount, and in the method of their collection. We learn from Appian that the ordinary dues paid by occupiers of arable land in Italy were $\frac{1}{10}$ of seed crops and $\frac{1}{5}$ of plant produce. Owners who turned cattle or sheep on pasture land belonging to the state also paid fixed dues to the treasury. The occupiers of the Roman public land in Campania paid a large rent (Cic. *de leg. Agr.* i. 7. 21). Appian's account of the public land (*Bell. Civ.* i. 7) would lead us to suppose that the amount of tax paid by the occupier, and the method adopted by the state for the collection of the revenues, depended upon the nature of the land at the time when it first passed to a *possessor*. He says that some of the public land which was in a good state of cultivation was let on lease; but that with regard to the poor or devastated land proclamation was made that anyone might squat on it and till it in return for the small payment in kind mentioned above. It has been questioned whether the land described by Appian and by Cicero as let on lease, of which the Campanian land and some lands in Sicily are typical, represents a legally distinct class. It seems probable that the distinction is one of practice rather than of law, and that the difference lay not in the relation between the state and the possessor (as would be the case if the leased land were really let to individuals by the censor, while the occupied land was held by mere permission of the state without any contract) but in the details of the contract between the censor and the *publicanus* with regard to the collection of the dues. The conditions of the tenure of the Roman public land in Africa are known to us from the *Lex Agraria* of 111 B.C. (Bruns, *Fontes*, i. 3. 11, vv. 85 foll.). Here the *publicanus* is the middleman between the state and the *possessor*, and purchases from the censor the right of collecting dues. The law places no restriction on bargaining between the censor and the *publicanus*, but enacts that no *possessor* or *pastor* shall ever be required by the *publicanus* to pay more than the amount prescribed by the censors of 115 B.C. These conditions may be regarded as typical for the occupation of public lands. And when Cicero speaks of public land as let on lease (*locatus*) by the censor, he no doubt refers to the farming of the taxes to a *publicanus* for a fixed period, and not to the letting of the land. This seems clear from a passage (in *Verr.* iii. 6. 12) where he speaks of land in Sicily which had been restored by Rome to former owners as being leased. The land itself could not be leased by Rome if it belonged not to Rome but to the Sicilian inhabitants; but the collection of the revenues due to Rome could be so leased to *Publicani* (*q.v.*). And the same explanation would apply to Cicero's statements that the Campanian land was let on lease by the censors (cf. Festus, s.v. *venditiones*). The view that there was a distinct class of the public land which was let out for a fixed term of years to tenants on a definite lease, unlike the ordinary public land which was always held in occupation merely at will (*precario*), has been maintained by W. A. Becker, and seems to be supported, with the help of conjecture, by a few passages in Cicero and by Hyginus (*Gromatici*, p. 116). But the passage of Hyginus is barely intelligible even on this supposition; and Cicero's repeated statement that the Campanian land was expressly exempted from the legislation of the Gracchi (cf. *Lex Agraria*, Bruns, *loc. cit.* v. 6) shows that there was not sufficient distinction between the Campanian tenure and that of other public land in Italy to make this definite exception by name superfluous. The Sempronian law could obviously not touch land which the state had leased to occupiers on the basis of a definite contract. Moreover, we have absolutely no evidence for such a contract, even in Cicero's speeches against Rullus, when he might be expected to mention it as an objection to Rullus's bill. That there were some distinctive characteristics about the tenure of certain lands, of which the Campanian land is typical, seems proved by the repeated association of these lands with certain special lands in the provinces, especially at Leontini in Sicily, and by some passages in the *Gromatici* where *agri vectigales* are spoken of as a distinct class. But what these characteristics were cannot be clearly determined. It seems certain that in every case the possessor occupied *precario*, and that only in the bargain between the censor and the middleman was there room for contract. Thus the state was justified in the claim to resume public land which it made in many of the Agrarian laws.

The earliest agrarian measures of which we have any record are the distributions of land conquered in war to poor citizens, which later authorities attribute to Numa and Servius Tullius. Such assignments, however, are not the result of legislative acts, but of a voluntary surrender on the king's part of his own portion of the spoils. It is probable that the agrarian law which resulted from the proposals of Spurius Cassius (consul 486 B.C.) was the first attempt made by the Roman people to exercise its control over the occupation of state territory. According to the traditional account, Cassius proposed that such portion of lands lately conquered from the Hernici as fell to the Roman state should be divided in equal shares between the Roman *plebs* and the Latins; and further that poor citizens should receive allotments of land previously conquered, and occupied without any legal right by the Patricians. The inclusion of the Latins in the distribution was afterwards dropped; but the law in its final form certainly asserted the right of the Plebeians to take their share in the public land. The accounts given of it by Livy and Dionysius are no doubt coloured by their knowledge of later agrarian legislation, and it seems hardly likely that the proposal to resume and redistribute public land already occupied was made at this early stage; but it probably challenged the exclusive claim of Patricians to occupy. We hear of another agrarian law proposed by the tribune Lucius Icilius in 456 B.C. (*Lex Icilia de Aventino publicando*) which regulated in some way the tenure of public land on the Aventine. In 376 B.C. the tribunes Licinius and Sextius introduced into their laws, for the promotion of the privileges of the *plebs*, a clause enacting that no more than 500 *jugera* of land should be occupied by a single cultivator. It seems almost certain from Livy's account that this measure referred only to the occupation of *ager publicus*, though some modern authorities have upheld the view that it dealt with land held on any kind of tenure, others again that it dealt only with private property in land. According to Appian, the law also enacted that only 100 cattle and 500 sheep might be turned by one owner on the public pastures. But it failed of its object because it did not provide any adequate machinery for the resumption by the state of land held in excess of the prescribed amount, and was therefore easily evaded. The next agrarian law we hear of was a more special measure dealing with lands conquered from the Senones and Picentines. In 232 B.C. C. Flaminius, then tribune of the *plebs*, proposed to resume these lands for the state, although they were already occupied by large landholders, and to distribute them in allotments to poor citizens. The measure met with much opposition from the richer classes, and did not gain the sanction of the senate; but C. Flaminius ignored constitutional usage and brought it direct before the council of the *plebs*, by which it was made law. In 133 B.C. the tribune Tiberius Gracchus (*q.v.*) re-enacted the earlier measure of Licinius and Sextius, with the additional provisions that each owner might occupy 250 *jugera* for each son, in addition to the original 500, and that a commission of three (*iii. viri agris dandis adsignandis*) should be appointed to carry out the terms of the law. He also enacted that the land occupied in excess of the prescribed amount, and on that account resumed for the state by the land commission, should be distributed in inalienable lots to poor citizens. Subsequent modifications of those provisions which dealt with the powers of the land commission led to a re-enactment of the whole by C. Gracchus, the brother of Tiberius, tribune in 123 B.C. But within 15 years from the tribunate of C. Gracchus the whole of his law had been rendered null by three further enactments. The first of these permitted the sale of land allotted under the law, which thus tended to return into the hands of its former occupiers as private property, which the state had no longer any right to resume. The second abolished the commission appointed to carry out the terms of the law, thus putting a stop to further resumption and distribution, and also transformed existing occupiers into owners of the land they occupied, paying only a small due to the treasury. The third (probably the surviving *Lex Agraria*, Bruns, *loc. cit.*) abolished the payment. This law belongs to the year 111 B.C. The dates of the two former laws are uncertain, but it is probable that the first was passed in 121, the second in 119 or 118. From this time forward a change comes over land legislation. The ordinary public land in Italy, in the hands of occupiers, which had given rise to all the agrarian legislation between 376 and 111, had practically ceased to exist. The Campanian land still remained, but the same reasons which led to its exemption from the Gracchan legislation seem to have continued to protect its holders until 63 B.C. In the meantime several agrarian laws were passed which provided for the distribution of land placed in some other way at the disposal of the state. In 100 B.C. Appuleius Saturninus (*q.v.*), tribune of the *plebs*, proposed the allotment of lands recently taken from the Cimbri in Gaul. This law was passed, but eventually declared null by the senate, with the rest of Saturninus's laws. A more dangerous precedent was set by Sulla in his dictatorship (82–81 B.C.). He was the first to confiscate the lands of his political foes, and of communities which had resisted him, and treating them as *ager publicus*, assign them to his veterans as a prize. This example was followed by Octavian (Augustus) and Antony (M. Antonius) after their proscriptions in 43 B.C. A third method of providing land for distribution was that adopted by Servilius Rullus (*q.v.*) in 63 B.C. His bill enacted that land should be purchased in Italy with money gained by the sale of Roman territories abroad, and allotted to citizens. A commission of ten (*x. viri agris dandis adsignandis*), annually elected by 9 out of the 35 tribes, was to carry out the terms of the law. Rullus also ventured to propose the distribution of the Campanian land, which had hitherto been respected by all agrarian reformers. It was chiefly on this ground that Cicero in his three speeches on the Agrarian law succeeded in exciting such a general feeling against it that it was eventually withdrawn. In 60 B.C. the tribune L. Flavius brought forward a bill for the distribution of lands to Pompey's veterans. The Campanian land was certainly to be included in the distribution, and it is clear from Cicero that the bill in some way dealt violently with the rights of private owners. It also, however, enacted that land should be purchased by the state with the wealth which Pompey's conquests had brought into the treasury. The last proposal was supported by Cicero, but the bill seems to have been dropped, only to reappear in more moderate form in the following year. A consular bill, the *lex Julia Campana*, was passed by Julius Caesar in 59 B.C., which provided for the settlement of Pompey's veterans on the Campanian land, and other lands purchased by the state from private owners in Italy with the full consent of the latter. In its original form, the bill omitted all reference to the Campanian land, which seems to have been included by Caesar in the distribution only when the continued and unreasoning opposition of the senate had goaded him to extreme measures. A commission of twenty was to be appointed to carry out the law, from which Caesar himself was expressly excluded. This measure finally settled the question of the Campanian land, which now passed out of the category of *ager publicus*. The last agrarian law of the republic was that passed in 44 B.C. on the proposal of the consul M. Antonius, or of his brother L. Antonius. We have no detailed account of the measure, but it seems to have provided grants of land for veterans, and was to be administered by seven commissioners. The law was afterwards cancelled by decree of the senate, probably on the ground of some technical flaw. The emperor Vespasian attempted to reclaim for the state small oddments of land (*subseciva*) which were held by neighbouring owners to whom they had never been definitely assigned. The attempt met with violent opposition, and though resumed by Titus, was finally crushed by Domitian, who issued an edict recognizing all oddments of land thus held to be private property.

AUTHORITIES.—Niebuhr, *History of Rome* (English translation), ii. p. 129 foll. (Cambridge, 1832); Becker, *Handbuch der römischen Alterthümer*, iii. 2, p. 142 (Leipzig, 1843); Marquardt, *Römische Staatsverwaltung*, i. p. 96 foll. (Leipzig, 1881); Madvig, *Verfassung und Verwaltung des römischen Staates*, ii. p. 364 foll. (Leipzig, 1882), (See also ROME, *History*.) (A. H. J. G.; A. M. CL.)

AGREDA, MARIA FERNANDEZ CORONEL, ABBESS OF, known in religion as Sor (Sister) Maria de Jesus (1602–1665), was the daughter of Don Francisco Coronel and of his wife Catalina de Arana. She was born at Agreda, on the borders of Navarre and Aragon, on the 2nd of April 1602. All her family were powerfully influenced by the ecstatic piety of Spain in that age. Her biographer, Samaniego, records that even as an infant in arms she was filled with divine knowledge. Her stupidity as a child is piously accounted for by extreme humility. From childhood she was favoured by ecstasies and visions. When she was fifteen the whole family entered religion. The father, now an old man, and the two sons entered the Franciscan house of San Antonio de Nalda. Maria, her mother and sister established a Franciscan nunnery in the family house at Agreda, which, when Maria's reputation had extended, was replaced by the existing building. She began it with one hundred reals (one pound sterling) lent her by a devotee, and it was completed in fourteen years by voluntary gifts. Much against her own wish, we are told, she was appointed abbess at the age of twenty-five. In 1668, four years after her death, the Franciscans published a story that at the age of twenty-two she had been miraculously conveyed to Mexico, to convert a native people, and had made five hundred journeys through the air for that purpose in one year. Though the rule required the abbess to be changed every three years, Maria remained the effective ruler of Agreda till her death. The Virgin was declared abbess, and Maria acted as her *locum tenens*. In her later years she inclined to the "internal prayer," and neglect of the outward offices of the church, which was usual with the "alumbrados" or Quietists. The Inquisition took notice of her, but she was not proceeded against with severity. Maria's importance in religion and Spanish history is based on two grounds. In the earlier part of her life, while the Franciscan, Francisco Andres de la Torre, was her confessor, she wrote an *Introduction to the History of the Most Blessed Virgin*. It was destroyed by the direction of another confessor. Later on, by the order of her superiors, and under the guidance of her Franciscan confessor, Andres de Fuen Mayor, she wrote *The Mystic City of God*. It is an extraordinary book, full of apocryphal history, visions and scholasticism, which professes to have been written by divine inspiration, and is devoted to praise of the Virgin. In 1642 she sent to Philip IV. an account of a vision she had had, of a council of the infernal powers for the destruction of Catholicism and Spain. The king visited her when on his way to Aragon to suppress the rebellion of Catalonia. A long correspondence, which lasted till her death on the 29th of March 1665, was begun. The king folded a sheet of paper down the middle and wrote on the one side of the division. The answers were to be written on the other and the sheet returned. By a pious fraud copies were kept at Agreda. How far Maria was only the mouthpiece of the Franciscans must of course be a matter of doubt. Her correspondence was apparently suspended whenever her confessor was absent. She must, however, have co-operated at least, and it is certain that the Franciscans, who were very unfortunate in some of their pious women, owed not a little to her. The letters are in excellent Spanish, are curious reading, and are invaluable as illustrations for the second part of the reign of Philip IV.

The correspondence of Sor Maria with the king has been published in full by Don F. Siluela, *Cartas de la Venerable Madre Sor Maria de Agreda y del Señor Rey Don Filipe IV.* (Madrid, 1885). *The Mystic City of God* is one of the most characteristic monuments of Mariolatry, and has continued to be much in favour with supporters of the dogma of the Immaculate Conception. It appeared in Madrid in 1668, with a biographical introduction by Samaniego, has been often reprinted, and was translated into French and Italian. It was for a time reserved by the Index, both Spanish and Papal, but was taken off by the influence of the Franciscans and of Spain. the chief supporters of the Immaculate Conception. An account of Maria de Agreda will be found in the *Tracts* of Michael Geddes (London, 1706), vol. iii., written by a competent critic and Anglican divine of the 18th century who detested "enthusiasm." (D. H.)

AGRICOLA, CHRISTOPH LUDWIG (1667–1719), German landscape painter, was born and died at Regensburg (Ratisbon). He spent a great part of his life in travel, visiting England, Holland and France, and residing for a considerable period at Naples. His numerous landscapes, chiefly cabinet pictures, are remarkable for fidelity to nature, and especially for their skilful representation of varied phases of climate. In composition his style shows the influence of Caspar Poussin, while in light and colour he imitates Claude Lorraine. His pictures are to be found in Dresden, Brunswick, Vienna, Florence, Naples and many other towns of both Germany and Italy.

AGRICOLA (the Latinized form of the name BAUER), **GEORG** (1490–1555), German scholar and man of science, known as "the father of mineralogy," was born at Glauchau in Saxony on the 24th of March 1490. Gifted with a precocious intellect, he early threw himself into the pursuit of the "new learning," with such effect that at the age of twenty he was appointed *Rector extraordinarius* of Greek at the so-called Great School of Zwickau, and made his appearance as a writer on philology. After two years he gave up his appointment in order to pursue his studies at Leipzig, where, as rector, he received the powerful support of the professor of classics, Peter Mosellanus (1493–1524), a celebrated humanist of the time, with whom he had already been in correspondence. Here he also devoted himself to the study of medicine, physics and chemistry. After the death of Mosellanus he went for a short time to Italy, where he took his doctor's degree. On his return he settled as practising physician in the Joachimstal, a centre of mining and smelting works, his object being partly "to fill in the gaps in the art of healing," partly to test what had been written about mineralogy by careful observation of ores and the methods of their treatment. His thorough grounding in philology and philosophy had accustomed him to systematic thinking, and this enabled him to construct out of his studies and observations of minerals a logical system which he began to publish in 1528. *Bermannus, sive de re metallica dialogus*, the first attempt to reduce to scientific order the knowledge won by practical work, brought Agricola into notice. In 1530 Prince Maurice of Saxony appointed him historiographer with an annual allowance, and he migrated to Chemnitz, the centre of the mining industry, in order to widen the range of his observations. The citizens showed their appreciation of his learning by appointing him town physician and electing him burgomaster. His popularity was, however, short-lived. Chemnitz was a violent centre of the Protestant movement, while Agricola never wavered in his allegiance to the old religion; and he was forced to resign his office. He now lived apart from the contentious movements of the time, devoting himself wholly to learning. His chief interest was still in mineralogy; but he occupied himself also with medical, mathematical, theological and historical subjects, his chief historical work being the *Dominatores Saxonici a prima origine ad hanc aetatem*, published at Freiberg. In 1544 he published the *De ortu et causis subterraneorum*, in which he laid the first foundations of a physical geology, and criticized the theories of the ancients. In 1545 followed the *De natura eorum quae effluunt e terra*; in 1546 the *De veteribus et novis metallis*, a comprehensive account of the discovery and occurrence of minerals; in 1548 the *De animantibus subterraneis*; and in the two following years a number of smaller works on the metals. His most famous work, the *De re metallica, libri xii.*, was published in 1556, though apparently finished several years before, since the dedication to the elector and his brother is dated 1550. It is a complete and systematic treatise on mining and metallurgy, illustrated with many fine and interesting woodcuts and containing, in an appendix, the German equivalents for the technical terms used in the Latin text. It long remained a standard work, and marks its author as one of the most accomplished chemists of his time. Believing the black rock of the Schlossberg at Stolpen to be the same as Pliny's basalt, he applied this name to it, and thus originated a petrological term which has been permanently incorporated in the vocabulary of science.

In spite of the early proof that Agricola had given of the tolerance of his own religious attitude, he was not suffered to end his days in peace. He remained to the end a staunch Catholic, though all Chemnitz had gone over to the Lutheran creed; and it is said that his life was ended by a fit of apoplexy brought on by a heated discussion with a Protestant divine. He died at Chemnitz on the 21st of November 1555, and so violent was the theological feeling against him, that he was not suffered to rest in the town to which he had added lustre. Amidst hostile demonstrations he was carried to Zeitz, seven miles from Chemnitz, and there buried.

See article by Gümbel in *Allgem. Deutsche Biog.* (1875); F. L. Becher, *Georg Agricola und Werner* (Freiberg, 1819); F. A. Schmidt, *Georg Agricola's Bermannus mit Einleitung* (Freiberg, 1806); Poggendorff, *Biographisches Handwörterbuch*; Agricola's works *passim*.

AGRICOLA, GNAEUS JULIUS (A.D. 37–93), Roman statesman and general, father-in-law of the historian Tacitus, was born on the 13th of June A.D. 37 (according to others, 39) at Forum Julii (Fréjus) in Gallia Narbonensis. His father, Julius Graecinus, having been put to death by Caligula, Agricola was brought up by his mother Julia Procilla. After studying philosophy at Massilia, he entered the army and served (59) under Suetonius Paulinus in Britain. In 61 he returned to Rome, where he married Domitia Decidiana, a Roman lady of distinction. In 63 he was quaestor in Asia, in 65 tribune, in 68 praetor, and when Vespasian was proclaimed emperor, he immediately declared himself his supporter. In 70 he was appointed to the command of the 20th legion in Britain, then stationed at Deva (Chester). On his return to Rome at the end of three years he was made censor, raised to the rank of patrician, and appointed governor of Aquitania (74–78). Appointed *consul suffectus* in the following year, he was admitted into the college of pontiffs and made governor of Britain. In the same year he betrothed his daughter to Tacitus. Although the legation of Britain lasted as a rule only three years, Agricola held the post for at least seven and succeeded in reconciling the inhabitants to Roman rule and inducing them to adopt the customs and civilization of their conquerors. His military achievements were equally brilliant. After conquering the Ordovices in North Wales and the island of Mona (Anglesey), during the next two years he carried his victorious arms to the Taus (Tay; others read Tanaus, perhaps the north Tyne), and in his fourth campaign fortified the country between Clota and Bodotria (the firths of Clyde and Forth) as a protection against the attacks of the Caledonians. Having explored the coasts of Fife and Forfar, he gained a decisive victory over the Caledonians under Galgacus at the Graupian hill (see BRITAIN, *Roman*). His successes, however, had aroused the envy and suspicion of Domitian. He was recalled to Rome, where he lived a life of studied retirement, to avoid the possibility of giving offence to the tyrant. He died in 93, poisoned, it was rumoured, by the emperor's orders. The *Life of Agricola* by his son-in-law Tacitus is practically a panegyric or funeral oration.

See Urlichs, *De Vita et Honoribus Agricolae* (1868); Dio Cassius xxxix. 50, lxvi. 20; Mommsen, *Provinces of the Roman Empire* (Eng. trans., 1886), i. 183-184, 194.

AGRICOLA, JOHANN FRIEDRICH (1720–1774), German musician, was born at Dobitschen in Saxe-Altenburg, on the 4th of January 1720. While a student of law at Leipzig he studied music under Johann Sebastian Bach. In 1741 he went to Berlin, where he studied musical composition. He was soon generally recognized as one of the most skilful organists of his time; and in 1751, as the result of a comic opera, *Il Filosofo convinto in amore*, performed at Potsdam, he was made court composer to Frederick the Great. He died in Berlin on the 1st of December 1774. In 1759, on the death of Karl Heinrich Graun, he was appointed conductor of the royal orchestra. Besides several operas of merit, he composed instrumental pieces and church music. His reputation chiefly rests, however, on his theoretical and critical writings on musical subjects. He wrote under the pseudonym of Flavio Anicio Olibrio.

AGRICOLA (originally SCHNEIDER, then SCHNITTER), **JOHANNES** (1494–1566), German Protestant reformer, was born on the 20th of April 1494, at Eisleben, whence he is sometimes called *Magister Islebius*. He studied at Wittenberg, where he soon gained the friendship of Luther. In 1519 he accompanied Luther to the great assembly of German divines at Leipzig, and acted as recording secretary. After teaching for some time in Wittenberg, he went to Frankfort in 1525 to establish the reformed mode of worship. He had resided there only a month when he was called to Eisleben, where he remained till 1526 as teacher in the school of St Andrew, and preacher in the Nicolai church. In 1536 he was recalled to teach in Wittenberg, and was welcomed by Luther. Almost immediately, however, a controversy, which had been begun ten years before and been temporarily silenced, broke out more violently than ever. Agricola was the first to teach the views which Luther was the first to stigmatize by the now well-known name Antinomian (*q.v.*), maintaining that while the unregenerate were still under the Mosaic law, Christians were entirely free from it, being under the gospel alone. In consequence of the bitter controversy with Luther that resulted, Agricola in 1540 left Wittenberg secretly for Berlin, where he published a letter addressed to the elector of Saxony, which was generally interpreted as a recantation of his obnoxious views. Luther, however, seems not to have so accepted it, and Agricola remained at Berlin. The elector Joachim II. of Brandenburg, having taken him into his favour, appointed him court preacher and general superintendent. He held both offices until his death in 1566, and his career in Brandenburg was one of great activity and influence. Along with Julius von Pflug, bishop of Naumburg-Zeitz, and Michael Helding, titular bishop of Sidon, he prepared the Augsburg Interim of 1548. He endeavoured in vain to appease the Adiaphoristic controversy (see ADIAPHORISTS). He died during an epidemic of plague on the 22nd of September 1566. Agricola wrote a number of theological works which are now of little interest. He was the first to make a collection of German proverbs which he illustrated with a commentary. The most complete edition, which contains seven hundred and fifty proverbs, is that published at Wittenberg in 1592; a modern one is that of Latendorf, 1862.

See Cordes, *Joh. Agricola's Schriften möglichst verzeichnet* (Altona, 1817); *Life* by G. Kawerau (1881), who also wrote the notice in Hauck-Herzog, *Realencyk. für prot. Theol.*, where other literature is cited.

AGRICOLA, MARTIN (*c.* 1500–1556), German musician, was born about 1500 in Lower Silesia. His German name was Sohr or Sore. From 1524 till his death he lived at Magdeburg, where he occupied the post of teacher or cantor in the Protestant school. The senator and music-printer Rhau, of Wittenberg, was a close friend of Agricola, whose theoretical works, providing valuable material concerning the change from the old to the new system of notation, he published. Agricola was also the first to harmonize in four parts Luther's chorale, *Ein' feste Burg*.

Four other Agricolas[1] are known as composers between the end of the 15th century and the middle of the 17th.

In the 18th century we find Burney, in the course of his tour in Germany (1772), much impressed by JOHANN FRIEDRICH AGRICOLA (1720–1774), court composer and director of the royal chapel to Frederick the Great. This Agricola was a pupil of Bach, and a fine organist and clever writer on music, especially on operatic style, the problems of which were beginning to be raised by French writers and composers in preparation for the work of Gluck.

AGRICOLA, RODOLPHUS (properly ROELOF HUYSMANN) (1443–1485), Dutch scholar, was born at Baflo, near Groningen, in 1443. He was educated at Louvain, where he graduated as master of arts. After residing for some time in Paris, he went in 1476 to Ferrara in Italy, and attended the lectures of the celebrated Theodorus Gaza (1400–1478) on the Greek language. Having visited Pavia and Rome, he returned to his native country about 1479, and was soon afterwards appointed syndic of Groningen. In 1482, on the invitation of Johann von Dalberg, bishop of Worms (1445–1503), whose friendship he had gained in Italy, he accepted a professorship at Heidelberg, and for three years delivered lectures there and at Worms on the literature of Greece and Rome. By his personal influence much more than by his writings he did much for the promotion of learning in Germany; and Erasmus and other critics of the generation immediately succeeding his own are full of his praises. In his opposition to the scholastic philosophy he in some degree anticipated the great intellectual revolution in which many of his pupils were conspicuous actors. He died at Heidelberg on the 28th of October 1485. His principal work is *De inventione dialectica, libri iii.*, in which he attempts to change the scholastic philosophy of the day.

See T. F. Tresling, *Vita et Merita Rudolphi Agricolae* (Groningen, 1830); v. Bezold, *R. Agricola* (München, 1884); and Ihm, *Der Humanist R. Agricola, sein Leben und seine Schriften* (Paderb., 1893).

AGRICULTURAL GANGS, groups of women, girls and boys organized by an independent gang-master, under whose supervision they execute agricultural piece-work for farmers in certain parts of England. They are sometimes called "public gangs" to distinguish them from "private gangs" consisting of workers engaged by the farmer himself, and undertaking work solely for him, under his own supervision or under that of one of his men. The system was for long prevalent in the counties of Cambridgeshire, Huntingdonshire, Lincolnshire, Nottinghamshire, Norfolk and Suffolk, and is still to be found in a much modified form in the fen district. The practice dates from the latter years of the reign of George III., when the low-lying, marshy lands surrounding the basin of the Wash were being rapidly drained and converted into rich alluvial districts. The unreformed condition of the poor-law, under which the support of the poor fell upon each individual parish, instead of a union of parishes, made landlords reluctant to erect cottages on the reclaimed land for the benefit of their tenants. Labour had to be obtained for the cultivation of these new lands, and that of women, girls and boys, being cheaper than the labour of men, was consequently very largely employed. The tendency to moral and physical ruin which resulted from this nomadic life was so great that an inquiry into the condition of agricultural child-labour was included in the reference to the commission on child-labour appointed in 1862, and the results were so startling that the Agricultural Gangs Act was passed in 1867, forbidding the employment of any child under eight years old, and of any female under a male gang-master unless a female licensed to act as gang-mistress were also present. Gang-masters must be licensed by two justices, and may not hold a liquor license. The distance to be traversed on foot is fixed by the justices, and the licenses must be renewed every six months. Later legislation made more stringent the regulations under which children are employed in agricultural gangs. By the Elementary Education Act 1876, repealing and re-enacting the principal provisions of the Agricultural (Children) Act 1873, no child shall be employed under the age of eleven years, and none between eleven years and thirteen years before the child has obtained a certificate of having reached the standard of education fixed by a by-law in force in the district.

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[1] Alexander, died 1506; Johann, *flor.* 1600; Wolfgang Christoph, *flor.* 1630; and George Ludwig, 1643–1676.

AGRICULTURE (from Lat. *ager*, field, and *colere*, to cultivate), the science, art and industry of utilizing the soil so as to produce the means of human subsistence, embracing in its widest sense the rearing of live-stock as well as the raising of crops. The history of agriculture is the history of man in his most primitive, and most permanent aspect. Hence the nations of antiquity ascribed to it a divine origin; Brahma in Hindustan, Isis in Egypt, Demeter in Greece, and Ceres in Italy, were its founders. The simplest form of agriculture is that in which crops are raised from one patch of ground till it is exhausted, when it is allowed to go wild and abandoned for another. This "extensive" husbandry is found in combination with a nomadic or semi-nomadic and pastoral organization, such as that of the German tribes described by Caesar and Tacitus (see especially *Germania*, 26). The discovery of the uses of the bare fallow and of manure, by making it possible to raise crops from the same area for an indefinite period, marks a stage of progress. This "intensive" culture in a more or less developed form was practised by the great nations of antiquity, and little decided advance was made till after the middle ages. The introduction of new plants, which made it possible to dispense with the bare fallow, and still later the application to husbandry of scientific discoveries as to soils, plant constituents and manures, brought about a revolution in farming. But the progress of husbandry, evidenced by the production of larger and better crops with more certainty, is due to that rationalizing of agricultural practices which is the work of modern times. What before was done in the light of experience is nowadays done in the light of knowledge. Even the earliest forms of intensive cultivation demand the practice of the fundamental processes of husbandry—ploughing, manuring, sowing, weeding, reaping. It is the improvements in methods, implements and materials, brought about by the application of science, that distinguish the husbandry of the 20th century from that of medieval and ancient times.

Egypt.

Ancient Husbandry.—The monumental records of Egypt are the source of the earliest information on farming. The Egypt of the Pharaohs was a country of great estates farmed either by tenants or by slaves or labourers under the superintendence of stewards. It owed its fertility to the Nile, which, inundating the land near its banks, was distributed by means of canals over more distant portions of its valley. The autumnal subsidence of the river was followed by shallow ploughing performed by oxen yoked to clumsy wooden ploughs, the clods being afterwards levelled with wooden hoes by hand. Next came the sowing, the seed being pressed into the soil by the feet of sheep which were driven over the fields. At harvest the corn was cut high on the stalk with short sickles and put up in sheaves, after which it was carried to the threshing-floor and there trodden out by the hoofs of oxen. Winnowing was done by women, who tossed the grain into the air with small wooden boards, the chaff being blown away by the winds. Wheat and barley were the chief crops, and another plant, perhaps identical with the durra, *i.e.* millet, of modern Egypt, was also cultivated. The latter, when ripe, was pulled up by the roots, and the grain was separated by means of an implement resembling a comb. To these crops may be added peas, beans and many herbs and esculent roots. Oxen were much prized, and breeding was carried on with a careful eye to selection. Immense numbers of ducks and geese were reared.

Diodorus Siculus, writing of later times, says that cattle were sent during a portion of each year to the marshy pastures of the delta, where they roamed under the care of herdsmen. They were fed with hay during the annual inundation, and at other times tethered in meadows of green clover. The flocks were shorn twice annually (a practice common to several Asiatic countries), and the ewes yeaned twice a year. (See also EGYPT.)

The agriculture of the region bordering the Tigris and Euphrates, like that of Egypt, depended largely on irrigation, and traces of ancient canals are still to be seen in Babylonia. But beyond the fact that both Babylonia and Assyria were large producers of cereals, little is known of their husbandry.

Biblical accounts among the Israelites.

The nomads of the patriarchal ages, whilst mainly dependent upon their flocks and herds, practised also agriculture proper. The tracts over which they roamed were in ordinary circumstances common to all shepherds alike. During the summer they frequented the mountainous districts, and retired to the valleys to winter. Vast flocks of sheep and of goat constituted their wealth, although they also possessed oxen. When the last were abundant, it seems to be an indication that tillage was practised. Job, besides immense possessions in flocks and herds, had 500 yoke of oxen, which he employed in ploughing, and a "very great husbandry." Isaac, too, conjoined tillage with pastoral husbandry, and that with success, for "he sowed in the land Gerar, and reaped an hundred-fold"—a return which, it would appear, in some favoured regions, occasionally rewarded the labour of the husbandman. In the parable of the sower, Jesus Christ mentions an increase of thirty, sixty and an hundred fold.

Along with the Babylonians, Egyptians and Romans, the Israelites are classed as one of the great agricultural nations of antiquity. The Mosaic Institute contained an agrarian law, based upon an equal division of the soil amongst the adult males, a census of whom was taken just before their entrance into Canaan. Provision was thus made for 600,000 yeomen, assigning (according to different calculations) from sixteen to twenty-five acres of land to each. This land, held in direct tenure from Jehovah, their sovereign, was in theory inalienable. The accumulation of debt upon it was prevented by the prohibition of interest, the release of debts every seventh year, and the reversion of the land to the proprietor, or his heirs, at each return of the year of jubilee. The owners of these small farms cultivated them with much care, and rendered them highly productive. They were favoured with a soil extremely fertile, and one which their skill and diligence kept in good condition. The stones were carefully cleared from the fields, which were also watered from canals and conduits, communicating with the brooks and streams with which the country "was well watered everywhere," and enriched by the application of manures. The seventh year's fallow prevented the exhaustion of the soil, which was further enriched by the burning of the weeds and spontaneous growth of the Sabbatical year. The crops chiefly cultivated were wheat, millet, barley, beans and lentils; to which it is supposed, on grounds not improbable, may be added rice and cotton. The chief implements were a wooden plough of simple and light construction, a hoe or mattock, and a light harrow. The ox and the ass were used for labour. The word "oxen," which occurs in our version of the Scriptures, as well as in the Septuagint and Vulgate, denotes the species, rather than the sex. As the Hebrews did not mutilate any of their animals, bulls were in common use. The quantity of land ploughed by a yoke of oxen in one day was called a yoke or acre. Towards the end of October, with which month the rainy season begins, seed-time commenced, and of course does so still. The seedtime, begun in October, extends, for wheat and some other white crops, through November and December; and barley continues to be sown until about the middle of February. The seed appears to have been sometimes ploughed in, and at other times to have been covered by harrowing. The cold winds which prevail in January and February frequently injured the crops in the more exposed and higher districts. The rainy season extends from October to April, during which time refreshing showers fall, chiefly during the night, and generally at intervals of a few days. The harvest was earlier or later as the rains towards the end of the season were more or less copious. It, however, generally began in April, and continued through May for the different crops in succession. In the south, and in the plains, the harvest, as might be expected, commenced some weeks earlier than in the northern and mountainous districts. The slopes of the hills were carefully terraced and irrigated wherever practicable, and on these slopes the vine and olive were cultivated with great success. At the same time the hill districts and neighbouring deserts afforded pasturage for numerous flocks and herds, and thus admitted of the benefits of a mixed husbandry. Not by a figure of speech but literally, every Israelite sat under the shadow of his own vine and fig-tree; whilst the country as a whole is described (2 Kings xviii. 32) as "a land of corn and wine, a land of bread and vineyards, a land of oil olive and of honey."

Greece.

The earliest known forms of intensive husbandry were based chiefly upon the proximity of rivers and irrigation. The agriculture of classical ages was slightly more developed in so far as the husbandman of Greece and Rome was less able to leave to nature the fertilization of the soil. Greece being a mountainous land was favourable to the culture of the vine rather than to that of cereals. Scanty information on its agriculture is to be derived from the *Works and Days* of Hesiod (about the 8th century B.C.), the *Oeconomicus* of Xenophon (4th century B.C.), the *History of Plants* and the *Origin of Plants* of Theophrastus (4th century B.C.). The latter is the first writer on botany, and his works also contain interesting remarks on manures, the mixing of soils and other agricultural topics (see also GEOPONICI). Greek husbandry had no salient characteristics. The summer fallow with repeated ploughing was its basis. The young crop was hoed, reaping was performed with a sickle, and a high stubble left on the ground as manure. The methods of threshing and winnowing were the same as those in use in ancient Egypt. Wheat, barley and spelt were the leading crops. Meadows were pastured rather than mown. Attica was famous for its olives and figs, but general agriculture excelled in Peloponnesus, where, by means of irrigation and drainage, all the available land was utilized.

Rome.

In the early days of the Roman republic land in Italy was held largely by small proprietors, and agriculture was highly esteemed and classed with war as an occupation becoming a free man. The story of Cincinnatus, twice summoned from the plough to the highest offices in the state, illustrates the status of the Roman husbandman. The later tendency was towards the absorption of smaller holdings into large estates. As wealth increased the peasant-farmer gave way before the large landowner, who cultivated his property by means of slave-labour, superintended by slave-bailiffs. The low price of grain, which was imported in huge quantities from Sicily and other Roman provinces, operated to crush the small holder, at the same time as it made arable farming unremunerative. Sheep-raising, involving larger holdings, less supervision and less labour, was preferred by the capitalist land-holder to the cultivation of the wheat, spelt, vines or olives which were the chief crops of the country. Lupine, beans, peas and vetches were grown for fodder, and meadows, often artificially watered, supplied hay. Swine and poultry were used for food to a greater extent than oxen, which were bred chiefly for ploughing. The following epitome of Virgil's advice to the husbandman in the first book of the *Georgics* suggests the outline of Roman husbandry: "First learn the peculiarities of your soil and climate. Plough the fallow in early spring, and plough frequently—twice in winter, twice in summer unless your land is poor, when a light ploughing in September will do. Either let the land lie fallow every other year or else let spelt follow pulse, vetches or lupine. Repetition of one crop exhausts the ground; rotation will lighten the strain, only the exhausted soil must be copiously dressed with manure or ashes. It often does good to burn the stubble on the ground. Harrow down the clods, level the ridges by cross ploughing, work the land thoroughly. Irrigation benefits a sandy soil, draining a marshy soil. It is well to feed down a luxuriant crop when the plants are level with the ridge tops. Geese and cranes, chicory, mildew, thistles, cleavers, caltrops, darnel and shade are farmer's enemies. Scare off the birds, harrow up the weeds, cut down all that shades the crop. Ploughs, waggons, threshing-sledges, harrows, baskets, hurdles, winnowing-fans are the farmer's implements. The plough consists of several parts made of seasoned wood. The threshing-floor must be smooth and rammed hard to leave no crevices for weeds and small animals to get through. Some steep seed in soda and oil lees to get a larger produce. Careful annual selection by hand of the best seed is the only way to prevent degeneration. It is best to mow stubble and hay at night when they are moist."

In addition to the use of several kinds of animal and other manures, green crops were sometimes ploughed in by the Romans. The shrewdness which, more than inventiveness, characterized their husbandry comes out well in the following quotation from the 18th book of the *Natural History* of Pliny:—"Cato would have this point especially to be considered, that the soil of a farm be good and fertile; also, that near it there be plenty of labourers and that it be not far from a large town; moreover, that it have sufficient means for transporting its produce, either by water or land. Also that the house be well built, and the land about it as well managed. They are in error who hold the opinion that the negligence and bad husbandry of the former owner is good for his successor. Now, I say there is nothing more dangerous and disadvantageous to the buyer than land so left waste and out of heart; and therefore Cato counsels well to purchase land of one who has managed it well, and not rashly to despise and make light of the skill and knowledge of another."

Roman writers on agriculture (see GEOPONICI) are more numerous than those of Greece. The earliest important treatises are the *De re Rustica* of Cato (234–149 B.C.) and the *Rerum Rusticarum Libri* of Varro. More famous than either are the *Georgics* of Virgil, published about 30 B.C., and treating of tillage, horticulture, cattle-breeding and bee-keeping. The works of Columella (1st century A.D.) and of Palladius (4th century A.D.) are exhaustive treatises, and the *Natural History* of the elder Pliny (A.D. 23–70) contains considerable information on husbandry. Under the later empire agriculture sank into a condition of neglect, in which it remained throughout the Dark Ages. In Spain its revival was due to the Saracens, and by them, and their successors the Moors, agriculture was carried to a high pitch of excellence. The work on agriculture[1] of Ibn-al-Awam, who lived in the 12th century A.D., treats of the varieties of soils, manuring, irrigation, ploughing, sowing, harvesting, stock, horticulture, arboriculture and plant diseases, and is a lasting record of their skill and industry.

The subsequent history of agriculture is treated in the following pages primarily from the British standpoint. Doubtless Flanders may claim to be the pioneer of "high farming" in medieval times, other countries following her lead in many respects. It is not, however, necessary to deal with the agricultural evolution of continental Europe, the gradual progress of agriculture as a whole being well enough typified in the story of its development in England, which indeed has led the way in modern times. After sections on the history and chief modern features of British agriculture, a separate account is given of the general features of American agriculture.

HISTORY OF ENGLISH AGRICULTURE

The "combined" or "common-field" system of husbandry practised by the village community or township (see VILLAGE COMMUNITIES) may be taken as the starting-point of English agriculture, in which, till the end of the 18th century, it is a dominant influence. The territory of the "township" consisted of arable land, meadow, pasture and waste. The arable land was divided into two or, more usually, three fields, which were cut up into strips bounded by balks and allotted to the villagers in such a way that one holding might include several disconnected strips in each field—a measure designed to prevent the whole of the best land falling to one man. The fields were fenced in from seed-time to harvest, after which the fences were taken down and the cattle turned in to feed on the stubble. According to early methods of cropping, which were destined to prevail for centuries, wheat, the chief article of food, was sown in one autumn, reaped the next August; the following spring, oats or barley were sown, and the year following the harvest was a period of fallow. This procedure was followed on each of the three fields so that in every year one of them was fallow. In addition to the cereals, beans, peas and vetches were grown to some extent. The meadow-land was also divided into strips from which the various holders drew their supply of hay. The pasture-land was common to all, though the number of beasts which one man might turn into it was sometimes limited. Rough grazing could also be had on the outlying waste lands. In the absence of artificial grasses and roots, hay was very valuable; it constituted almost the only winter food for live stock, which were consequently in poor condition in spring.

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[1] Translation by Clément-Mullet (Paris, 1864).

Under the manorial system, the rise of which preceded the Norman Conquest, communal methods of husbandry remained, but the position of the cultivator was radically altered. "Villeins," instead of free-holders, formed the most numerous class of the population. They were bound to the soil and occupied holdings of scattered strips (amounting usually to a virgate or 30 acres) in return for a payment partly in labour and partly in kind. A portion of the manor, generally about a third, constituted the lord's demesne, which, though sometimes separate, usually consisted of strips intermingled with those of his villeins. It thus formed part of the common farm and was cultivated by the villeins and their oxen under the superintendence of a bailiff. Below the villeins in the social scale came the cottiers possessing smaller holdings, sometimes only a garden, and no oxen. Free tenants and, after the Norman Conquest, slaves formed small proportions of the population. During the middle ages cattle and sheep were the chief farm animals, but the intermixture of stock consequent on the common-field system was a barrier to improvement in the breed and conduced to the propagation of disease. Oxen, usually yoked in teams of eight, were used for ploughing. Sheep were small and their fleeces light, nevertheless, owing to the meagreness of the yields of cereals[1] and the demand for wool for export, sheep-farming was looked to, as early as the 12th century, as the chief source of profit. Pigs and poultry were universally kept. The treatise on husbandry of Walter of Henley, dating from the early 13th century, is very valuable as describing the management of the demesne under the two- or three-field system. The following are typical passages:—

> "April is a good season for fallowing, if the earth breaks up behind the plough; for second fallowing after St John's Day when the dust rises behind the plough; for seed-ploughing when the earth is well settled and not too cracked; however, the busy man cannot be always waiting on the seasons." "At sowing do not plough large furrows, but little and well laid together, that the seed may fall evenly."
>
> "Know that an acre sown with wheat takes three ploughings, except lands that are sown each year, and that each ploughing costs 6d. more or less and the harrowing 1d. It is well to sow at least two bushels to the acre."
>
> "Change your seed every year at Michaelmas, for the seed grown on other land will bring you more than that grown on your own."
>
> "Neither sell your stubble nor move it from the ground unless you need it for thatching. Have manure put up in heaps and mixed with earth."
>
> "Ridge marshy ground so as to let the water run off."

During the 13th century there arose a tendency to commute labour-rents for money payments. This change led to the gradual disappearance of tenants in villeinage—the villeins and cottiers—and the rise on the one hand of the small independent farmer, on the other of the hired labourer. The plague of 1348 marks an epoch in English agriculture. The diminution of the population by one-half led to a scarcity of labour and an increase of wages which deprived the landowner of his narrow margin of profit. To meet this situation, the Statute of Labourers (1351) enacted that no man should refuse to work at the same rate of wages as prevailed before the plague. In addition the landowners attempted to revive the disappearing system of labour-rents. The bitter feelings engendered between employer and employed culminated in the peasants' revolt of 1381. Meanwhile large numbers of landowners were forced to adopt one of two alternatives. In some cases they ceased to farm their own land and let it out on lease often together with the stock upon it; or else they abandoned arable culture, laid down their demesnes to pasture, enclosed the waste lands and devoted themselves to sheep-farming. In the latter course they were encouraged by the high prices of wool during the 14th century, and by Edward III.'s policy of fostering both the export of wool and the home manufacture of woollen goods. The 15th century, barren of progress in methods of husbandry, was in its early years moderately prosperous. Later on the increasing abandonment of arable husbandry for sheep-farming brought about a less demand for labour, and rural depopulation was accelerated as the peasant was deprived of his grazing-ground by the enclosure of more and more of the waste land.[2]

Agriculture under the Tudors and Stuarts.

From the beginning of the reign of Henry VII. to the end of Elizabeth's, a number of statutes were made for the encouragement of tillage, though probably to little purpose. "Where in some towns," says the statute 4th Henry VII. (1488), "two hundred persons were occupied and lived of their lawful labours, now there are occupied two or three herdsmen, and the residue fall into idleness"; therefore it is ordained that houses which within three years have been let for farms, with twenty acres of land lying in tillage or husbandry, shall be upheld, under the penalty of half the profits, to be forfeited to the king or the lord of the fee. Almost half a century afterwards the practice had become still more alarming; and in 1534 a new act was tried, apparently with as little success. "Some have 24,000 sheep, some 20,000 sheep, some 10,000, some 6000, some 4000, and some more and some less"; and yet it is alleged the price of wool had nearly doubled, "sheep being come to a few persons' hands." A penalty was therefore imposed on all who kept above 2000 sheep; and no person was to take in farm more than two tenements of husbandry. By the 39th Elizabeth (1597) arable land made pasture since the 1st Elizabeth shall be again converted into tillage, and what is arable shall not be converted into pasture.

The literature of agriculture, in abeyance since the treatise of Walter of Henley, makes another beginning in the 16th century. The best of the early works is the *Book of Husbandry* (1st ed. 1523), commonly ascribed to Sir Anthony Fitzherbert, a judge of the Common Pleas in the reign of Henry VIII., but more probably written by his elder brother John. This was followed by the *Book of Surveying and Improvements* (1523), by the same author. In the former treatise we have a clear and minute description of the rural practices of that period, and from the latter may be learned a good deal of the economy of the feudal system in its decline.

The *Book of Husbandry* begins with a description of the plough and other implements, after which about a third part of it is occupied with the several operations as they succeed one another throughout the year. Among other passages in this part of the work, the following deserve notice:—

> "Somme (ploughs) wyll tourn the sheld bredith at every landsende, and plowe all one way"; the same kind of plough that is now found so useful on hilly grounds. Of wheel-ploughs he observes, that "they be good on even grounde that lyeth lyghte"; and on such lands they are still most commonly employed. Cart-wheels were sometimes bound with iron, of which he greatly approves. On the much agitated question about the employment of horses or oxen in labour, the most important arguments are distinctly stated.
>
> "In some places," he says, "a horse plough is better," and in others an oxen plough, to which, upon the whole, he gives the preference. Beans and peas seem to have been common crops. He mentions the different kinds of wheat, barley and oats; and after describing the method of harrowing "all maner of cornnes," we find the roller employed. "They used to role their barley grounde

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[1] Walter of Henley mentions six bushels per acre as a satisfactory crop.

[2] This process of enclosure must be distinguished from that of enclosing the arable common fields which, though advocated by Fitzherbert in a passage quoted below proceeded slowly till the 18th century.

after a showr of rayne, to make the grounde even to mowe." Under the article "To falowe," he observes, "the greater clottes (clods) the better wheate, for the clottes kepe the wheat warme all wynter; and at March they will melte and breake and fal in manye small peces, the whiche is a new dongynge and refreshynge of the corne." This is agreeable to the present practice, founded on the very same reasons. "In May, the shepe folde is to be set out"; but Fitzherbert does not much approve of folding, and points out its disadvantages in a very judicious manner. "In the latter end of May and the begynnynge of June, is tyme to wede the corne"; and then we have an accurate description of the different weeds, and the instruments and mode of weeding. Next comes a second ploughing of the fallow; and afterwards, in the latter end of June, the mowing of the meadows begins. Of this operation, and of the forks and rakes and the haymaking there is a very good account. The corn harvest naturally follows: rye and wheat were usually *shorn*, and barley and oats cut with the scythe. The writer does not approve of the common practice of cutting wheat high and then mowing the stubbles. "In Somersetshire," he says, "they do shere theyr wheat very lowe; and the wheate strawe that they purpose to make *thacke* of, they do not threshe it, but cut off the ears, and bynd it in sheves, and call it *rede*, and therewith they thacke theyr houses." He recommends the practice of setting up corn in shocks, with two sheaves to cover eight, instead of ten sheaves as at present—probably owing to the straw being then shorter. The corn was commonly housed; but if there be a want of room, he advises that the ricks be built on a scaffold and not upon the ground. The fallow received a third ploughing in September, and was sown about Michaelmas. "Wheat is moost commonlye sowne under the forowe, that is to say, cast it uppon the falowe, and then plowe it under"; and this branch of his subject is concluded with directions about threshing, winnowing and other kinds of barn-work.

Fitzherbert next proceeds to live stock. "An housbande," he says, "can not well thryue by his corne without he have other cattell, nor by his cattell without corne. And bycause that shepe, in myne opynyon, is the mooste profytablest cattell that any man can haue, therefore I pourpose to speake fyrst of shepe." His remarks on this subject are so accurate that one might imagine they came from a storemaster of the present day.

In some places at present "they neuer seuer their lambes from their dammes"; "and the poore of the peeke (high) countreye, and such other places, where, as they vse to mylke theyr ewes, they vse to wayne theyr lambes at 12 weekes olde, and to mylke their ewes fiue or syxe weekes"; but that, he observes, "is greate hurte to the ewes, and wyll cause them that they wyll not take the ramme at the tyme of the yere for pouertye, but goo barreyne." "In June is tyme to shere shepe; and ere they be shorne, they must be verye well washen, the which shall be to the owner greate profyte in the sale of his wool, and also to the clothe-maker."

His remarks on horses, cattle, &c., are not less interesting; and there is a very good account of the diseases of each species, and some just observations on the advantage of mixing different kinds on the same pasture. Swine and bees conclude this branch of the work.

The author then points out the great advantages of enclosure; recommends "quycksettynge, dychynge and hedgeyng"; and gives particular directions about *settes*, and the method of training a hedge, as well as concerning the planting and management of trees. Fitzherbert throws some light on the position of women in the agriculture of his day. "It is a wyues occupation," he says, "to wynowe all maner of cornes, to make malte, to washe and wrynge, to make heye, shere corne, and, in time of nede, to helpe her husbande to fyll the mucke wayne or dounge carte, dryue the ploughe, to loode heye, corne and suche other; and to go or ride to the market to sel butter, chese, mylke, egges, chekyns, capons, hennes, pygges, gese, and all maner of cornes."

The *Book of Surveying* adds considerably to our knowledge of the rural economy of that age. "Four maner of commens" are described; several kinds of mills for corn and other purposes, and also "quernes that goo with hand"; different orders of tenants, down to the "boundmen," who "in some places contynue as yet"; "and many tymes, by colour thereof, there be many freemen taken as boundmen, and their lands and goods is taken from them." Lime and marl are mentioned as common manures, and the former was sometimes spread on the surface to destroy heath. Both draining and irrigation are noticed, though the latter but slightly. And the work concludes with an inquiry "how to make a township that is worth XX. marke a yere, worth XX. li. a year," advocating the transition from communal or open field to individual or enclosure farming.

"It is undoubted, that to every townshyppe that standeth in tyllage in the playne countrey, there be errable landes to plowe and sowe, and leyse to tye or tedder theyr horses and mares upon, and common pasture to kepe and pasture their catell, beestes and shepe upon; and also they have medowe grounde to get theyr hey upon. Than to let it be known how many acres of errable lande euery man hath in tyllage, and of the same acres in euery felde to chaunge with his neyghbours, and to leve them toguyther, and to make hym one seuerall close in euery felde for his errable lands; and his leyse in euery felde to leve them togyther in one felde, and to make one seuerall close for them all. And also another seuerall close for his portion of his common pasture, and also his porcion of his medowe in a seuerall close by itselfe, and al kept in seureall both in wynter and somer; and euery cottage shall haue his portion assigned hym accordynge to his rent, and than shall nat the ryche man ouerpresse the poore man with his cattell; and euery man may eate his oun close at his pleasure. And vndoubted, that hay and strawe that will find one beest in the house wyll finde two beestes in the close, and better they shall lyke. For those beestis in the house have short heare and thynne, and towards March they will pylle and be bare; and therefore they may nat abyde in the fylde before the heerdmen in winter tyme for colde. And those that lye in a close under a hedge haue longe heare and thyck, and they will neuer pylle nor be bare; and by this reason the husbande maye kepe twyse so many catell as he did before.

"This is the cause of this approwment. Nowe euery husbande hath sixe seuerall closes, whereof iii. be for corne, the fourthe for his leyse, the fyfte for his commen pastures, and the sixte for his haye; and in wynter time there is but one occupied with corne, and than hath the husbande other fyue to occupy tyll lente come, and that he hath his falowe felde, his ley felde, and his pasture felde al sommer. And when he hath mowen his medowe, then he hath his medowe grounde, soo that if he hath any weyke catell that wold be amended, or dyvers maner of catell, he may put them in any close he wyll, the which is a great advantage; and if all shulde lye commen, than wolde the edyche of the corne feldes and the aftermath of all the medowes be eaten in X. or XII. dayes. And the rych men that hath moche catell wold have the advantage, and the poore man can have no help nor relefe in wynter when he hath moste nede; and if an acre of lande be worthe sixe pens, or it be enclosed, it will be worth VIII. pens, when it is enclosed by reason of the compostying and dongyng of the catell that shall go and lye upon it both day and nighte; and if any of his thre closes that he hath for his corne be worne or ware bare, than he may breke and plowe up his close that he hadde for his layse, or the close that he hadde for his commen pasture, or bothe, and sowe them with corne, and let the other lye for a time, and so shall he have always reist grounde, the which will bear moche corne with lytel donge; and also he shall have a great profyte of the wod in the hedges whan it is growen; and not only these profytes and advantages beforesaid, but he shall save moche more than al these, for by reason of these closes he shall save meate, drinke and wages of a shepherde, the wages of the heerdmen, and the wages of the swine herde, the which may fortune to be as chargeable as all his holle rente; and also his corne shall be better saved from eatinge or destroyeng with catel. For dout ye nat but heerdemen with their catell, shepeherdes with their shepe, and tieng of horses and mares, destroyeth moch corne, the which the hedges wold save. Paraduenture some men would say that this shuld be against the common weale, bicause the shepeherdes, heerdmen and swyne-herdes shuld than be put out of wages. To that it may be answered, though these occupations be not used, there be as many newe occupations that were not used before; as getting of quicke settes, diching, hedging and plashing, the which the same men may use and occupye."

The next author who writes professedly on agriculture is Thomas Tusser, whose *Five Hundred Points of Husbandry*, published in 1562, enjoyed such lasting repute that in 1723 Lord Molesworth recommended that it should be taught in schools. In it the book of husbandry consists of 118 pages, and then follows the *Points of Housewifrie*, occupying 42 pages more. It is written in verse. Amidst much that is valueless there are some useful notices concerning the state of agriculture at the time in different parts of England. Hops, which had been introduced in the early part of the 16th century, and on the culture of which a treatise was published in 1574 by Reginald Scott, are mentioned as a well-known crop. Buckwheat was sown after barley. Hemp and flax are mentioned as common crops. Enclosures must have been numerous in some counties; and there is a very good comparison between "champion (open fields) country and several," which Blith afterwards transcribed into his *Improver Improved*. Carrots, cabbages, turnips and rape, not yet cultivated in the fields, are mentioned among the herbs and roots for the kitchen. There is nothing to be found in Tusser about serfs or bondmen, as in Fitzherbert's works.

In 1577 appeared the *Foure Bookes of Husbandry*, translated, with augmentation, from the work of Conrad Heresbach. Much stress is laid on the value of manure, and mention is made of clover.

Fitzherbert, in deploring the gradual discontinuance of the practice of marling land, had alluded to the grievance familiar in modern times of tenants "who, if they should marl and make their holdings much better, fear lest they should be put out, or make a great fine or else pay more rent." This subject is treated at length in Sir John Norden's *Surveyor's Dialogue* (1st ed. 1607), the next agricultural work demanding notice. The author, writing from the landowner's point of view, ascribes the rise in rents and the rise in the price of corn[1] to the "emulation" of tenants in competing for holdings, a practice implying that the agriculture of the period was prosperous. Norden's work contains many judicious observations on the "different natures of grounds, how they may be employed, how they may be bettered, reformed and amended." The famous meadows near Salisbury are mentioned, where, when cattle have fed their fill, hogs, it is said, "are made fat with the remnant—namely, with the knots and sappe of the grasse." "Clouer grasse, or the grasse honey suckle" (white clover), is directed to be sown with other hay seeds. "Carrot rootes" were then raised in several parts of England, and sometimes by farmers. London street and stable dung was carried to a distance by water, and appears from later writers to have been got for the trouble of removing. Leases of 21 years are recommended for persons of small capital as better than employing it in purchasing land. The works of Gervase Markham, Leonard Mascall, Gabriel Plattes and other authors of the first half of the 17th century may be passed over, the best part of them being preserved by Blith and Hartlib, who are referred to below.

Sir Richard Weston's *Discourse on the Husbandry of Brabant and Flanders* was published by Hartlib in 1645, and its title indicates the source to which England owed much of its subsequent agricultural advancement. Weston was ambassador from England to the elector palatine in 1619, and had the merit of being the first who introduced the *great clover*, as it was then called, into English agriculture, about 1652, and probably turnips also. Clover thrives best, he says, when you sow it on the barrenest ground, such as the worst heath ground in England. The ground is to be pared and burnt, and unslacked lime must be added to the ashes. It is next to be well ploughed and harrowed; and about 10 ℔ of clover seed must be sown on an acre in April or the end of March. If you intend to preserve seed, then the second crop must be let stand till it come to a full and dead ripeness, and you shall have at the least five bushels per acre. Being once sown, it will last five years; the land, when ploughed, will yield, three or four years together, rich crops of wheat, and after that a crop of oats, with which clover seed is to be sown again. It is in itself an excellent manure, Sir Richard adds; and so it should be, to enable land to bear this treatment. Before 1655 the culture of clover, exactly according to the present method, seems to have been well known in England, and it had also made its way to Ireland.

A great many works on agriculture appeared during the time of the Commonwealth, of which Walter Blith's *Improver Improved* and Samuel Hartlib's *Legacie* are the most valuable. The first edition of the former was published in 1649, and of the latter in 1651; and both of them were enlarged in subsequent editions. In the first edition of the *Improver Improved* no mention is made of clover, nor in the second of turnips, but in the third, clover is treated of at some length, and turnips are recommended as an excellent cattle crop, the culture of which should be extended from the kitchen garden to the field. Sir Richard Weston must have cultivated turnips before this; for Blith says that Sir Richard affirmed to himself that he fed his swine with them. They were first given boiled, but afterwards the swine came to eat them raw, and would run after the carts, and pull them forth as they gathered them—an expression which conveys an idea of their being cultivated in the fields.

Blith's book is the first systematic work in which there are some traces of alternate husbandry or the practice of interposing clover and turnip between culmiferous crops. He is a great enemy to commons and common fields, and to retaining land in old pasture, unless it be of the best quality. His description of the different kinds of ploughs is interesting; and he justly recommends such as were drawn by two horses (some even by one horse) in preference to the weighty and clumsy machines which required four or more horses or oxen. The following passage indicates the contemporary theory of manuring:—"In thy tillage are these special opportunities to improve it, either by liming, marling, sanding, earthing, mudding, snayl-codding, mucking, chalking, pidgeons-dung, hens-dung, hogs-dung or by any other means as some by rags, some by coarse wool, by pitch marks, and tarry stuff, any oyly stuff, salt and many things more, yea indeed any thing almost that hath any liquidness, foulness, saltness or good moysture in it, is very naturall inrichment to almost any sort of land." Blith speaks of an instrument which ploughed, sowed and harrowed at the same time; and the setting of corn was then a subject of much discussion. Blith was a zealous advocate of drainage and holds that drains to be efficient must be laid 3 or 4 ft. deep. The drainage of the Great Level of the Fens was prosecuted during the 17th century, but lack of engineering skill and the opposition of the fen-men hindered the reclamation of a now fertile region.

Hartlib's *Legacie* contains, among some very judicious directions, a great deal of rash speculation. Several of the deficiencies which the writer complains of in English agriculture must be placed to the account of climate, and never have been or can be supplied. Some of his recommendations are quite unsuitable to the state of the country, and display more of general knowledge and good intention than of either the theory or practice of agriculture. Among the subjects deserving notice may be mentioned the practice of steeping and liming seed corn as a preventive of smut; changing every year the *species* of grain, and bringing seed corn from a distance; ploughing down green crops as manure; and feeding horses with broken oats and chaff. This writer seems to differ a good deal from Blith about the advantage of interchanging tillage and pasture. "It were no losse to this island," he says, "if that we should not plough at all, if so be that we could certainly have corn at a reasonable rate, and likewise vent for all our manufactures of wool"; and one reason for this is, that pasture employs more hands than tillage, instead of depopulating the country, as was commonly imagined. The *grout*, which he mentions as "coming over to us in Holland ships," about which he desires information, was probably the same as shelled barley; and mills for manufacturing it were introduced into Scotland from Holland towards the beginning of the 18th century.

Among the other writers previous to the Revolution mention must be made of John Ray the botanist and of John Evelyn, both men of great talent and research, whose works are still in high estimation.

The first half of the 17th century was a period of agricultural activity, partly due, no doubt, to the increase of enclosed farms. Marling and liming are again practised, new agricultural implements and manures introduced, and the new crops more widely used. But the Civil War and the subsequent political disturbances intervened to prevent the continuance of this progress, and the agriculture of the end of the century seems to have relapsed into stagnation.

Scottish agriculture of the 17th century.

Of the state of agriculture in Scotland in the 16th and the greater part of the 17th century very little is known; no professed treatise on the subject appeared till after the Revolution. The south-eastern counties were the earliest improved, and yet in 1660 their condition seems to have been very wretched. Ray, who made a tour along the eastern coast in that year, says, "We observed *little or no fallow ground* in Scotland; some ley ground we saw, which they manured with sea wreck. The men seemed to be very lazy, and may be frequently observed to plough in their cloaks. It is the fashion of them to wear cloaks when they go abroad, but especially on Sundays. They have neither good bread, cheese nor drink. They cannot make them, nor will they learn. Their butter is very indifferent, and one would wonder how they could contrive to make it so bad. They use much pottage made of coal-wort, which they call *kail*, sometimes broth of decorticated barley. The ordinary country-houses are pitiful cots, built of stone and covered with turfs, having in them but one room, many of them no chimneys, the windows very small holes and not glazed. The ground in the valleys and plains bear very good corn, but especially bears barley or bigge, and oats, but rarely wheat and rye."

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[1] During the 16th century wheat had risen in price, and between 1606 and 1618 never fell below 30s. a quarter. At the same time wages remained low.

It is probable that no great change had taken place in Scotland from the end of the 15th century, except that tenants gradually became possessed of a little stock of their own, instead of having their farm stocked by the landlord. "The minority of James V., the reign of Mary Stuart, the infancy of her son, and the civil wars of her grandson Charles I., were all periods of lasting waste. The very laws which were made during successive reigns for protecting the tillers of the soil from spoil are the best proofs of the deplorable state of the husbandman."[1]

In the 17th century those laws were made which paved the way for an improved system of agriculture in Scotland. By a statute of 1633 landholders were enabled to have their tithes valued, and to buy them either at nine or six years' purchase, according to the nature of the property. The statute of 1685, conferring on landlords a power to entail their estates, was indeed of a very different tendency in regard to its effects on agriculture. But the two Acts in 1695, for the division of commons and separation of intermixed properties, facilitated improvements.

Progress of agriculture from 1688 to 1760.

From the Revolution to the accession of George III. the progress of agriculture was by no means so considerable as might be imagined from the great exportation of corn. It is probable that very little improvement had taken place, either in the cultivation of the soil or in the management of live stock, from the Restoration down to the middle of the 18th century. Clover and turnips were confined to a few districts, and at the latter period were scarcely cultivated at all by common farmers in the northern part of the island. Of the writers of this period, therefore, it is necessary to notice only such as describe some improvement in the modes of culture, or some extension of the practices that were formerly little known.

In John Houghton's *Collections on Husbandry and Trade*, a periodical work begun in 1681, there is one of the earliest notices of turnips being eaten by sheep:—"Some in Essex have their fallow after turnips, which feed their sheep in winter, by which means the turnips are scooped, and so made capable to hold dews and rain water, which, by corrupting, imbibes the nitre of the air, and when the shell breaks it runs about and fertilizes. By feeding the sheep, the land is dunged as if it had been folded; and those turnips, though few or none be carried off for human use, are a very excellent improvement, nay, some reckon it so, though they only plough the turnips in without feeding." This was written in February 1694. Ten years before, John Worlidge, one of his correspondents, and the author of the *Systema Agriculturae* (1669), observes, "Sheep fatten very well on turnips, which prove an excellent nourishment for them in hard winters when fodder is scarce; for they will not only eat the greens, but feed on the roots in the ground, and scoop them hollow even to the very skin. Ten acres (he adds) sown with clover, turnips, &c., will feed as many sheep as one hundred acres thereof would before have done."

The next writer of note is John Mortimer, whose *Whole Art of Husbandry*, a regular, systematic work of considerable merit, was published in 1707.

From the third edition of Hartlib's *Legacie* we learn that clover was cut green and given to cattle; and it appears that this practice of *soiling*, as it is now called, had become very common about the beginning of the 18th century, wherever clover was cultivated. Rye-grass was now sown along with it. Turnips were hand-hoed and extensively employed in feeding sheep and cattle.

The first considerable improvement in the practice of that period was introduced by Jethro Tull, a gentleman of Berkshire, who about the year 1701 invented the drill, and whose *Horse-hoeing Husbandry*, published in 1731, exhibits the first decided step in advance upon the principles and practices of his predecessors. Not contented with a careful attention to details, Tull set himself, with admirable skill and perseverance, to investigate the growth of plants, and thus to arrive at a knowledge of the principles by which the cultivation of field-crops should be regulated. Having arrived at the conclusion that the food of plants consists of minute particles of earth taken up by their rootlets, it followed that the more thoroughly the soil in which they grew was disintegrated, the more abundant would be the "pasture" (as he called it) to which their fibres would have access. He was thus led to adopt that system of sowing his crops in rows or drills, so wide apart as to admit of tillage of the intervals, both by ploughing and hoeing, being continued until they had well-nigh arrived at maturity. Such reliance did he place in the pulverization of the soil that he grew as many as thirteen crops of wheat on the same field without manure.

As the distance between his rows appeared much greater than was necessary for the range of the roots of the plants, he begins by showing that these roots extend much farther than is commonly believed, and then proceeds to inquire into the nature of their food. After examining several hypotheses, he decides this to be fine particles of earth. The chief and almost the only use of dung, he thinks, is to divide the earth, to dissolve "this terrestrial matter, which affords nutriment to the mouths of vegetable roots"; and this can be done more completely by tillage. It is therefore necessary not only to pulverize the soil by repeated ploughings before it be seeded, but, as it becomes gradually more and more compressed afterwards, recourse must be had to tillage while the plants are growing; and this is *hoeing*, which also destroys the weeds that would deprive the plants of their nourishment.

The leading features of Tull's husbandry are his practice of laying the land into narrow ridges of 5 or 6 ft., and upon the middle of these drilling one, two, or three rows, distant from one another about 7 in. when there were three, and 10 in. when only two. The distance of the plants on one ridge from those on the contiguous one he called an *interval*; the distance between the rows on the same ridge, a *space* or *partition*; the former was stirred repeatedly by the horse-hoe, the latter by the hand-hoe.

"Hoeing," he says, "may be divided into deep, which is our horse-hoeing; and shallow, which is the English hand-hoeing; and also the shallow horse-hoeing used in some places betwixt rows, where the intervals are very narrow, as 16 or 18 inches. This is but an imitation of the hand-hoe, or a succenadeum to it, and can neither supply the use of dung nor fallow, and may be properly called scratch-hoeing." But in his mode of forming ridges his practice seems to have been original; his implements, especially his drill, display much ingenuity; and his claim to the title of founder of the present horse-hoeing husbandry of Great Britain seems indisputable.

Contemporary with Tull was Charles, 2nd Viscount Townshend, a typical representative of the large landowners to whom the strides made by agriculture in the 18th century were due. The class to which he belonged was the only one which could afford to initiate improvements. The bulk of the land was still farmed by small tenants on the old common-field system, which made it impossible for the individual to adopt a new crop rotation and hindered innovation of every kind. On the other hand, the small farmers who occupied separated holdings were deterred from improving by the fear of a rise in rent. Townshend's belief in the growing of turnips gained him the nickname of "Turnip Townshend." In their cultivation he adopted Tull's practice of drilling and horse-hoeing, and he was also the founder of the Norfolk or four-course system, the first of those rotations which dispense with the necessity of a summer-fallow and provide winter-keep for live-stock (see below, *Rotation of Crops*). The spread of these principles in Norfolk made it, according to Arthur Young (writing in 1770), one of the best cultivated counties in England. In the latter half of the century another Norfolk farmer, Thomas William Coke of Holkham, earl of Leicester,

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[1] Chalmers' *Caledonia*, vol. ii. p. 732.

(1752–1842), figures as a pioneer of high-farming. He was one of the first to use oil-cake and bone-manure, to distinguish the feeding values of grasses, to appreciate to the full the beneficial effects of stock on light lands and to realize the value of long leases as an incentive to good farming.

Agriculture in Scotland in the 18th century.

Of the progress of the art in Scotland, till towards the end of the 17th century, we are almost entirely ignorant. The first work, written by James Donaldson, was printed in 1697, under the title of *Husbandry Anatomized; or, an Inquiry into the Present Manner of Tilling and Manuring the Ground in Scotland.* It appears from this treatise that the state of the art was not more advanced at that time in North Britain than it had been in England in the time of Fitzherbert. Farms were divided into infield and outfield; corn crops followed one another without the intervention of fallow, cultivated herbage or turnips, though something is said about fallowing the outfield; enclosures were very rare; the tenantry had not begun to emerge from a state of great poverty and depression; and the wages of labour, compared with the price of corn, were much lower than at present, though that price, at least in ordinary years, must appear extremely moderate in our times. Leases for a term of years, however, were not uncommon; but the want of capital rendered it impossible for the tenantry to attempt any spirited improvements.

The next work on the husbandry of Scotland is *The Countryman's Rudiments, or an Advice to the Farmers in East Lothian, how to labour and improve their Grounds*, said to have been written by John Hamilton, 2nd Lord Belhaven about the time of the Union, and reprinted in 1723. The author bespeaks the favour of those to whom he addresses himself in the following significant terms:—"Neither shall I affright you with hedging, ditching, marling, chalking, paring and burning, draining, watering and such like, which are all very good improvements indeed, and very agreeable with the soil and situation of East Lothian, but I know ye cannot bear as yet a crowd of improvements, this being only intended to initiate you in the true method and principles of husbandry." The farm-rooms in East Lothian, as in other districts, were divided into infield and outfield.

> "The infield (where wheat is sown) is generally divided by the tenant into four divisions or breaks, as they call them, viz. one of wheat, one of barley, one of pease and one of oats, so that the wheat is sowd after the pease, the barley after the wheat and the oats after the barley. The outfield land is ordinarily made use of promiscuously for feeding of their cows, horse, sheep and oxen; 'tis also dunged by their sheep who lay in earthen folds; and sometimes, when they have much of it, they fauch or fallow a part of it yearly."

Under this management the produce seems to have been three times the seed; and yet, says the writer, "if in East Lothian they did not leave a higher stubble than in other places of the kingdom, their grounds would be in a much worse condition than at present they are, though bad enough." "A good crop of corn makes a good stubble, and a good stubble is the equalest mucking that is." Among the advantages of enclosures, he observes, "you will gain much more labour from your servants, a great part of whose time was taken up in gathering thistles and other garbage for their horses to feed upon in their stables; and thereby the great trampling and pulling up and other destruction of the corns while they are yet tender will be prevented." Potatoes and turnips are recommended to be sown in the yard (kitchen-garden). Clover does not seem to have been in use. Rents were paid in corn; and for the largest farm, which he thinks should employ no more than two ploughs, the rent was about six chalders of victual "when the ground is very good, and four in that which is not so good. But I am most fully convinced they should take long leases or tacks, that they may not be straitened with time in the improvement of their rooms; and this is profitable both for master and tenant."

Such was the state of the husbandry of Scotland in the early part of the 18th century. The first attempts at improvement cannot be traced farther back than 1723, when a number of landholders formed themselves into a society, under the title of the *Society of Improvers in the Knowledge of Agriculture in Scotland.* John, 2nd earl of Stair, one of their most active members, is said to have been the first who cultivated turnips in that country. The *Select Transactions* of this society were collected and published in 1743 by Robert Maxwell, who took a large part in its proceedings. It is evident from this book that the society had exerted itself with success in introducing cultivated herbage and turnips, as well as in improving the former methods of culture. But there is reason to believe that the influence of the example of its numerous members did not extend to the common tenantry, who not unnaturally were reluctant to adopt the practices of those by whom farming was perhaps regarded as primarily a source of pleasure rather than of profit. Though this society, the earliest probably in the United Kingdom, soon counted upwards of 300 members, it existed little more than 20 years.

In the introductory paper in Maxwell's collection we are told that—

> "The practice of draining, enclosing, summer fallowing, sowing flax, hemp, rape, turnip and grass seeds, planting cabbages after, and potatoes with, the plough, in fields of great extent, is introduced; and that, according to the general opinion, more corn grows now yearly where it was never known to grow before, these twenty years last past, than perhaps a sixth of all that the kingdom was in use to produce at any time before."

In 1757 Maxwell issued another work entitled *The Practical Husbandman; being a collection of Miscellaneous papers on Husbandry, &c.* In it the greater part of the *Select Transactions* is republished, with a number of new papers, among which an *Essay on the Husbandry of Scotland*, with a proposal for the improvement of it, is the most valuable. In this he lays it down as a rule that it is bad husbandry to take two crops of grain successively, which marks a considerable progress in the knowledge of modern husbandry; though he adds that in Scotland the best husbandmen after a fallow take a crop of wheat; after the wheat, peas; then barley, and then oats; and after that they fallow again. The want of enclosures was still a matter of complaint. The ground continued to be cropped so long as it produced two seeds; the best farmers were contented with four seeds, which was more than the general produce.

1760 to 1815.

The gradual advance in the price of farm produce soon after the year 1760, occasioned by the increase of population and of wealth derived from manufactures and commerce, gave a powerful stimulus to rural industry, augmented agricultural capital and called forth a more skilful and enterprising race of farmers.

A more rational system of cropping now began to take the place of the thriftless and barbarous practice of sowing successive crops of corn until the land was utterly exhausted, and then leaving it foul with weeds to recover its power by an indefinite period of rest. Green crops, such as turnips, clover and rye grass, began to be alternated with grain crops, whence the name *alternate husbandry*.

The writings of Arthur Young (*q.v.*), secretary to the Board of Agriculture, describe the transition from the old to the new agriculture. In many places turnips and clover were still unknown or ignored. Large districts still clung to the old common-field system, to the old habits of ploughing with teams of four or eight, and to slovenly methods of cultivation. Young's condemnation of these survivals was as pronounced as his support of the methods of the large farmers to whom he ascribed the excellence of the husbandry of Kent, Norfolk and Essex. He realized that with the enclosure of the waste lands and the absorption of small into large holdings, the common-field farmer must migrate to the town or become a hired labourer; but he also realized that to feed a rapidly growing industrial population, the land must be improved by draining, marling, manuring and the use of better implements, in short by the investment of the capital which the yeoman farmer, content to feed himself and his own family, did not possess. The enlargement of farms, and in Scotland the letting of them under leases for a considerable term of years, continued to be a marked feature in the agricultural progress of the country until the end of the century, and is to be regarded both as a cause and a consequence of that progress. The passing of some 3500 enclosure bills, affecting between 5 and 5½ million acres, during the reign of George III., before which the whole number was between 200 and 250, shows how rapidly the break-up of the common-field husbandry and the cultivation of new land now proceeded. The disastrous American War for a time interfered with the national prosperity; but with the return of peace in 1783 the cultivation of the country made more rapid progress. The quarter of a century immediately following 1760 is memorable for the introduction of various important improvements. It was during this period that the genius of Robert Bakewell produced an extraordinary change in the character of our more important breeds of live stock, more especially by the perfecting of a new race of sheep—the well-known Leicesters. Bakewell's fame as a breeder was for a time enhanced by the improvement which he effected on the Long-horned cattle, then the prevailing breed of the midland counties of England. These, however, were ere long rivalled and afterwards superseded by the Shorthorn or Durham breed, which the brothers Charles and Robert Colling obtained from the useful race of cattle that had long existed in the valley of the Tees, by applying to them the principle of breeding which Bakewell had already established. To this period also belong George and Matthew Culley—the former a pupil of Bakewell—who left their paternal property on the bank of the Tees and settled on the Northumbrian side of the Tweed, bringing with them the valuable breeds of live stock and improved husbandry of their native district. The improvements introduced by these energetic and skilful farmers spread rapidly, and exerted a most beneficial influence upon the border counties.

From 1784 to 1795 improvements advanced with steady steps. This period was distinguished for the adoption and working out of ascertained improvements. Small's swing plough and Andrew Meikle's threshing-machine, although invented some years before this, were now perfected and brought into general use, to the great furtherance of agriculture. Two important additions were about this time made to the field crops, viz. the Swedish turnip and potato oat. The latter was accidentally discovered in 1788, and both soon came into general cultivation. In the same year Merino sheep were introduced by George III., who was a zealous farmer. For a time this breed attracted much attention, and sanguine expectations were entertained that it would prove of national importance. Its unfitness for the production of mutton, and increasing supplies of fine clothing wool from other countries, soon led to its total rejection.

In Scotland the opening up of the country by the construction of practicable roads, and the enclosing and subdividing of farms by hedge and ditch, was now in active progress. The former admitted of the general use of wheel-carriages, of the ready conveyance of produce to markets, and in particular of the extended use of lime, the application of which was immediately followed by a great increase of produce. The latter, besides its more obvious advantages, speedily freed large tracts of country from stagnant water and their inhabitants from ague, and prepared the way for the underground draining which soon after began to be practised. Dawson of Frogden in Roxburghshire is believed to have been the first who grew turnips as a field crop to any extent. It is on record that as early as 1764 he had 100 acres of drilled turnips on his farm in one year. An Act passed in 1770, which relaxed the rigour of strict entails and afforded power to landlords to grant leases and otherwise improve their estates, had a beneficial effect on Scottish agriculture.

The husbandry of the country was thus steadily improving, when suddenly the whole of Europe became involved in the wars of the French Revolution. In 1795, under the joint operation of a deficient harvest and the diminution in foreign supplies of grain owing to outbreak of war, the price of wheat, which, for the twenty preceding years, had been under 50s. a quarter, suddenly rose to 81s. 6d., and in the following year reached 96s. In 1797 the fear of foreign invasion led to a panic and run upon the banks, in which emergency the Bank Restriction Act, suspending cash payment, was passed, and ushered in a system of unlimited credit transactions. Under the unnatural stimulus of these extraordinary events, every branch of industry extended with unexampled rapidity. But in nothing was this so apparent as in agriculture; the high prices of produce holding out a great inducement to improve lands then arable, to reclaim others that had previously lain waste, and to bring much pasture-land under the plough. Nor did this increased tillage interfere with the increase of live stock, as the green crops of the alternate husbandry more than compensated for the diminished pasturage. This extraordinary state of matters lasted from 1795 to 1814, the prices of produce even increasing towards the close of that period. The average price of wheat for the whole period was 80s. 7d. per quarter; but for the last five years it was 107s., and in 1812 it reached 126s. 6d. The agriculture of Great Britain, as a whole, advanced with rapid strides during this period; but nowhere was the change so great as in Scotland. Indeed, its progress there, during these twenty years, is probably without parallel in the history of any other country. This is accounted for by a concurrence of circumstances. Previous to this period the husbandry of Scotland was still in a backward state as compared with the best districts of England, where many practices, only of recent introduction in the north, had been in general use for generations. This disparity made the subsequent contrast the more striking. The land in Scotland was now, with trifling exceptions, let on leases for terms varying from twenty to thirty years, and in farms of sufficient size to employ at the least two or three ploughs. The unlimited issues of government paper and the security afforded by these leases induced the Scottish banks to afford every facility to landlords and tenants to embark capital in the improvement of the land. The substantial education supplied by the parish schools, of which nearly the whole population could then avail themselves, had diffused through all ranks such a measure of intelligence as enabled them promptly to discern and skilfully and energetically to take advantage of this spring-tide of prosperity, and to profit by the agricultural information now plentifully furnished by means of the Bath and West of England Society, established in 1777; the Highland Society, instituted in 1784; and the National Board of Agriculture, in 1793.

1815 to 1875.

The restoration of peace to Europe, and the re-enactment of the Corn Laws in 1815, mark the beginning of another era in the history of agriculture. The sudden return to peace-prices was followed by a time of severe depression, low wages, diminished rents and bad farming. The fall in prices was aggravated, first by the unpropitious weather and deficient harvest of the years 1816, 1817, and still more by the passing in 1819 of the bill restoring cash payments, which, coming into operation in 1821, caused serious embarrassment to all persons who had entered into engagements at a depreciated currency, which had now to be met with the lower prices of an enhanced one. The frequency of select-committees and commissions, which sat in 1814, 1821 and 1822, 1833 and 1836, testifies to the gravity of the crisis. The years 1830–1833 are especially memorable for a disastrous outbreak of sheep-rot and for agrarian outrages, caused partly by the dislike of the labourers to the introduction of agricultural machines.

During this period of depression, which lasted till the 'forties, want of confidence prevented any general improvement in agricultural methods. At the same time, certain developments destined to exercise considerable influence in later times are to be noted. Before the close of the 18th century, and during the first quarter of the 19th, a good deal had been done in the way of draining the land, either by open ditches or by James Elkington's system of deep covered drains. In 1834 James Smith of Deanston promulgated his system of thorough draining and deep ploughing, the adoption of which immeasurably improved the clay lands of the country. The early years of the reign of Queen Victoria witnessed the strengthening of the union between agriculture and chemistry. The Board of Agriculture in 1803 had commissioned Sir Humphry Davy to deliver a course of lectures on the connexion of chemistry with vegetable physiology. In 1840 the appearance of *Chemistry in its Application to Agriculture and Physiology* by Justus von Liebig set on foot a movement in favour of scientific husbandry, the most notable outcome of which was the establishment by Sir John Bennet Lawes in 1843 of the experimental station of Rothamsted. Since Blith's time bone was the one new fertilizer that had come into use. Nitrate of soda, Peruvian guano and superphosphate of lime in the form of bones dissolved by sulphuric acid were now added to the list of manures, and the practice of analysing soils became more general. Manual labour in farming operations began to be superseded by the use of drills, hay-makers and horse-rakes, chaff-cutters and root-pulpers. The reaping-machine, invented in 1812 by John Common, improved upon by the Rev. Patrick Bell in England and by Cyrus H. McCormick and others in America, and finally perfected about 1879 by the addition of an efficient self-binding apparatus, is the most striking example of the application of mechanics to agriculture. Improvements in the plough, harrow and roller were introduced, adapting those implements to different soils and purposes. The steam-engine first took the place of horses as a threshing power in 1803, but it was not until after 1850 that it was applied to the plough and cultivator. The employment of agricultural machines received considerable impetus from the Great Exhibition of 1851. The much-debated Corn Laws, after undergoing various modifications, and proving the fruitful source of business uncertainty, social discontent and angry partisanship, were finally abolished in 1846, although the act was not consummated until three years later. Several other acts of the legislature passed during this period exerted a beneficial influence on agriculture. Of these, the first in date and importance is the Tithe Commutation Act of 1836. Improvement was also stimulated by the Public Money Drainage Acts 1846–1856, under which government was empowered to advance money on certain conditions for the improvement of estates. Additional facilities were granted by the act passed in 1848 for disentailing estates, and for burdening such as are entailed with the share of the cost of certain specified improvements.

Meanwhile much had been done in the organization of agricultural knowledge. Mention has already been made of the institution of the Highland Society and the National Board of Agriculture. These institutions were the means of collecting a vast amount of statistical and general information connected with agriculture, and by their publications and premiums made known the practices of the best-farmed districts and encouraged their adoption elsewhere. These associations were soon aided in their important labours by numerous local societies which sprang up in all parts of the kingdom. After a highly useful career, under the presidency till 1813 of Sir John Sinclair, the Board of Agriculture was dissolved in 1819, but left in its statistical account, county surveys and other documents much interesting and valuable information regarding the agriculture of the period. In 1800 the original *Farmers' Magazine* came into existence under the editorship of Robert Brown of Markle, the author of the well-known treatise on *Rural Affairs*. The Highland Society having early extended its operations to the whole of Scotland, by and by made a corresponding addition to its title, and as the Highland and Agricultural Society of Scotland gradually extended its operations. In 1828, shortly after the discontinuance of the *Farmers' Magazine*, its *Prize Essays and Transactions* began to be issued statedly in connexion with the *Quarterly Journal of Agriculture*. This society early began to hold a great show of live stock, implements, &c. In 1842 certain Midlothian tenant-farmers had the merit of originating an Agricultural Chemistry Association (the first of its kind), by which funds were raised for the purpose of conducting such investigations as the title of the society implies. After a successful trial of a few years this association was dissolved, transferring its functions to the Highland and Agricultural Society.

In England the Agricultural Society was founded in 1838, with the motto "Practice with Science," and shortly afterwards incorporated by royal charter. In 1845 the Royal Agricultural College at Cirencester was incorporated. This era of revival was not, however, without its calamities. The foot-and-mouth disease first appeared about 1840, having been introduced, as is supposed, by foreign cattle. It spread rapidly over the country, affecting all domesticated animals except horses, and although seldom attended by fatal results, caused everywhere great alarm and loss. It was soon followed by the more terrible lung-disease, or pleuro-pneumonia. In 1865 the rinderpest, or steppe murrain, originating amongst the vast herds of the Russian steppes, had spread westward over Europe, until it was brought to London by foreign cattle. Several weeks elapsed before the true character of the disease was known, and in this brief space it had already been carried by animals purchased in Smithfield market to all parts of the country. After causing the most frightful losses, it was at last stamped out by the resolute slaughter of all affected animals and of all that had been in contact with them. Severe as were the losses in flocks and herds from these imported diseases, they were eclipsed by the ravages of the mysterious potato blight, which, first appearing in 1845, pervaded the whole of Europe, and in Ireland especially proved the precursor of famine and pestilence.

A short period of low prices followed the repeal of the Corn Laws, wheat averaging only 38s. 6d. a quarter in 1851, but the years from 1852 to 1875 were the most prosperous of the century. The letters written by Sir James Caird to *The Times* during 1850, and republished in 1852 under the title *English Agriculture in 1850–1851*, give a general review of English agriculture at the time. The scientific and mechanical improvements of the first half of the century were widely adopted, while the prices of the protectionist period showed little decline. Amelioration in all breeds of domesticated animals was manifested, not so much in the production of individual specimens of high merit as in the diffusion of these and other good breeds over the country, and in the improved quality of live stock as a whole. The fattening of animals was conducted on more scientific principles. Increased attention was successfully bestowed on the improvement of field crops. Improved varieties, obtained by cross-impregnation either naturally or artificially brought about, were carefully propagated and generally adopted, and increased attention was bestowed on the cultivation of the natural grasses. The most important additions to the list of field crops were Italian rye-grass, winter beans, white Belgian carrot and alsike clover.

Agriculture since 1875.

The last quarter of the 19th century proved, however, a fateful period for British agriculture. The great future that seemed to await the application of steam power to the tillage of the soil proved illusory. The clay soils of England, the latent fertility of which was to be brought into play in a fashion that should mightily augment the home-grown supplies of food, remained intractable, and the extent of land devoted to the cultivation of corn crops, instead of expanding, diminished in a marked degree. British farmers of long experience look back to 1874 as the last of the really good years, and consider that the palmy days of British agriculture began to dwindle at about that time. The shadow of the approaching depression had already fallen upon the land before the year 1875 had run its course, and the outlook became ominous as the decade of the 'seventies neared its close. One memorable feature was associated with 1877 in that this was the last year in which the dreaded cattle plague (rinderpest) made its appearance in England. The same year, 1877, was the last also in which the annual average price of English wheat (then 56s. 9d.) exceeded 50s. a quarter. With declining prices for farm produce came that year of unhappy memory, 1879, when persistent rains and an almost sunless summer ruined the crops and reduced many farmers to a state of destitution. Much of the grain was never harvested, whilst owing mainly to the excessive floods there commenced an outbreak of liver-rot in sheep, due to the ravages of the fluke parasite. This continued for several years, and the mortality was so great that its adverse effects upon the ovine population of the country were still perceptible ten years afterwards. A fall in rents was the necessary sequel of the agricultural distress, to inquire into which a royal commission was appointed in 1879, under the chairmanship of the duke of Richmond and Gordon. Its report, published in 1882, testified to "the great extent and intensity of the distress which has fallen upon the agricultural community. Owners and occupiers have alike suffered from it. No description of estate or tenure has been exempted. The owner in fee and life tenant, the occupier, whether of large or of small holding, whether under lease, or custom, or agreement, or the provisions of the Agricultural Holdings Act—all without distinction have been involved in a general calamity." The two most prominent causes assigned for the depression were bad seasons and foreign competition, aggravated by the increased cost of production and the heavy losses of live stock. Abundant evidence was forthcoming as to the extent to which agriculture had been injuriously affected "by an unprecedented succession of bad seasons." As regards the pressure of foreign competition, it was stated to be greatly in excess of the anticipations of the supporters, and of the apprehensions of the opponents of the repeal of the Corn Laws. Whereas formerly the farmer was to some extent compensated by a higher price for a smaller yield, in recent years he had had to compete with an unusually large supply at greatly reduced prices. On the other hand, he had enjoyed the advantage of an extended supply of feeding-stuffs—such as maize, linseed-cake and cotton-cake—and of artificial manures imported from abroad. The low price of agricultural produce, beneficial though it might be to the general community, had lessened the ability of the land to bear the proportion of taxation which had heretofore been imposed upon it. The legislative outcome of the findings of this royal commission was the Agricultural Holdings Act 1883, a measure which continued in force in its entirety till 1901, when a new act came into operation.

The apparently hopeless outlook for corn-growing compelled farmers to cast about for some other means of subsistence, and to rely more than they had hitherto done upon the possibilities of stock-breeding. It was in particular the misfortunes of the later 'seventies that gave the needed fillip to that branch of stock-farming concerned with the production of milk, butter and cheese, and from this period may be said to date the revival of the dairying industry, which received a powerful impetus through the introduction of the centrifugal cream separator, and was fostered by the British Dairy Farmers' Association (formed in 1875). The generally wet character of the seasons in 1879 and the two or three years following was mainly responsible for the high prices of meat, so that the supplies of fresh beef and mutton from Australia which now began to arrive found a ready market, and the trade in imported fresh meat which was thus commenced has practically continued to expand ever since. The great losses arising from spoilt hay crops served to stimulate experimental inquiry into the method of preserving green fodder known as ensilage, with the result that the system eventually became successfully incorporated in the ordinary routine of agricultural practice. A contemporaneous effort in the direction of drying hay by artificial means led to nothing of practical importance. By 1882 the cry as to land going out of cultivation became loud and general, and the migration of the rural population into the towns in search of work continued unchecked (see below, *Agricultural Population*). In 1883 foot-and-mouth disease was terribly rampant amongst the herds and flocks of Great Britain, and was far more prevalent than it has ever been since. It was about this time that the first experiments were made (in Germany) with basic slag, a material which had hitherto been regarded as a worthless by-product of steel manufacture. A year or two later field trials were begun in England, with the final result that basic slag has become recognized as a valuable source of phosphorus for growing crops, and is now in constant demand for application to the soil as a fertilizer.

In 1883 the veterinary department of the Privy Council—which had been constituted in 1865 when the country was ravaged by cattle plague—was abolished by order in council, and the "Agricultural Department" was substituted, but no alteration was effected in the work of the department, so far as it related to animals. In 1889 the Board of Agriculture (for Great Britain) was formed under an act of parliament of that year (see AGRICULTURE, BOARD OF). The election took place in the same year (1889) of the first county councils, and the allotment to them of various sums of money under the Local Taxation (Customs and Excise) Act 1890 enabled local provision to be made for the promotion of technical instruction in agriculture (see below, *Agricultural Education*). It was about this time that the value of a mixture of lime and sulphate of copper (*bouillie bordelaise*), sprayed in solution upon the growing plants, came to be recognized as a check upon the ravages of potato disease.

The general experience of the decade of the 'eighties was that of disappointing summers, harsh winters, falling prices, declining rents and the shrinkage of land values. It is true that one season of the series, that of 1887, was hot and droughty, but the following summer was exceedingly wet. Nevertheless, the decade closed more hopefully than it opened, and found farmers taking a keener interest in grass land, in live stock and in dairying. Cattle-breeders did well in 1889, but sheep-breeders fared better; on the other hand, owing to receding prices, corn-growers were more disheartened than ever. With the incoming of the last decade of the century there seemed to be some justifiable hopes of the dawn of better times, but they were speedily doomed to disappointment. In 1891 excessively heavy autumn rains washed the arable soils to such an extent that the next season's corn crops were below average. Wheat in particular was a poor crop in 1892, and the low yield was associated with falling prices due to large imports. The hay crop was very inferior, and in some cases it was practically ruined. This gave a stimulus to the trade in imported hay, which rose from 61,237 tons in 1892 to 263,050 tons in 1893, and despite some large home-grown crops in certain subsequent years (1897 and 1898) this expansion has never since been wholly lost.

The misfortunes of 1892 proved to be merely a preparation for the disasters of 1893, in which year occurred the most destructive drought within living memory. Its worst effects were seen upon the light land farms of England, and so deplorable was the position that a royal commission on agricultural depression was appointed in September of that year under the chairmanship of Mr Shaw Lefevre (afterwards Lord Eversley). Thus, within the last quarter of the 19th century—and, as a matter of fact, only fourteen years apart—two royal commissions on agriculture were appointed, the one in a year of memorable flood, 1879, and the other in a year of disastrous drought, 1893. The report of the commission of 1893 was issued in March 1896. Amongst its chief recommendations were those relating to amendments in the Agricultural Holdings Acts, and to tithe rent-charge, railway rates, damage by game, sale of adulterated products, and sale of imported goods (meat, for example) as home produce. Two legislative enactments arose out of the work of this commission. In the majority report it was stated "that, in order to place agricultural lands in their right position as compared with other ratable properties, it is essential that they should be assessed to all local rates in a reduced proportion of their ratable value." The Agricultural Rates Act 1896 gave effect to this recommendation. Its objects were to relieve agricultural land from half the local rates, and to provide the means of making good out of imperial funds the deficiency in local taxation caused thereby. It was provided that the act should continue in force only till the 31st of March 1902, but a further act in 1901 extended the period by four years, and in 1905 its operation was extended to the 31st of March 1910. The other measure arising out of the report of the royal commission of 1893 was the Agricultural Holdings Act 1900. This was an amending act and not a consolidating act; consequently it had to be read as if incorporated into the already existing acts. As affecting agricultural practice there were three noteworthy improvements in respect of the making of which, without the consent of or notice to his landlord, a tenant might claim compensation—(1) the consumption on the holding "by horses, other than those regularly employed on the holding," of corn, cake or other feeding-stuff not produced on the holding; (2) the "consumption on the holding by cattle, sheep, or pigs, or by horses other than those regularly employed on the holding, of corn proved by satisfactory evidence to have been produced and consumed on the holding"; (3) "laying down temporary pasture with clover, grass, lucerne, sainfoin or other seeds sown more than two years prior to the determination of the tenancy." A further act was passed in 1906 (the Agricultural Holdings Act 1906) which improved the tenant's position in respect of freedom of cropping, disposal of produce and compensation for disturbance.

After 1894, in which year the brilliant prospects of a bountiful harvest were ultimately extinguished by untimely and heavy rains, all the remaining seasons of the closing decade of the 19th century were dominated by drought. A fact that was amply illustrated, moreover, is that the period of incidence of a drought is not less important than its duration, and the same is true of abnormal rainfall. A spring drought, a summer drought, an autumn drought, each has its distinctive characteristics in so far as the effect upon the crops is concerned. The hot drought of 1893 extended over the spring and summer months, but there was an abundant rainfall in the autumn; correspondingly there was an unprecedentedly bad yield of corn and hay crops, but a moderately fair yield of the main root crops (turnips and swedes). In 1899 the drought became most intense in the autumn after the corn crops had been harvested, but during the chief period, of growth of the root crops; correspondingly the corn crops of that year rank very well amongst the crops of the decade, but the yield of turnips and swedes was the worst on record. It is quite possible for a hot dry season to be associated with a large yield of corn, provided the drought is confined to a suitable period, as was the case in 1896 and still more so in 1898; the English wheat crops in those years were probably the biggest in yield per acre that had been harvested since 1868, which is always looked back upon as a remarkable year for wheat. The drought of 1898 was interrupted by copious rains in June, and these falling on a warm soil led to a rapid growth of grass and, as measured by yield per acre, an exceedingly heavy crop of hay.

With the exceptions of 1891 and 1894, every year in the period 1891–1900 was stricken by drought. The two meteorological events of the decade which will probably live longest in the recollection were, however, the terrible drought of 1893, resulting in a fodder famine in the succeeding winter, and the severe frost of ten weeks' duration at the beginning of 1895. Between these two occurrences came the disastrous decline in the value of grain in the autumn of 1894, when the weekly average price of English wheat fell to the record *minimum* of 17s. 6d. per imperial quarter. As a consequence, the extent of land devoted to wheat in the British Isles receded in 1895 to less than 1½ million acres. The year 1903 was memorable for a very heavy rainfall, comparable though not equal in its disastrous effects to that of 1879. Successful trials of sulphate of copper solution as a means of destroying charlock in corn crops took place in the years 1898–1900. Charlock is a most persistent cruciferous weed, but if sprayed when young with the solution named it is killed, the corn plants being uninjured. In 1901 the formation of the Agricultural Organization Society marked the first systematic attempt to organize co-operation among the farmers of Great Britain. In the subsequent years the principle, which had already made great progress in Ireland, began to obtain a hold in England and Wales, where, in 1906, there were 145 local co-operative societies with a turn-over of £350,000.

Amongst legislative measures of importance to agriculturists mention should be made, in addition to those that have been referred to, of the Tithe Rent-charge Recovery Act 1891, which transfers the liability for payment of tithe from the occupier to the owner. In the same year was passed the Markets and Fairs (Weighing of Cattle) Act. The object of the Small Holdings Act 1892 was to facilitate the acquisition of small agricultural holdings. It provided that a county council might acquire any suitable land, with the object of allotting from one to fifty acres, or, if more than fifty acres, of an annual value not exceeding £50, to persons who desired to buy, and would themselves cultivate, the holdings. If, owing to proximity to a town or otherwise, the prospective value were too high, the council might hire such land for the purpose of letting it. (See ALLOTMENTS AND SMALL HOLDINGS for this and other acts.) The Fertilizers and Feeding Stuffs Act 1893 compelled sellers of fertilizers (*i.e.* manures), manufactured or imported, to state the percentage of the nitrogen, of the soluble and insoluble phosphates, and of the potash in each article sold, and this statement was to have the effect of a warranty. Similar stringent conditions applied as regards the sale of feeding-stuffs for live stock. The Fertilizers and Feeding Stuffs Act 1906, amending and re-enacting the act of 1893, provided for the compulsory appointment by county councils of official samplers. It also provides penalties for breaches of duty by the seller, but grants him protection in cases where he is not morally responsible. The Finance Act of 1894, with its great changes in the death duties, overshadowed all other acts of that year both in its immediate effects and in its far-reaching consequences. The Copyhold Consolidation Act 1894 supersedes six previous copyhold statutes, but does not effect any alteration in the law concerning enfranchisement. The Diseases of Animals Act 1896 provided for the compulsory slaughter of imported live stock at the place of landing. The Light Railways Act and the Locomotives on Highways Act were added to the statute book in 1896, and various clauses in the Finance Act effected reforms in respect of the death duties, the land-tax, farmers' income-tax and the beer duty. The Chaff-cutting Machines (Accidents) Act 1897 is a measure very similar in its intention to the Threshing Machines Act 1878, and provides for the automatic prevention of accidents to persons in charge of chaff-cutting machines. The Sale of Food and Drugs Act 1899 has special reference in its earlier sections to the trade in dairy produce and margarine. In 1899 was also passed the act establishing the Department of Agriculture and Technical Instruction in Ireland.

The year 1900 saw the passing of a Workmen's Compensation Act, which extended the benefits of the act of 1897 to agricultural labourers.

Acreage and Yields of British Crops.

The most notable feature in connexion with the cropping of the land of the United Kingdom between 1875 and 1905 was the lessened cultivation of the cereal crops associated with an expansion in the area of grass land. At the beginning of the period the aggregate area under wheat, barley and oats was nearly 10½ million acres; at the close it did not amount to 8 million acres. There was thus a withdrawal during the period of over 2½ million acres from cereal cultivation. From Table I., showing the acreages at intervals of five years, it will be learnt that the loss fell chiefly upon the wheat crop, which at the close of the period occupied barely more than half the area assigned to it at the beginning. If the land taken from wheat had been cropped with one or both of the other cereals, the aggregate area would have remained about the same. This, however, was not the case, for a fairly uniform decrease in the barley area was accompanied by somewhat irregular fluctuations in the acreage of oats. To the decline in prices of home-grown cereals the decrease in area is largely attributable. The extent of this decline is seen in Table II., wherein are given the annual average prices from 1875 to 1905, calculated upon returns from the 190 statutory markets of England and Wales (Corn Returns Act 1882). These prices are per imperial quarter,—that is, 480 lb of wheat, 400 lb of barley and 312 lb of oats, representing 60 lb, 50 lb and 30 lb per bushel respectively. After 1883 the annual average price of English wheat was never so high as 40s. per quarter, and only twice after

TABLE I.—*Areas of Cereal Crops in the United Kingdom —Acres.*

Year.	Wheat.	Barley.	Oats.	Total.
1875	3,514,088	2,751,362	4,176,177	10,441,627
1880	3,065,895	2,695,000	4,191,716	9,952,611
1885	2,553,092	2,447,169	4,282,594	9,282,855
1890	2,483,595	2,300,994	4,137,790	8,922,379
1895	1,456,042	2,346,367	4,527,899	8,330,308
1900	1,901,014	2,172,140	4,145,633	8,218,787
1905	1,836,598	1,872,305	4,137,406	7,846,309

1892 did it exceed 30s. In one of these exceptional years, 1898, the average rose to 34s., but this was due entirely to a couple of months of inflated prices in the early half of the year, when the outbreak of war between Spain and the United States of America coincided with a huge speculative deal in the latter country. The weekly average prices of English wheat in 1898 fluctuated between 48s. 1d. and 25s. 5d. per quarter, the former being the highest weekly average since 1882. The *minimum* annual average was 22s. 10d. in 1894, in the autumn of which year the weekly average sank to 17s. 6d. per quarter, the lowest on record. Wheat was so great a glut in the market that various methods were devised for feeding it to stock, a purpose for which it is not specially suited; in thus utilizing the grain, however, a smaller loss was often incurred than in sending it to market. In 1894 the monthly average price for October, the chief month for wheat-sowing in England, was only 17s. 8d. per quarter, and farmers naturally shrank from seeding the land freely with a crop which could not be grown except at a heavy loss. The result was that in the following year the wheat crop of the United Kingdom was harvested upon the smallest area on record—less than 1½ million acres. In only one year, 1878, did the annual average price of English barley touch 40s. per quarter; it never reached 30s. after 1885, whilst in 1895 it fell to so low a level as 21s. 11d. The same story of declining prices applies to oats. An average of 20s. per quarter was touched in 1891 and 1902, but with those exceptions this useful feeding grain did not reach that figure after 1885. In 1895 the average price of 480 lb of wheat, at 23s. 1d., was identical with that of 312 lb of oats in 1880, and it was less in the preceding year. The declining prices that have operated against the growers of wheat should be studied in conjunction with Table III., which shows, at intervals of five years, the imports of wheat grain and of wheat meal and flour into the United Kingdom. The import of the manufactured product from 1875 to 1900 increased at a much greater ratio than that of the raw grain, for whilst in 1875 the former represented less than one-ninth of the total, by 1900 the proportion had risen to nearly one-fourth. The offal, which is quite as valuable as the flour itself, was thus retained abroad instead of being utilized for stock-feeding purposes in the United Kingdom. In the five subsequent years the proportion was fundamentally altered, so that with a greatly increased importation of grain, that of meal and flour was in the proportion of about one-ninth. The highest and lowest areas of wheat, barley and oats in the United Kingdom during the period 1875-1905 were the following:—

TABLE II.—*Gazette Annual Average Prices per Imperial Quarter of British Cereals in England and Wales*, 1875–1905.

Year.	Wheat.		Barley.		Oats.	
	s.	d.	s.	d.	s.	d.
1875	45	2	38	5	28	8
1876	46	2	35	2	26	3
1877	56	9	39	8	25	11
1878	46	5	40	2	24	4
1879	43	10	34	0	21	9
1880	44	4	33	1	23	1
1881	45	4	31	11	21	9
1882	45	1	31	2	21	10
1883	41	7	31	10	21	5
1884	35	8	30	8	20	3
1885	32	10	30	1	20	7
1886	31	0	26	7	19	0
1887	32	6	25	4	16	3
1888	31	10	27	10	16	9
1889	29	9	25	10	17	9
1890	31	11	28	8	18	7
1891	37	0	28	2	20	0
1892	30	3	26	2	19	10
1893	26	4	25	7	18	9
1894	22	10	24	6	17	1
1895	23	1	21	11	14	6
1896	26	2	22	11	14	9
1897	30	2	23	6	16	11
1898	34	0	27	2	18	5
1899	25	8	25	7	17	0
1900	26	11	24	11	17	7
1901	26	9	25	2	18	5
1902	28	1	25	8	20	2
1903	26	9	22	8	17	2
1904	28	4	22	4	16	4
1905	29	8	24	4	17	4

TABLE III.—*Imports into the United Kingdom of Wheat Grain, and of Wheat Meal and Flour—Cwt.*

Year.	Wheat Grain.	Meal and Flour.	Total.
1875	51,876,517	6,136,083	58,012,600
1880	55,261,924	10,558,312	65,820,236
1885	61,498,864	15,832,843	77,331,707
1890	60,474,180	15,773,336	76,247,516
1895	81,749,955	18,368,410	100,118,365
1900	68,669,490	21,548,131	90,217,621
1905	97,622,752	11,954,763	109,577,515

Wheat . 3,514,088 acres in 1875; 1,407,618 acres in 1904.
Barley . 2,931,809 „ „ 1879; 1,872,305 „ „ 1905.
Oats . 4,527,899 „ „ 1895; 3,998,200 „ „ 1879.

These show differences amounting to 2,106,470 acres for wheat, 1,059,504 acres for barley, and 529,699 acres for oats. The acreage of wheat, therefore, fluctuated the most, and that of oats the least. Going back to 1869, it is found that the extent of wheat in that year was 3,981,989 acres or very little short of four million acres.

The acreage of rye grown in the United Kingdom as a grain crop is small, the respective *maximum* and *minimum* areas during the period 1875–1905 having been 102,676 acres in 1894 and 47,037 acres in 1880. Rye is perhaps more largely grown as a green crop to be fed off by sheep, or cut green for soiling, in the spring months.

Of corn crops other than cereals, beans and peas are both less cultivated than formerly. In the period 1875–1905 the area of beans in the United Kingdom fluctuated between 574,414 acres in 1875 and 230,429 acres in 1897, and that of peas between 318,410 acres in 1875 and 155,668 acres in 1901. The area of peas (175,624 acres in 1905) shrank by nearly one-half, and that of beans (256,383 acres in 1905) by more than one-half. Taking cereals and pulse corn together, the aggregate areas of wheat, barley, oats, rye, beans and peas in the United Kingdom varied as follows over the six quinquennial intervals embraced in the period 1875–1905:—

Year.	Acres.	Year.	Acres.
1875	11,399,030	1890	9,574,249
1880	10,672,086	1895	8,865,338
1885	10,014,625	1900	8,707,602
		1905	8,333,770

Disregarding minor fluctuations, there was thus a loss of corn land over the 30 years of 3,065,260 acres, or 27 %.

The area withdrawn from corn-growing is not to be found under the head of what are termed "green crops." In 1905 the total area of these crops in the United Kingdom was 4,144,374 acres, made up thus:—

Crop.	Acres.
Potatoes	1,236,768
Turnips and swedes	1,879,384
Mangel	477,540
Cabbage, kohl-rabi and rape	225,315
Vetches or tares	139,285
Other green crops	186,082

The extreme aggregate areas of these crops during the thirty years were 5,057,020 acres in 1875 and 4,109,394 acres in 1904. At five-year intervals the areas were:—

Year.	Acres.	Year.	Acres.
1875	5,057,029	1890	4,534,145
1880	4,746,293	1895	4,399,949
1885	4,765,195	1900	4,301,774
		1905	4,144,374

These crops, therefore, which, except potatoes, are used mainly for stock-feeding, have like the corn crops been grown on gradually diminishing areas.

The land that has been lost to the plough is found to be still further augmented when an inquiry is instituted into the area devoted to clover, sainfoin and grasses under rotation. The areas of five-year intervals are given in Table IV. Under the old Norfolk or four-course rotation (roots, barley, clover, wheat) land thus seeded with clover or grass seeds was intended to be ploughed up at the end of a year. Labour difficulties, low prices of produce, bad seasons and similar causes provided inducements for leaving the land in grass for two years, or over three years or more, before breaking it up for wheat. In many cases it would be decided to let such land remain under grass indefinitely, and thus it would no longer be enumerated in the Agricultural Returns as temporary grass land, but would pass into the category of permanent grass land, or what is often spoken of as "permanent pasture." Whilst much grass land has been laid down with the intention from the outset that it should be permanent, at the same time some considerable areas have through stress of circumstances been allowed to drift from the temporary or rotation grass area to the permanent list, and have thus still further diminished the area formerly under the dominion of the plough. The column relating to permanent grass in Table IV. shows clearly enough how the British Isles became more pastoral, while the figures already given demonstrate the extent to which they became less arable. In the period 1875–1905 the extreme areas returned as "permanent pasture"—a term which, it should be clearly understood, does not include heath or mountain land, of which there are in Great Britain alone about 13 million acres used for grazing—were 23,772,602 acres in 1875, and 28,865,373 acres in 1905. Comparing 1905 with 1875 the increase in permanent grass land amounted to over five million acres, or about 21 %.

Table IV.—*Areas of Grass Land (excluding Heath and Mountain Land) in the United Kingdom—Acres.*

Year.	Temporary (*i.e.* under rotation).	Permanent (*i.e.* not broken up in rotation).	Total.
1875	6,337,953	23,772,602	30,110,555
1880	6,389,232	24,717,092	31,106,324
1885	6,738,206	25,616,071	32,354,277
1890	6,097,210	27,115,425	33,212,635
1895	6,061,139	27,831,117	33,892,256
1900	6,025,025	28,266,712	34,291,737
1905	5,779,323	28,865,373	34,644,696

On account of the greater humidity and mildness of its climate, Ireland is more essentially a pastoral country than Great Britain. The distribution between the two islands of such important crops of arable land as cereals and potatoes is indicated in Table V. The figures are those for 1905, but, though the absolute acreages vary somewhat from year to year, there is not much variation in the proportions. The comparative insignificance of Ireland in the case of the wheat and barley crops, represented by 2 and 8 % respectively, receives some compensation when oats and potatoes are considered, about one-fourth of the area of the former and more than half that of the latter being claimed by Ireland. It is noteworthy, however, that Ireland year by year places less reliance upon the potato crop. In 1888 the area of potatoes in Ireland was 804,566 acres, but it continuously contracted each year, until in 1905 it was only 616,755 acres, or 187,811 acres less than 17 years previously.

Table V.—*Areas of Cereal and Potato Crops in Great Britain and Ireland in* 1905.

	Wheat.	Barley.
	Acres.	Acres.
Great Britain . .	1,796,993	1,713,664
Ireland . .	37,860	154,645
Total . .	1,834,853	1,868,309
	Oats.	Potatoes.
Great Britain . .	3,051,376	608,473
Ireland . .	1,066,806	616,755
Total . .	4,118,182	1,225,228

A similar comparison for the several sections of Great Britain, as set forth in Table VI., shows that to England belong about 95 % of the wheat area, over 80 % of the barley area, over 60 % of the oats area, and over 70 % of the potato area, and these proportions do not vary much from year to year. The figures for cereals are important, as they indicate that it is the farmers of England who are the chief sufferers through the diminishing prices of corn; and particularly is this true of East Anglia, where corn-growing is more largely pursued than in any other part of the country. Scotland possesses nearly one-third of the area of oats and nearly one-fourth of that of potatoes. Beans are almost entirely confined to England, and this is even more the case with peas. The mangel crop also is mainly English, the summer in most parts of Scotland being neither long enough nor warm enough to bring it to maturity.

Table VI.—*Areas of Cereal and Potato Crops in England, Wales and Scotland, and in Great Britain, in* 1905.

	Wheat.	Barley.
	Acres.	Acres.
England . .	1,704,281	1,410,287
Wales . .	44,073	91,243
Scotland . .	48,641	212,134
Great Britain	1,796,995	1,713,664
	Oats.	Potatoes.
England . .	1,880,475	434,773
Wales . .	207,929	29,435
Scotland . .	962,972	144,265
Great Britain	3,051,376	608,473

The Produce of British Crops.

Whilst the returns relating to the acreage of crops and the number of live stock in Great Britain have been officially collected in each year since 1866, the annual official estimates of the produce of the crops in the several sections of the kingdom do not extend back beyond 1885. The practice is for the Board of Agriculture to appoint local estimators, who report in the autumn as to the total production of the crops in the localities respectively assigned to them. By dividing the total production, say of wheat, in each county by the number of acres of wheat as returned by the occupiers on June 4, the estimated average yield per acre is obtained. It is important to notice that the figures relating to total production and yield per acre are only *estimates*, and it is not claimed for them that they are anything more. The fact that much of the wheat to which the figures apply is still in the stack after the publication of the figures shows that the latter are essentially estimates. The total produce of any crop in a given year must depend mainly upon the acreage grown, whilst the average yield per acre will be determined chiefly by the character of the season. In Table VII. are shown, in thousands of bushels, the estimated produce of the corn crops of the United Kingdom in the years 1890–1905. The largest area of wheat in the period was that of 1890, and the smallest was that of 1904; the same two years are seen to have been respectively those of highest and lowest total produce. It is noteworthy that in 1895 the country produced about half as much wheat

Table VII.—*Estimated Annual Total Produce of Corn Crops in the United Kingdom, 1890–1905—Thousands of Bushels.*

Year.	Wheat.	Barley.	Oats.	Beans.	Peas.
1890	75,994	80,794	171,295	11,860	6313
1891	74,743	79,555	166,472	10,694	5777
1892	60,775	76,939	168,181	7,054	5028
1893	50,913	65,746	168,588	4,863	4756
1894	60,704	78,601	190,863	7,198	6229
1895	38,285	75,028	174,476	5,626	4732
1896	58,247	77,825	162,860	6,491	4979
1897	56,296	72,613	163,556	6,650	5250
1898	74,885	74,731	172,578	7,267	4858
1899	67,261	74,532	166,140	7,566	4431
1900	54,322	68,546	165,137	7,469	4072
1901	53,928	67,643	161,175	6,154	4017
1902	58,278	74,439	184,184	7,704	5106
1903	48,819	65,310	172,941	7,535	4812
1904	37,920	62,453	176,755	5,901	4446
1905	60,333	65,004	166,286	8,262	4446

as in any one of the years 1890, 1891 and 1898. The produce of barley, like that of oats, is less irregular than that of wheat, the extremes for barley being 80,704,000 bushels (1890) and 62,453,000 bushels (1904), and those for oats 190,863,000 bushels (1894) and 161,175,000 bushels (1901). Similar details for potatoes, roots and hay, brought together in Table VIII., show that the production of potatoes varies much from year to year. The imports of potatoes into the United Kingdom vary, to some extent inversely; thus, the low production in 1897 was accompanied by an increase of imports from 3,921,205 cwt. in 1897 to 6,751,728 cwt. in 1898. No very great reliance can be placed upon the figures relating to turnips (which include swedes), as these are mostly fed to sheep on the ground, so that the estimates as to yield are necessarily vague. Mangels are probably more closely estimated, as these valuable roots are carted and stored for subsequent use for feeding stock. Under hay are included the produce of clover, sainfoin and rotation grasses, and also that of permanent meadow. The extent to which the annual production of the leading fodder crop may vary is shown in the table by the two consecutive years 1893 and 1894; from only nine million tons in the former year the production rose to upwards of fifteen million tons in the latter, an increase of over 70%.

TABLE VIII.—*Estimated Annual Total Produce of Potatoes, Roots and Hay in the United Kingdom, 1890–1905—Thousands of Tons.*

Year.	Potatoes.	Turnips.	Mangels.	Hay.
1890	4622	32,002	6709	14,466
1891	6090	29,742	7558	12,671
1892	5634	31,419	7428	11,567
1893	6541	31,110	5225	9,082
1894	4662	30,678	7310	15,699
1895	7065	29,221	6376	12,238
1896	6263	28,037	5875	11,416
1897	4107	29,785	7379	14,043
1898	6225	26,499	7228	15,916
1899	5837	20,370	7604	12,898
1900	4577	28,387	9650	13,742
1901	7043	25,298	9224	11,358
1902	5920	29,116	10,809	15,246
1903	5277	23,523	8212	14,955
1904	6230	28,033	8813	14,860
1905	7186	26,563	9493	13,554

Turning to the average yields per acre, as ascertained by dividing the number of acres into the total produce, the results of a decade are collected in Table IX. The effects of a prolonged spring and summer drought, like that of 1893, are exemplified in the circumstance that four corn crops and the two hay crops all registered very low average yields that year, viz. wheat 26·08 bushels, barley 29·30 bushels, oats 38·14 bushels, beans 19·61 bushels, rotation hay 23·55 cwt., permanent hay 20·41 cwt. On the other hand, the season of 1898 was exceptionally favourable to cereals and to hay. The effects of a prolonged autumn drought, as distinguished from spring and summer drought, are shown in the very low yield of turnips in 1899. Mangels are sown earlier and have a longer period of growth than turnips; if they become well established in the summer they are less susceptible to autumn drought. The hay made from clover, sainfoin and grasses under rotation generally gives a bigger average yield than that from permanent grass land. The mean values at the foot of the table—they are not, strictly speaking, exact averages—indicate the average yields per acre in the United Kingdom to be about 31 bushels of wheat, 33 bushels of barley, 40 bushels of oats, 28 bushels of beans, 26 bushels of peas, 4¾ tons of potatoes, 13¼ tons of turnips and swedes, 18¼ tons of mangels, 32 cwt. of hay from temporary grass, and 29 cwt. of hay from permanent grass. Although enormous single crops of mangels are sometimes grown, amounting occasionally to 100 tons per acre, the general average yield of 18¼ tons is about 5 tons more than that of turnips and swedes. Again, although from the richest old permanent meadow-lands very heavy crops of hay are taken season after season, the general average yield of permanent grass is about 3 cwt. of hay per acre less than that from clover, sainfoin and grasses under rotation. The general average yields of the corn crops are not fairly comparable one with the other, because they are given by measure and not by weight, whereas the weight per bushel varies considerably. For purposes of comparison it would be much better if the yields of corn crops were estimated in cwt. per acre. This, indeed, is the practice in Ireland, and in order to incorporate the Irish figures with those for Great Britain so as to obtain average values for the United Kingdom, the Irish yields are calculated into bushels at the rate of 60 lb to the bushel of wheat, of beans and of peas, 50 lb to the bushel of barley and 39 lb to the bushel of oats.

TABLE IX.—*Estimated Annual Average Yield per Acre of Crops in United Kingdom*, 1895–1904.

Year.	Wheat.	Barley.	Oats.	Beans.	Peas.	Potatoes.	Turnips and Swedes.	Mangels.	Hay. Rotation.	Hay. Permanent.
	Bush.	Bush.	Bush.	Bush.	Bush.	Tons.	Tons.	Tons.	Cwt.	Cwt.
1895	26·33	32·09	38·67	22·98	22·62	5·64	13·11	16·44	29·08	25·21
1896	33·63	34·16	37·97	25·69	25·34	4·93	12·79	14·99	27·95	24·14
1897	29·07	32·91	38·84	28·91	27·55	3·47	13·90	18·03	32·53	30·71
1898	34·75	36·24	42·27	31·13	27·60	5·23	12·74	17·71	36·49	34·27
1899	32·76	34·64	40·57	30·19	27·22	4·82	9·97	17·41	31·04	29·11
1900	28·61	31·67	39·97	28·18	25·89	3·77	14·29	19·97	32·42	30·98
1901	30·93	31·70	39·35	24·29	25·97	5·81	12·95	19·37	28·98	23·85
1902	32·91	35·83	44·50	31·49	28·51	4·92	15·35	20·85	35·29	32·57
1903	30·15	32·38	40·81	31·27	26·56	4·45	12·44	17·19	33·07	31·27
1904	26·97	31·25	40·80	23·23	25·75	5·24	14·83	18·57	33·43	31·04
Mean, 10 years	30·85	33·28	40·35	27·68	26·24	4·84	13·21	18·18	32·06	29·32
1905	32·88	34·79	40·38	32·33	25·71	5·86	14·19	19·91	32·24	28·37

TABLE X.—*Decennial Average Yields in Great Britain of Wheat, Barley and Oats—Bushels per acre.*

10-Year Periods.	Wheat.	Barley.	Oats.
1885–1894	29·32	33·02	38·21
1886–1895	28·81	32·68	38·23
1887–1896	29·49	32·82	38·13
1888–1897	29·19	32·97	38·51
1889–1898	29·86	33·26	38·86
1890–1899	30·15	33·50	38·81
1891–1900	29·92	33·13	38·46
1892–1901	29·88	32·80	38·26
1893–1902	30·53	32·83	38·64
1894–1903	30·95	33·16	39·05
1895–1904	30·56	32·82	38·81
1896–1905	31·21	33·04	38·92

The figure denoting the general average yield per acre of any class of crop needs readjustment after every successive harvest. If a decennial period be taken, then—for the purpose of the new calculation—the earliest year is omitted and the latest year added, the number of years continuing at ten. Adopting this course in the case of the cereal crops of Great Britain the decennial averages recorded in Table X. are obtained, the period 1885–1894 being the earliest decade for which the official figures are available. It thus appears that the average yield of wheat in Great Britain, as calculated upon the crops harvested during the ten years (1896–1905), exceeded 31 bushels to the acre, whereas, for the ten years ended 1895, it fell below 29 bushels. A large expansion in the acreage of the wheat crop would probably be attended by a decline in the average yield per acre, for when a crop is shrinking in area the tendency is to withdraw from it first the land least suited to its growth. The general average for the United Kingdom might then recede to rather less than 28 bushels of 60 lb per bushel, which was for a long time the accepted average—unless, of course, improved methods of cultivating and manuring the soil were to increase its general wheat-yielding capacity.[1]

Crops and Cropping.

The greater freedom of cropping and the less close adherence to the formal system of rotation of crops, which characterize the early years of the 20th century, rest upon a scientific basis. Experimental inquiry has done much to enlighten the farmer as to the requirements of plant-life, and to enable him to see how best to meet these requirements in the case of field crops. He cannot afford to ignore the results that have been gradually accumulated—the truths that have been slowly established—at the agricultural experiment stations in various parts of the world. Of these stations the greatest, and the oldest now existing, is that at Rothamsted, Harpenden, Herts, England, which was founded in 1843 by Sir John Bennet Lawes (*q.v.*). The results of more than half a century of sustained experimental inquiry were communicated to the world by Lawes and his collaborator, Sir J. H. Gilbert, in about 130 separate papers or reports, many of which were published, from 1847 onwards, in the *Journal of the Royal Agricultural Society of England*.[2]

In the case of plants the method of procedure was to grow some of the most important crops of rotation, each separately year after year, for many years in succession on the same land, (*a*) without manure, (*b*) with farmyard manure and (*c*) with a great variety of chemical manures; the same description of manure being, as a rule, applied year after year on the same plot. Experiments on an actual course of rotation, without manure, and with different manures, have also been made. Wheat, barley, oats, beans, clover and other leguminous plants, turnips, sugar beet, mangels, potatoes and grass crops have thus been experimented upon. Incidentally there have been extensive sampling and analysing of soils, investigations into rainfall and the composition of drainage waters, inquiries into the amount of water transpired by plants, and experiments on the assimilation of free nitrogen.

Cereals.—Amongst the field experiments there is, perhaps, not one of more universal interest than that in which wheat was grown for fifty-seven years in succession, (*a*) without manure, (*b*) with farmyard manure and (*c*) with various artificial manures. The results show that, unlike leguminous crops such as beans or clover, wheat may be successfully grown for many years in succession on ordinary arable land, provided suitable manures be applied and the land be kept clean. Even without manure the average produce over forty-six years, 1852–1897, was nearly thirteen bushels per acre, or about the average yield per acre of the wheat lands of the whole world. Mineral manures alone give very little increase, nitrogenous manures alone considerably more than mineral manures alone, but the mixture of the two considerably more than either separately. In one case, indeed, the average produce by mixed minerals and nitrogenous manure was more than that by the annual application of farmyard manure; and in seven out of the ten cases in which such mixtures were used the average yield per acre was from over two to over eight bushels more than the average yield of the United Kingdom (assuming this to be about twenty-eight bushels of 60 lb per bushel) under ordinary rotation. It is estimated that the reduction in yield of the unmanured plot over the forty years, 1852–1891, after the growth of the crops without manure during the eight preceding years, was, provided it had been uniform throughout, equivalent to a decline of one-sixth of a bushel from year to year due to exhaustion—that is, irrespectively of fluctuations due to season. It is related that a visitor from the United States, talking to Sir John Lawes, said, "Americans have learnt more from this field than from any other agricultural experiment in the world."

Experiments upon the growth of barley for fifty years in succession on rather heavy ordinary arable soil resulted in showing that the produce by mineral manures alone is larger than that without manure; that nitrogenous manures alone give more produce than mineral manures alone; and that mixtures of mineral and nitrogenous manure give much more than either used alone—generally twice, or more than twice, as much as mineral manures alone. Of mineral constituents, whether used alone or in mixture with nitrogenous manures, phosphates are much more effective than mixtures of salts of potash, soda and magnesia. The average results show that, under all conditions of manuring—excepting with farmyard manure—the produce was less over the later than over the earlier periods of the experiments, an effect partly due to the seasons. But the average produce over forty years of continuous growth of barley was, in all cases where nitrogenous and mineral manures (containing phosphates) were used together, much higher than the average produce of the crop grown in ordinary rotation in the United Kingdom, and very much higher than the average in most other countries when so grown. The requirements of barley within the soil, and its susceptibility to the external influences of season, are very similar to those of its near ally, wheat. Nevertheless there are distinctions of result dependent on differences in the habits of the two plants, and in the conditions of their cultivation accordingly. In the British Isles wheat is, as a rule, sown in the autumn on a heavier soil, and has four or five months in which to distribute its roots, and so it gets possession of a wide range of soil and subsoil before barley is sown in the spring. Barley, on the other hand, is sown in a lighter surface soil, and, with its short period for root-development, relies in a much greater degree on the stores of plant-food within the surface soil. Accordingly it is more susceptible to exhaustion of surface soil as to its nitrogenous, and especially as to its mineral supplies; and in the common practice of agriculture it is found to be more benefited by direct mineral manures, especially phosphatic manures, than is wheat when sown under equal soil conditions. The exhaustion of the soil induced by both barley and wheat is, however, characteristically that of available nitrogen; and when, under the ordinary conditions of manuring and cropping, artificial manure is still required, nitrogenous manures are, as a rule, necessary for both crops, and, for the spring-sown barley, superphosphate also. Although barley is appropriately grown on lighter soils than wheat, good crops, of fair quality, may be grown on the heavier soils after another grain crop by the aid of artificial manures, provided that the land is sufficiently clean. Experiments similar to the foregoing were carried on for many years in succession at Rothamsted upon oats, and gave results which were in general accordance with those on the other cereal crops.

Additional significance to the value of the above experiments on wheat and barley is afforded by the fact that the same series, with but slight modifications, has also been carried out since 1876 at the Woburn (Bedfordshire) experimental farm of the

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[1] The higher yield of wheat in the later years of the 19th century appears to be largely attributable to better grain-growing seasons. The yields in the experimental wheat-field at Rothamsted—where there is no change either of land or of treatment—indicate this. The following figures show the average yields per acre of the selected plots at Rothamsted over six 8-yearly periods from 1852 to 1899, and afford evidence that the higher yield of later years is due to the seasons:—

Average of—			Bushels (of 60 lb) per acre.
8	years	1852–1859	28[illegible]
8	,,	1860–1867	28[illegible]
8	,,	1868–1875	27[illegible]
8	,,	1876–1883	25[illegible]
8	,,	1884–1891	29[illegible]
8	,,	1892–1899	30
32	,,	1852–1883	27⅝
16	,,	1884–1899	30
48	,,	1852–1899	28⅜

The average of the first thirty-two years was thus 27⅝ bushels per acre, of the last sixteen years 30 bushels, and of the whole forty-eight years 28⅜ bushels.

[2] See J. B. Lawes and J. H. Gilbert, *Rothamsted Memoirs on Agricultural Chemistry and Physiology*, 7 vols. (1893–1899); A. D. Hall, *Book of the Rothamsted Experiments* (1905).

Royal Agricultural Society of England, the soil here being of light sandy character, and thus very different from the heavy soil of Rothamsted. The results for the thirty years, 1877–1906, are in their general features entirely confirmatory of those obtained at Rothamsted.

Root-Crops.—Experiments upon root-crops—chiefly white turnips, Swedish turnips (swedes) and mangels—have resulted in the establishment of the following conclusions. Both the quantity and the quality of the produce, and consequently its feeding value, must depend greatly upon the selection of the best description of roots to be grown, and on the character and the amount of the manures, and especially on the amount of nitrogenous manure employed. At the same time, no hard-and-fast rules can be laid down concerning these points. Independently of the necessary consideration of the general economy of the farm, the choice must be influenced partly by the character of the soil, but very much more by that of the climate. Judgment founded on knowledge and aided by careful observation, both in the field and in the feeding-shed, must be relied upon as the guide of the practical farmer. Over and above the great advantage arising from the opportunity which the growth of root-crops affords for the cleaning of the land, the benefits of growing the root-crop in rotation are due (1) to the large amount of manure applied for its growth, (2) to the large residue of the manure left in the soil for future crops, (3) to the large amount of matter at once returned as manure again in the leaves, (4) to the large amount of food produced, and (5) to the small proportion of the most important manurial constituents of the roots which is retained by store or fattening animals consuming them, the rest returning as manure again; though, when the roots are consumed for the production of milk, a much larger proportion of the constituents is lost to the manure.

Leguminous Crops and the Acquisition of Nitrogen.—The fact that the growth of a leguminous crop, such as red clover, leaves the soil in a higher condition for the subsequent growth of a grain crop—that, indeed, the growth of such a leguminous crop is to a great extent equivalent to the application of a nitrogenous manure for the cereal crop—was in effect known ages ago. Nevertheless it was not till near the approach of the closing decade of the 19th century that the explanation of this long-established point of agricultural practice was forthcoming. It was in the year 1886 that Hellriegel and Wilfarth first published in Germany the results of investigations in which they demonstrated that, through the agency of micro-organisms dwelling in nodular outgrowths on the roots of ordinary leguminous plants, the latter are enabled to assimilate the free nitrogen of the air. The existence of the root nodules had long been recognized, but hitherto no adequate explanation had been afforded as to their function.

Since Hellriegel's striking discovery farm crops have been conveniently classified as nitrogen-accumulating and nitrogen-consuming. To the former belong the ordinary leguminous crops—the clovers, beans, peas, vetches or tares, sainfoin, lucerne, for example—which obtain their nitrogen from the air, and are independent of the application of nitrogenous manures, whilst in their roots they accumulate a store of nitrogen which will ultimately become available for future crops of other kinds. It is, in fact, fully established that these leguminous crops acquire a considerable amount of nitrogen by the fixation of the free nitrogen of the atmosphere under the influence of the symbiotic growth of their root-nodule-microbes and the higher plant. The cereal crops (wheat, barley, oats, rye, maize); the cruciferous crops (turnips, cabbage, kale, rape, mustard); the solanaceous crops (potatoes); the chenopodiaceous crops (mangels, sugar-beets), and other non-leguminous crops have, so far as is known, no such power, and are therefore more or less benefited by the direct application of nitrogenous manures. The field experiments on leguminous plants at Rothamsted have shown that land which is, so to speak, exhausted so far as the growth of one leguminous crop is concerned, may still grow very luxuriant crops of another plant of the same natural order, but of different habits of growth, and especially of different character and range of roots. This result is doubtless largely dependent on the existence, the distribution and the condition of the appropriate microbes for the due infection of the different descriptions of plant, for the micro-organism that dwells symbiotically with one species is not identical with that which similarly dwells with another. It seems certain that success in any system involving a more extended growth of leguminous crops in rotations must be dependent on a considerable variation in the description grown. Other essential conditions of success will commonly include the liberal application of potash and phosphatic manures, and sometimes chalking or liming for the leguminous crop. As to how long the leguminous crop should occupy the land, the extent to which it should be consumed on the land, or the manure from its consumption be returned, and under what conditions the whole or part of it should be ploughed in—these are points which must be decided as they arise in practice. It seems obvious that the lighter and poorer soils would benefit more than the heavier or richer soils by the extended growth of leguminous crops.

Remarkable as Hellriegel's discovery was, it merely furnished the explanation of a fact which had been empirically established by the husbandman long before, and had received most intelligent application when the old four-course (or Norfolk) rotation was devised. But it gave some impetus to the practice of green manuring with leguminous crops, which are equally capable with such a crop as mustard of enriching the soil in humus, whilst in addition they bring into the soil from the atmosphere a quantity of nitrogen available for the use of subsequent crops of any kind. In Canada and the United States this rational employment of a leguminous crop for ploughing in green is largely resorted to for the amelioration of worn-out wheat lands and other soils, the condition of which has been lowered to an unremunerative level by the repeated growth year after year of a cereal crop. The well-known paper of Lawes, Gilbert and Pugh (1861), "On the Sources of the Nitrogen of Vegetation, with special reference to the Question whether Plants assimilate free or uncombined Nitrogen," answered the question referred to in the negative. The attitude taken up later on with regard to this problem is set forth in the following words, which are quoted from the Memoranda of the Rothamsted Experiments, 1900 (p. 7):—

> "Experiments were commenced in 1857, and conducted for several years in succession, to determine whether plants assimilate free or uncombined nitrogen, and also various collateral points. Plants of the gramineous, the leguminous and of other families were operated upon. The late Dr Pugh took a prominent part in this inquiry. The conclusion arrived at was that our agricultural plants do not themselves directly assimilate the free nitrogen of the air by their leaves.
>
> "In recent years, however, the question has assumed quite a new aspect. It now is—whether the free nitrogen of the atmosphere is brought into combination under the influence of micro-organisms, or other low forms, either within the soil or in symbiosis with a higher plant, thus serving indirectly as a source of nitrogen to plants of a higher order. Considering that the results of Hellriegel and Wilfarth on this point were, if confirmed, of great significance and importance, it was decided to make experiments at Rothamsted on somewhat similar lines. Accordingly, a preliminary series was undertaken in 1888; more extended series were conducted in 1889 and in 1890; and the investigation was continued up to the commencement of the year 1895. Further experiments relating to certain aspects of the subject were begun in 1898. The results have shown that, when a soil growing leguminous plants is infected with appropriate organisms, there is a development of the so-called leguminous nodules on the roots of the plants, and, coincidently, increased growth and gain of nitrogen."

The conclusions of Hellriegel and Wilfarth have thus been confirmed by the later experiences of Rothamsted, and since that time efforts have been directed energetically to the practical application of the discovery. This has taken the form of inoculating the soil with the particular organism required by the particular kind of leguminous crop. To this end the endeavour has been made to produce preparations which shall contain in portable form the organisms required by the several plants, and though, as yet, it can hardly be claimed that they have been generally successful, the work done justifies hopes that the problem will eventually be solved in a practical direction.

Grass.—Another field experiment of singular interest is that relating to the mixed herbage of permanent meadow, for which seven acres of old grass land were set apart in Rothamsted Park in 1856. Of the twenty plots into which this land is divided, two were left without manure from the outset, two received ordinary farmyard manure for a series of years, whilst the remainder each received a different description of artificial or chemical manure, the same being, except in special cases, applied year after year on the same plot. During the growing season the field affords striking evidence of the influence of different manurial dressings. So much, indeed, does the character of the herbage vary from plot to plot that the effect may fairly be described as kaleidoscopic. Repeated analyses have shown how greatly both the botanical constitution and the chemical composition of the mixed herbage vary according to the description of manure applied. They have further shown how dominant is the influence of season. Such, moreover, is the effect of different manures that the gross produce of the mixed herbage is totally different on the respective plots according to the manure employed, both as to the proportion of the various species composing it and as to their condition of development and maturity.

The Rotation of Crops.

The growth, year after year, on the same soil of one kind of plant unfits it for bearing further crops of the kind which has exhausted it, and renders them less vigorous and more liable to disease. The farmer therefore arranges his cropping in such a way that roots, or leguminous crops, succeed the cereal crops.

It is not only the conditions of growth, but the *uses* to which the different crops are put, that have to be considered in the case of rotation. Thus the cereal crops, when grown in rotation, yield more produce for sale in the season of growth than when grown continuously. Moreover, the crops alternated with the cereals accumulate very much more of mineral constituents and of nitrogen in their produce than do the cereals themselves. By far the greater proportion of those constituents remains in circulation in the manure of the farm, whilst the remainder yields highly valuable products for sale in the forms of meat and milk. For this reason these crops are known as "restorative," cereals the produce of which is sold off the farm being classed as "exhaustive." With a variety of crops, again, the mechanical operations of the farm, involving horse and hand labour, are better distributed over the year, and are therefore more economically performed. The opportunities which rotation cropping affords for the cleaning of the land from weeds is another distinct element of advantage. Although many different rotations of crops are practised, they may for the most part be considered as little more than local adaptations of the system of alternating root-crops and leguminous crops with cereal crops, as exemplified in the old four-course rotation—roots, barley, clover, wheat.

Under this system the clover is ploughed up in the autumn, the nitrogen stored up in its roots being left in the soil for the nourishment of the cereal crop. The following summer the wheat crop is harvested, and an opportunity is afforded for extirpating weeds which in the three previous years have received little check. Or, where the climate is warm and the soil light, a "catch-crop," *i.e.* rye, vetches, winter-oats or some other rapidly-growing crop may be sown in autumn and fed off or otherwise disposed of prior to the root-sowing. On heavy soils, however, the farmer cannot afford to curtail the time necessary for thorough cultivation of the land. The cleaning process is carried on through the next summer by means of successive hoeings of the spring-sown root-crop. As turnips or swedes may occupy the ground till after Christmas little time is left for the preparation of a seed-bed for barley, but as the latter is a shallow-rooted crop only surface-stirring is required. Clover is sown at the same time or shortly after the cereal and thus occupies the land for two years.

The rotations extending to five, six, seven or more years are, in most cases, only adaptations of the principle to variations of soil, altitude, aspect, climate, markets and other local conditions. They are effected chiefly by some alteration in the description of the root-crop, and perhaps by the introduction of the potato crop; by growing a different cereal, or it may be more than one cereal consecutively; by the growth of some other leguminous crop than clover, since "clover-sickness" may result if that crop is grown at too short intervals, or the intermixture of grass seeds with the clover, and perhaps by the extension by one or more years of the period allotted to this member of the rotation. Whatever the specific rotation, there may in practice be deviations from the plan of retaining on the farm the whole of the root-crops, the straw of the grain crops and the leguminous fodder crops (clover, vetches, sainfoin, &c.) for the production of meat or milk, and, coincidently, for that of manure to be returned to the land. It is equally true that, when under the influence of special local or other demand—proximity to towns, easy railway or other communication, for example—the products which would otherwise be retained on the farm are exported from it, the import of town or other manures is generally an essential condition of such practice. This system of free sale, indeed, frequently involves full compensation by purchased manures of some kind. Such deviations from the practice of merely selling grain and meat off the farm have much extended in recent years, and will probably continue to do so under the altered conditions of British agriculture, determined by very large imports of grain, increasing imports of meat and of other products of stock-feeding, and very large imports of cattle-food and other agricultural produce. More attention is thus being devoted to dairy produce, not only on grass farms, but on those that are mainly arable.

The benefits that accrue from the practice of rotation are well illustrated in the results obtained from the investigations at Rothamsted into the simple four-course system, which may fairly be regarded as a self-supporting system. Reference may first be made to the important mineral constituents of different crops of the four-course rotation. Of *phosphoric acid*, the cereal crops take up as much as, or more than, any other crops of the rotation, excepting clover; and the greater portion thus taken up is lost to the farm in the saleable product—the grain. The remainder, that in the straw, as well as that in the roots and the leguminous crops, is supposed to be retained on the farm, excepting the small amount exported in meat and milk. Of *potash*, each of the rotation crops takes up very much more than of phosphoric acid. But much less potash than phosphoric acid is exported in the cereal grains, much more being retained in the straw, whilst the other products of the rotation—the root and leguminous crops—which are also supposed to be retained on the farm, contain very much more potash than the cereals, and comparatively little of it is exported in meat and milk. Thus the whole of the crops of rotation take up very much more of potash than of phosphoric acid, whilst probably even less of it is ultimately lost to the land. Of *lime*, very little is taken up by the cereal crops, and by the root-crops much less than of potash; more by the leguminous than by the other crops, and, by the clover especially, sometimes much more than by all the other crops of the rotation put together. Very little of the lime of the crops, however, goes off in the saleable products of the farm in the case of the self-supporting rotation under consideration. Although, therefore, different, and sometimes very large, amounts of these typical mineral constituents are taken up by the various crops of rotation, there is no material export of any in the saleable products, *excepting of phosphoric acid and of potash*; and, so far at least as phosphoric acid is concerned, experience has shown that it may be advantageously supplied in purchased manures.

Of *nitrogen*, the cereal crops take up and retain much less than any of the crops alternated with them, notwithstanding the circumstance that the cereals are very characteristically benefited by nitrogenous manures. The root-crops, indeed, may contain two or more times as much nitrogen as either of the cereals, and the leguminous crops, especially the clover, much more than the root-crops. The greater part of the nitrogen of the cereals is, however, sold off the farm; but perhaps not more than 10 or 15% of that of either the root-crop or the clover (or other forage leguminous crop) is sold off in animal increase or in milk. Most of the nitrogen in the straw of the cereals, and a very large proportion of that of the much more highly nitrogen-yielding crops, returns to the land as manure, for the benefit of future cereals and other crops. As to the source of the nitrogen of the root-crops—the so-called "restorative crops"—these are as dependent as any crop that is grown on available nitrogen within the soil, which is generally supplied by the direct application of nitrogenous manures, natural or artificial. Under such conditions of supply, however, the root-crops, gross feeders as they are, and distributing a very large extent of fibrous feeding root within the soil, avail themselves of a much larger quantity of the nitrogen supplied than the cereal crops would do in similar circumstances. This result is partly due to their period of accumulation and growth extending even months after the period of collection by the ripening cereals has terminated, and at the season when nitrification within the soil is most active, and the accumulation of nitrates in it is the greatest. When a full supply of both mineral constituents and nitrogen is at command, these root-crops assimilate a very large amount of carbon from the atmosphere, and produce, besides nitrogenous food materials, a very large amount of the carbohydrate sugar, as respiratory and fat-forming food for the live stock of the farm. The still more highly nitrogenous leguminous crops, although not characteristically benefited by nitrogenous manures, nevertheless contribute much more nitrogen to the total produce of the rotation than any of the other crops comprised in it. It is the leguminous fodder crops—especially clover, which has a much more extended period of growth, and much wider range of collection within the soil and subsoil, than any of the other crops of the rotation—that yield in their produce the largest amount of nitrogen per acre. Much of this is doubtless taken up as nitrate, yet the direct application of nitrate of soda has comparatively little beneficial influence on their growth. The nitric acid is most likely taken up chiefly as nitrate of lime, but probably as nitrate of potash also, and it is significant that the high nitrogen-yielding clover takes up, or at least retains, very little soda. Table XI., from Warington's *Chemistry of the Farm*, 19th edition (Vinton and Co.), will serve to illustrate the subjects that have been discussed in this section.

Table XI.—*The Weight and Average Composition of Ordinary Crops, in lb. per Acre.*

Crop.	Weight of Crop.		Total Pure Ash.	Nitrogen.	Sulphur.	Potash.	Soda.	Lime.	Magnesia.	Phosphoric Acid.	Chlorine.	Silica.
	At Harvest.	Dry.										
Wheat, grain, 30 bushels	1,800	1530	30	34	2·7	9·3	0·6	1·0	3·6	14·2	0·1	0·6
" straw	3,158	2653	142	16	5·1	19·5	2·0	8·2	3·5	6·9	2·4	96·3
Total crop	4,958	4183	172	50	7·8	28·8	2·6	9·2	7·1	21·1	2·5	96·9
Barley, grain, 40 bushels	2,080	1747	46	35	2·9	9·8	1·1	1·2	4·0	16·0	0·5	11·8
" straw	2,447	2080	111	14	3·2	25·9	3·9	8·0	2·9	4·7	3·6	56·8
Total crop	4,527	3827	157	49	6·1	35·7	5·0	9·2	6·9	20·7	4·1	68·6
Oats, grain, 45 bushels	1,890	1625	51	34	3·2	9·1	0·8	1·8	3·6	13·0	0·5	19·9
" straw	2,835	2353	140	18	4·8	37·0	4·6	9·8	5·1	6·4	6·1	65·4
Total crop	4,725	3978	191	52	8·0	46·1	5·4	11·6	8·7	19·4	6·6	85·3
Maize, grain, 30 bushels	1,680	1500	22	28	1·8	6·5	0·2	0·5	3·4	10·0	0·2	0·5
" stalks, &c.	2,208	1877	99	15	..	29·8	..	..	..	8·0	..	..
Total crop	3,888	3377	121	43	..	36·3	..	..	..	18·0	..	..
Meadow hay, 1½ ton	3,360	2822	203	49	5·7	50·9	9·2	32·1	14·4	12·3	14·6	56·9
Red Clover hay, 2 tons	4,480	3763	258	98	9·4	83·4	5·1	90·1	28·2	24·9	9·8	7·0
Beans, grain, 30 bushels	1,920	1613	58	78	4·4	24·3	0·6	2·9	4·2	22·8	1·1	0·4
" straw	2,240	1848	99	29	4·9	42·8	1·7	26·3	5·7	6·3	4·3	6·9
Total crop	4,160	3461	157	107	9·3	67·1	2·3	29·2	9·9	29·1	5·4	7·3
Turnips, root, 17 tons	38,080	3126	218	61	15·2	108·6	17·0	25·5	5·7	22·4	10·9	2·6
" leaf	11,424	1531	146	49	5·7	40·2	7·5	48·5	3·8	10·7	11·2	5·1
Total crop	49,504	4657	364	110	20·9	148·8	24·5	74·0	9·5	33·1	22·1	7·7
Swedes, root, 14 tons	31,360	3349	163	70	14·6	63·3	22·8	19·7	6·8	16·9	6·8	3·1
" leaf	4,704	706	75	28	3·2	16·4	9·2	22·7	2·4	4·8	8·3	3·6
Total crop	36,064	4055	238	98	17·8*	79·7	32·0	42·4	9·2	21·7	15·1	6·7
Mangels, root, 22 tons	49,280	5914	426	98	4·9	222·8	69·4	15·9	18·3	36·4	42·5	8·7
" leaf	18,233	1654	254	51	9·1	77·9	49·3	27·0	24·2	16·5	40·6	9·2
Total crop	67,513	7568	680	149	14·0	300·7	118·7	42·9	42·5	52·9	83·1	17·9
Potatoes, tubers, 6 tons	13,440	3360	127	46	2·7	76·5	3·8	3·4	6·3	21·5	4·4	2·6

*Calculated from a single analysis only.

For further information on the routine and details of farming, reference may be made to the articles under the headings of the various crops and implements.

British Live Stock.

The numbers of live stock in the United Kingdom are shown at five-yearly intervals in Table XII. Under horses are embraced only unbroken horses and horses used solely for agriculture (including mares kept for breeding). The highest and lowest annual totals for the United Kingdom in the period 1875–1905 were the following:—

	Highest.	Lowest.	Difference.
Horses . .	2,116,800 in 1905	1,819,687 in 1875	295,113
Cattle . .	11,674,019 ,, 1905	9,731,537 ,, 1877	1,942,482
Sheep . .	33,642,808 ,, 1892	27,448,220 ,, 1882	6,194,588
Pigs. . .	4,362,040 ,, 1890	2,863,488 ,, 1880	1,498,552

After 1892 cattle, which in that year numbered 11,519,417, and sheep declined continuously for three years to the totals of 1895, the diminution being mainly the result of the memorable drought of 1893. Sheep, which numbered 32,571,018 in 1878, declined continuously to 27,448,220 in 1882—a loss of over five million head in five years. This was chiefly attributable to the ravages of the liver fluke which began in the disastrously wet season of 1879. Pigs, being prolific breeders, fluctuate more widely in numbers than cattle or sheep, for the difference of 1,498,552 in their case represents one-third of the highest total, whereas the difference is less than one-seventh for horses, less than one-sixth for cattle, and less than one-fifth for sheep. The relative proportions— as distinguished from the actual numbers —in which stock are distributed over the several sections of the United Kingdom do not vary greatly from year to year. Table XIII., in which the totals for the United Kingdom include those for the Channel Islands and Isle of Man, illustrates the preponderance of the sheep-breeding industry in the drier climate of Great Britain, and of the cattle-breeding industry in the more humid atmosphere of Ireland. In Great Britain in 1905, for every head of cattle there were about four head of sheep, whereas in Ireland the cattle outnumbered the sheep. Again, whilst Great Britain possessed only half as many cattle more than Ireland, she possessed six times as many sheep. The cattle population of England alone slightly exceeded that of Ireland, but cattle are more at home on the broad plains of England than amongst the hills and mountains of Wales and Scotland, which are suitable for sheep. Hence, whilst in England sheep were not three times as numerous as cattle, in Wales they were nearly five times, and in Scotland nearly six times as many. Great Britain had twice as many pigs as Ireland, but the swine industry is mainly English and Irish, and England possessed more than six times as many pigs as Wales and Scotland together, the number in the last-named country being particularly small. One English county alone, Suffolk, maintained more pigs than the whole of Scotland.

TABLE XII.—*Numbers of Horses, Cattle, Sheep and Pigs in the United Kingdom.*

Year.	Horses.	Cattle.	Sheep.	Pigs.
1875	1,819,687	10,162,787	33,491,948	3,495,167
1880	1,929,680	9,871,153	30,239,620	2,863,488
1885	1,909,200	10,868,760	30,086,200	3,686,628
1890	1,964,911	10,789,858	31,667,195	4,362,040
1895	2,112,207	10,753,314	29,774,853	4,238,870
1900	2,000,402	11,454,902	31,054,547	3,663,669
1905	2,116,800	11,674,019	29,076,777	3,601,659

TABLE XIII.—*Numbers of Horses, Cattle, Sheep and Pigs in the United Kingdom in 1905.*

1905.	Horses.	Cattle.	Sheep.	Pigs.
England . .	1,204,124	5,020,936	14,698,018	2,083,226
Wales . .	161,923	738,789	3,534,967	211,479
Scotland . .	206,386	1,227,295	7,024,211	130,214
Great Britain .	1,572,433	6,987,020	25,257,196	2,424,919
Ireland . .	534,875	4,645,215	3,749,352	1,164,316
United Kingdom[1] .	2,116,800	11,674,019	29,076,777	3,601,659

British Imports of Live Animals and Meat.

The stock-breeders and graziers of the United Kingdom have, equally with the corn-growers, to face the brunt of foreign competition. Up to 1896 store cattle were admitted into the United Kingdom for the purpose of being fattened, but under the Diseases of Animals Act of that year animals imported since then have to be slaughtered at the place of landing. The dimensions of this trade are shown in Table XIV.

TABLE XIV.—*Numbers of Cattle, Sheep and Pigs imported into the United Kingdom*, 1891–1905.

Year.	Cattle.	Sheep.	Pigs.
1891	507,407	344,504	542
1892	502,237	79,048	3826
1893	340,045	62,682	138
1894	475,440	484,597	8
1895	415,565	1,065,470	321
1896	562,553	769,592	4
1897	618,321	611,504	..
1898	569,066	663,747	450
1899	503,504	607,755	..
1900	495,645	382,833	..
1901	495,635	383,594	..
1902	419,488	293,203	..
1903	522,546	354,241	..
1904	549,532	382,240	..
1905	565,139	183,084	150

The animals come mainly from the United States of America, Canada and Argentina, and the traffic in cattle is more uniform than that in sheep, whilst that in pigs seems practically to have reached extinction. The quantities of dead meat imported increased with great rapidity from 1891 to 1905, a circumstance largely due to the rise of the trade in chilled and frozen meat. Fresh beef in this form is imported chiefly from the United States and Australasia, fresh mutton from Australasia and Argentina.

Table XV. shows how rapidly this trade expanded during the decade of the 'nineties. The column headed bacon and hams indicates clearly enough that the imports of fresh meat did not displace those of preserved pig meat, for the latter expanded from 4,715,000 cwt. to 7,784,000 cwt. during the decade. The column for all dead meat includes not only the items tabulated, but also the following, the quantities stated being those for 1905:—Beef, salted, 142,806 cwt.; beef, otherwise preserved, 598,030 cwt.; preserved mutton, 30,111 cwt.; salted pork, 205,965 cwt.; dead rabbits, 656,078 cwt.; meat, unenumerated, 875,032 cwt. The quantities of these are relatively small, and, excepting rabbits from Australia, they show no general tendency to increase. The extent to which these growing imports were associated with a decline in value is shown in Table XVI.

TABLE XV.—*Quantities of Dead Meat imported into the United Kingdom*, 1891–1905—*Thousands of Cwt.*

Year.	Fresh. Beef.	Fresh Mutton.	Fresh Pork.	Bacon and Hams.	All Dead Meat.
1891	1921	1663	128	4715	9,790
1892	2080	1700	132	5135	10,500
1893	1808	1971	182	4187	9,305
1894	2104	2295	180	4819	10,610
1895	2191	2611	288	5353	11,977
1896	2660	2895	299	6009	13,347
1897	3010	3193	348	6731	14,729
1898	3101	3314	558	7684	16,445
1899	3803	3446	669	7784	17,658
1900	4128	3393	695	7444	17,912
1901	4509	3608	792	7633	18,764
1902	3707	3660	655	6572	16,971
1903	4160	4017	706	6298	17,498
1904	4350	3495	610	6696	17,517
1905	5038	3811	506	6817	18,680

The trend of the import trade in meat, live and dead (exclusive of rabbits), may be gathered from Table XVII., in which are given the annual average imports from the eight quinquennial periods embraced between 1866 and 1905. An increase in live cattle accompanied a decrease in live sheep and pigs, but the imports of dead meat expanded fifteen-fold over the period.

The rate at which the trade in imported frozen mutton increased as compared with the industry in home-grown mutton is illustrated in the figures published annually by Messrs W.

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[1] Including Channel Islands and Isle of Man.

Weddel and Company, from which those for 1885 and 1890 and for each year from 1895 to 1906 are given in Table XVIII. The home-grown is the *estimated* dead weight of sheep and lambs slaughtered, which is taken at 40 % of the total number of sheep and lambs returned each year in the United Kingdom. In the imported column is given the weight of fresh (frozen) mutton and lamb imported, plus the *estimated* dead weight of the sheep imported on the hoof for slaughter. The quantity imported in 1899 was double that in 1890, and quadruple that in 1885. Moreover, in 1885 the imported product was only about one-seventh as much as the home-grown, whereas in 1890 it was more than one-fourth, and in 1906 close on two-thirds. This large import trade in fresh meat, which sprang up entirely within the last quarter of the 19th century, has placed an abundance of cheap and wholesome food well within the reach of the great industrial populations of the United Kingdom. At the same time it cannot be gainsaid that it has opened the way to fraud. Butchers have palmed off upon their customers imported fresh meat as home-grown, and secured a dishonest profit by charging for it the prices of the latter, which are considerably in excess of those of the imported product.

TABLE XVI.—*Average Values of Fresh Meat, Bacon and Hams imported into the United Kingdom, 1891–1905—per Cwt.*

Year.	Fresh Beef.		Fresh Mutton.		Fresh Pork.		Bacon.		Hams.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1891	42	1	39	6	47	6	37	11	46	4
1892	42	5	40	6	46	11	40	10	47	4
1893	42	4	39	3	50	0	53	0	58	5
1894	40	0	37	10	48	5	43	10	49	1
1895	39	0	35	2	46	1	39	0	44	11
1896	37	10	32	7	45	11	34	6	43	0
1897	38	5	30	3	44	0	35	5	42	8
1898	38	2	29	7	41	10	36	2	39	6
1899	38	8	31	7	41	11	35	10	41	5
1900	39	7	34	5	43	0	41	9	46	10
1901	39	6	36	7	43	4	47	1	48	8
1902	42	8	37	9	44	2	52	9	52	1
1903	40	3	39	0	44	1	52	10	55	1
1904	37	1	39	3	45	2	47	1	49	11
1905	35	6	38	6	46	0	46	6	47	4

TABLE XVII.—*Average Annual Imports of Cattle, Sheep and Pigs, and of Dead Meat, into the United Kingdom over eight 5-yearly Periods.*

Period.	Cattle.	Sheep.	Pigs.	Dead Meat.
	No.	No.	No.	Cwt.
1866–1870	194,947	610,300	64,827	1,155,867
1871–1875	215,990	864,516	74,040	3,134,175
1876–1880	272,745	938,704	44,613	5,841,913
1881–1885	387,282	974,316	24,355	6,012,495
1886–1890	438,098	800,599	19,437	7,681,729
1891–1895	448,139	407,260	967	10,436,549
1896–1900	549,818	607,086	91	15,785,354
1901–1905	510,468	319,272	30	17,384,366

TABLE XVIII.—*Home Product and Imports of Sheep and Mutton into the United Kingdom—Thousands of Tons.*

Year.	Home-grown.	Imported.	Year.	Home-grown.	Imported.
1885	322	47	1900	332	179
1890	339	92	1901	330	191
1895	319	157	1902	322	191
1896	329	164	1903	318	210[1]
1897	327	175	1904	311	185
1898	333	182	1905	312	195
1899	339	187	1906	313	207

Sale of Cattle by Live Weight.

In connexion with the internal live stock trade of Great Britain attention must be directed to the Markets and Fairs (Weighing of Cattle) Act 1891. The object of this measure is to replace the old-fashioned system of guessing at the weight of an animal by the sounder method of obtaining the exact weight by means of the weighbridge. The grazier buys and sells cattle much less frequently than the butcher buys them, so that the latter is naturally more skilled in estimating the weight of a beast through the use of the eye and the hand. The resort to the weighbridge should put both on an equality, and its use tends to increase. Under the act, as supplemented by an order of the Board of Agriculture in 1905, there were in that year 26 scheduled places in England and 10 in Scotland, or 36 altogether, from which returns were obtained. The numbers of cattle (both fat and store) weighed at scheduled places in 1893 and 1905[2] were respectively 7·59 and 18 % of those entering those markets. The numbers for Scotland are greater throughout than those for England, 72 % of the *fat* cattle entering the scheduled markets in Scotland in 1905[2] having been weighed, while in England the proportion was only 20 %. Little use is made of the weighbridge in selling store-cattle, sheep or swine. As the main object of the act is to obtain records of prices, it follows that only in so far as statements of the prices realized, together with the description of the animals involved, are obtained, is the full advantage of the statute secured. In 1905 the average price per cwt. for fat cattle in Great Britain was 32s. 11d. as compared with 35s. 2d. in 1900.

Food-values and Early Maturity.

In the feeding experiments which have been carried on at Rothamsted it has been shown that the amount consumed both for a given live weight of animal within a given time, and for the production of a given amount of increase, is, as current food-stuffs go, measurable more by the amounts they contain of digestible and available non-nitrogenous constituents than by the amounts of the digestible and available nitrogenous constituents they supply. The non-nitrogenous substance (the fat) in the increase in live weight of an animal is, at any rate in great part, if not entirely, derived from the non-nitrogenous constituents of the food. Of the nitrogenous compounds in food, on the other hand, only a small proportion of the whole consumed is finally stored up in the increase of the animal—in other words, a very large amount of nitrogen passes through the body beyond that which is finally retained in the increase, and so remains for manure. Hence it is that the amount of food consumed to produce a given amount of increase in live weight, as well as that required for the sustentation of a given live weight for a given time, should—provided the food be not abnormally deficient in nitrogenous substance—be characteristically dependent on its supplies of digestible and available non-nitrogenous constituents. It has further been shown that, in the exercise of force by animals, there is a greatly increased expenditure of the non-nitrogenous constituents of food, but little, if any, of the nitrogenous. Thus, then, alike for maintenance, for increase, and for the exercise of force, the exigencies of the system are characterized more by the demand for the digestible non-nitrogenous or more specially respiratory and fat-forming constituents than by that for the nitrogenous or more specially flesh-forming ones. Hence, as current fattening food-stuffs go—assuming, of course, that they are not abnormally low in the nitrogenous constituents—they are, *as foods*, more valuable in proportion to their richness in digestible and available non-nitrogenous than to that of their nitrogenous constituents. As, however, the manure of the animals of the farm is valuable largely in proportion to the nitrogen it contains, there is, so far, an advantage in giving a food somewhat rich in nitrogen, provided it is in other respects a good one, and, weight for weight, not much more costly.

The quantity of digestible nutritive matter in 1000 ℔ of ordinary feeding-stuffs when supplied to sheep or oxen is shown in Table XIX. This table is taken from Warington's *Chemistry of the Farm*, 19th edition (Vinton and Co.), to which reference may be made for a detailed discussion of the feeding of animals.

In the fattening of animals for the butcher the principle of early maturity has received full recognition. If the sole purpose for which an animal is reared is to prepare it for the block—and this is the case with steers amongst cattle and with wethers amongst sheep—the sooner it is ready for slaughter the less should be the outlay involved. During the whole time the animal is living the feeder has to pay what has been termed the "life tax"—that is, so much of the food has to go to the maintenance of the animal as a living organism, independently of that which may be undergoing conversion into what will subsequently be available in the form of beef or mutton. If a bullock can be rendered fit for the butcher at the age of two or three years, will the animal repay another year's feeding? It has been proved at the Christmas fat stock shows that the older a bullock gets the less will he gain in weight per day as a result of the feeding. With regard to this point the work of the Smithfield Club deserves recognition. This body was instituted in 1798 as the Smithfield Cattle and Sheep Society, the title being changed to that of the Smithfield Club in 1802. The original object—the supply of the cattle markets of Smithfield and other places with the cheapest and best meat—is still kept strictly in view. The judges, in making their awards at the show held annually in December, at Islington, North London (since 1862), are instructed to decide according to quality of flesh, lightness of offal, age and early maturity, with no restrictions as to feeding, and thus to promote the primary aim of the club in encouraging the selection and breeding of the best and most useful animals for the production of meat, and testing their capabilities in respect of early maturity. At the first show, held at Smithfield in 1799, two classes were provided for cattle and two for sheep, the prizes offered amounting to £52 : 10s. In 1839 the classes comprised seven for cattle, six for sheep, and one for pigs, with prizes to the amount of £300. By 1862 the classes had risen to 29 for cattle, 17 for sheep and 4 for pigs, and the prize money to £2072. At the centenary show in 1898 provision was made for 40 classes for cattle, 29 for sheep, 18 for pigs, and 7 for animals to be slaughtered, whilst to mark the importance of the occasion the prizes offered amounted to close upon £5000 in value. In 1907 there were 38 classes for cattle, 29 for sheep, 20 for pigs, and 12 for carcase competitors, and the value of the prizes was £4113. The sections provided for cattle are properly restricted to what may be termed the beef breeds; in the catalogue order they are Devon, South Devon, Hereford, Shorthorn, Sussex, Red Polled, Aberdeen-Angus, Galloway, Welsh, Highland, Cross-bred, Kerry and Dexter, and Small Cross-bred.

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[1] In 1903 two of the principal sources of supply of mutton shipped in excess of their exportable surplus, for which they suffered severely in 1904—hence the somewhat irregular movements after 1903.

[2] Returns for only ten months were available for this year.

TABLE XIX.—*Digestible Matter in* 1000 *lb. of various Foods.*

	Total Organic Matter.	Nitrogenous Substances.		Fat.	Soluble Carbo-hydrates.	Fibre.
		Albuminoids.	Amides, etc.			
Cotton cake (decorticated)	691	374	18	128	158	13
„ (undecorticated)	422	150	13	50	177	32
Linseed cake	655	230	11	103	266	45
Peas	747	175	25	12	499	36
Beans	733	196	28	12	446	51
Wheat[1]	786	92	13	15	656	10
Oats	600	81	7	45	441	26
Barley	715	70	4	19	607	15
Maize	786	73	6	44	651	12
Rice meal	612	67	10	102	411	22
Wheat bran	585	90	20	27	426	22
Malt sprouts	681	114	71	11	379	106
Brewers' grains	137	34	2	14	67	20
„ (dried)	529	136	8	57	266	62
Pasture grass	156	19	11	6	84	36
Clover (bloom beginning)	123	17	8	5	63	30
Clover hay (medium)	440	47	25	13	242	113
Meadow hay (best)	511	60	18	13	269	151
„ (medium)	485	40	12	12	269	152
„ (poor)	460	29	5	10	242	174
Maize silage	124	1	7	7	75	34
Bean straw	412	40		6	211	155
Oat straw	381	7	5	7	163	199
Barley straw	426	4	3	6	211	202
Wheat straw	351	4		4	150	193
Potatoes	213	5	9	1	195	3
Mangels (large)	89	1	8	½	74	6
„ (small)	109	2	6	½	96	5
Swedes	87	2	7	1	71	6
Turnips	68	1	5	1	56	5

It will be noticed that such characteristically milking breeds as the Ayrshire, Jersey and Guernsey have no place here. Provision is made, however, for all the well-known breeds of sheep and swine. In the cattle classes, aged beasts of huge size and of considerably over a ton in weight used to be common, but in recent years the tendency has been to reduce the upper limit of age, and thus to bring out animals ripe for the butcher in a shorter time than was formerly the case. An important step in this direction was taken in 1896, when the senior class for steers, viz. animals three to four years old, was abolished, the *maximum* age at which steers were allowed to compete for prizes being reduced to three years. The cow classes were abolished in 1897, and in the schedule of the 1905 exhibition the classes for each breed of cattle were (1) for steers not exceeding two years old, (2) for steers above two years and not exceeding three years old, and (3) for heifers not exceeding three years old. The single exception is provided by the slowly-maturing Highland breed of cattle, for which classes were allotted to (1) steers not exceeding three years old, (2) steers or oxen above three years old (with no *maximum* limit), and (3) heifers not exceeding four years old. As illustrating heavy weights, there were in the 1893 show, out of 310 entries of cattle, four beasts which weighed over a ton. They were all steers of three to four years old, one being a Hereford weighing 20 cwt. 2 qr. 4 lb, and the others Shorthorns weighing respectively 20 cwt. 2 qr., 20 cwt. 3 qr. 21 lb, and 22 cwt. 2 qr. 18 lb. In the 1895 show, out of 356 entries of cattle, there were seven beasts of more than a ton in weight. They were all three to four years old, and comprised four Shorthorns (top weight 21 cwt. 1 qr. 18 lb), one Sussex (22 cwt. 3 qr. 7 lb), and two cross-breds (top weight 20 cwt. 3 qr. 24 lb). In the 1899 show, with 311 entries of cattle, and the age limited to three years, no beast reached the weight of a ton, the heaviest animal being a cross-bred (Aberdeen-Angus and Shorthorn) which, at three years old, turned the scale at 19 cwt. 1 qr. 5 lb. Out of 301 entries in 1905 the top weight was 19 cwt. 1 qr. 25 lb in the case of a Shorthorn steer. Useful figures for purposes of comparison are obtained by dividing the weight of a fat beast by the number of days in its age, the weight at birth being thrown in. The average daily gain in live weight is thus arrived at, and as the animal increases in age this average gradually diminishes, until the daily gain reaches a stage at which it does not afford any profitable return upon the food consumed. At the centenary show of the Smithfield Club in 1898 the highest average daily gains in weight amongst prize-winning cattle were provided by a Shorthorn-Aberdeen cross-bred steer (age, one year seven months; daily gain 2·47 lb); a Shorthorn steer (age, one year seven months; daily gain, 2·44 lb); and an Aberdeen-Shorthorn cross-bred steer (age, one year ten months; daily gain, 2·33 lb). These beasts, it will be observed, were all under two years old. Amongst prize steers of two and a half to three years old, on the same occasion, the three highest daily average gains in live weight were 2·07 lb for an Aberdeen-Angus, 1·99 lb for a Shorthorn-Aberdeen cross-bred and 1·97 lb for a Sussex. In the sheep section of the Smithfield show the classes for ewes were finally abolished in 1898, and the classes restricted to wethers and wether lambs, whose function is exclusively the production of meat. At the 1905 show, sheep of each breed, and also cross-breds, competed as (1) wether lambs under twelve months old, and (2) wether sheep above twelve and under twenty-four months old. The only exception was in the case of the slowly-maturing Cheviot and mountain breeds, for which the second class was for wether sheep of any age above twelve months. Of prize sheep at the centenary show the largest average daily gain was 0·77 lb per head given by Oxford-Hampshire cross-bred wether lambs, aged nine months two weeks. In the case of wether sheep, twelve to twenty-four months old, the highest daily increase was 0·56 lb per head as yielded by Lincolns, aged twenty-one months. Within the last quarter of the 19th century the stock-feeding practices of the country were much modified in accordance with these ideas of early maturity. The three-year-old wethers and older oxen that used to be common in the fat stock markets are now rarely seen, excepting perhaps in the case of mountain breeds of sheep and Highland cattle. It was in 1875 that the Smithfield Club first provided the competitive classes for lambs, and in 1883 the champion plate offered for the best pen of sheep of any age in the show was for the first time won by lambs, a pen of Hampshire Downs. The young classes for bullocks were established in 1880. The time-honoured notion that an animal must have completed its growth before it could be profitably fattened is no longer held, and the improved breeds which now exist rival one another as regards the early period at which they may be made ready for the butcher by appropriate feeding and management.

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[1] In the absence of experiments it is assumed that wheat is digested like other foods of the same class.

In 1895 the Smithfield Club instituted a carcase competition in association with its annual show of fat stock, and it has been continued each year since. The cattle and sheep entered for this competition are shown alive on the first day, at the close of which they are slaughtered and the carcases hung up for exhibition, with details of live and dead weights. The competition thus constitutes what is termed a "block test," and it is instructive in affording the opportunity of seeing the quality of the carcases furnished by the several animals, and in particular the relative proportion and distribution of fat and lean meat. The live animals are judged and subsequently the carcases, and, though the results sometimes agree, more often they do not. Tables are constructed showing the fasted live weight, the carcase weight, and the weight of the various parts that are separated from and not included with the carcase. An abundance of lean meat and a moderate amount of fat well distributed constitutes a better carcase, and a more economical one for the consumer, than a carcase in which gross accumulations of fat are prominent. To add to the educational value of the display, information as to the methods of feeding would be desirable, as it would then be possible to correlate the quality of the meat with the mode of its manufacture. A point of high practical interest is the ratio of carcase weight to fasted live weight, and in the case of prize-winning carcases these ratios usually fluctuate within very narrow limits. At the 1899 show, for example, the highest proportion of the carcase weight to live weight was 68 % in the case of an Aberdeen-Angus steer and of a Cheviot wether, whilst the lowest was 61 %, afforded alike by a Shorthorn-Sussex cross-bred heifer and a mountain lamb. A familiar practical method of estimating carcase weight from live weight is to reckon one Smithfield stone (8 lb) of carcase for each imperial stone (14 lb) of live weight. This gives carcase weight as equal to 57 % of live weight, a ratio much inferior to the best results obtained at the carcase competition promoted by the Smithfield Club.

Breed Societies.

A noteworthy feature of the closing decades of the 19th century was the formation of voluntary associations of stockbreeders, with the object of promoting the interests of the respective breeds of live stock. As a typical example of these organizations the Shire Horse Society may be mentioned. It was incorporated in 1878 to improve and promote the breeding of the Shire or old English race of cart-horses, and to effect the distribution of sound and healthy sires throughout the country. The society holds annual shows, publishes annually the *Shire Horse Stud Book* and offers gold and silver medals for competition amongst Shire horses at agricultural shows in different parts of the country. The society has carried on a work of high national importance, and has effected a marked improvement in the character and quality of the Shire horse. What has thus voluntarily been done in England would in most other countries be left to the state, or would not be attempted at all. It is hardly necessary to say that the Shire Horse Society has never received a penny of public money, nor has any other of the voluntary breeders' societies. The Hackney Horse Society and the Hunters' Improvement Society are conducted on much the same lines as the Shire Horse Society, and, like it, they each hold a show in London in the spring of the year and publish an annual volume. Other horse-breeders' associations, all doing useful work in the interests of their respective breeds, are the Suffolk Horse Society, the Clydesdale Horse Society, the Yorkshire Coach Horse Society, the Cleveland Bay Horse Society, the Polo Pony Society, the Shetland Pony Stud Book Society, the Welsh Pony and Cob Society and the New Forest Pony Association. Thoroughbred race-horses are registered in the General Stud Book. The Royal Commission on Horse Breeding, which dates from 1887, is, as its name implies, not a voluntary organization. Through the commission the money previously spent upon Queen's Plates is offered in the form of "King's Premiums" (to the number of twenty-eight in 1907) of £150 each for thoroughbred stallions, on condition that each stallion winning a premium shall serve not less than fifty half-bred mares, if required. The winning stallions are distributed in districts throughout Great Britain, and the use of these selected sires has resulted in a decided improvement in the quality of half-bred horses. The annual show of the Royal Commission on Horse Breeding is held in London jointly and concurrently with that of the Hunters' Improvement Society.

Of organizations of cattle-breeders the English Jersey Cattle Society, established in 1878, may be taken as a type. It offers prizes in butter-test competitions and milking trials at various agricultural shows, and publishes the *English Herd Book and Register of Pure-bred Jersey Cattle*. This volume records the births in the herds of members of the society, and gives the pedigrees of cows and bulls, besides furnishing lists of prize-winners at the principal shows and butter-test awards, and reports of sales by auction of Jersey cattle. Other cattle societies, all well caring for the interest of their respective breeds, are the Shorthorn Society of Great Britain and Ireland, the Lincolnshire Red Shorthorn Association, the Hereford Herd Book Society, the Devon Cattle Breeders' Society, the South Devon Herd Book Society, the Sussex Herd Book Society, the Long-horned Cattle Society, the Red Polled Society, the English Guernsey Cattle Society, the English Kerry and Dexter Cattle Society, the Welsh Black Cattle Society, the Polled Cattle Society (for the Aberdeen-Angus breed), the English Aberdeen-Angus Cattle Association, the Galloway Cattle Society, the Ayrshire Cattle Herd Book Society, the Highland Cattle Society of Scotland and the Dairy Shorthorn Association.

In the case of sheep the National Sheep Breeders' Association looks after the interests of flockmasters in general, whilst most of the pure breeds are represented also by separate organizations. The Hampshire Down Sheep Breeders' Association may be taken as a type of the latter, its principal object being to encourage the breeding of Hampshire Down sheep at home and abroad, and to maintain the purity of the breed. It publishes an annual Flock Book, the first volume of which appeared in 1890. In this book are named the recognized and pure-bred sires which have been used, and ewes which have been bred from, whilst there are also registered the pedigrees of such sheep as are proved to be eligible for entry. Prizes are offered by the society at various agricultural shows where Hampshire Down sheep are exhibited. Other sheep societies include the Leicester Sheep Breeders' Association, the Cotswold Sheep Society, the Lincoln Longwool Sheep Breeders' Association, the Oxford Down Sheep Breeders' Association, the Shropshire Sheep Breeders' Association and Flock Book Society, the Southdown Sheep Society, the Suffolk

Sheep Society, the Border Leicester Sheep Breeders' Society, the Wensleydale Longwool Sheep Breeders' Association and Flock Book Society, the Incorporated Wensleydale Blue-faced Sheep Breeders' Association and Flock Book Society, the Kent Sheep Breeders' Association, the Devon Longwool Sheep Breeders' Society, the Dorset Horn Sheep Breeders' Association, the Cheviot Sheep Society and the Roscommon Sheep Breeders' Association.

The interests of pig-breeders are the care of the National Pig Breeders' Association, in addition to which there exist the British Berkshire, the Large Black Pig, and the Lincoln Curly-Coated White Pig Societies, and the Incorporated Tamworth Pig Breeders' Association.

The addresses of the secretaries of the various live-stock societies in the United Kingdom are published annually in the *Live Stock Journal Almanac.*

The Maintenance of the Health of Live Stock.

It was not till the closing decade of the 19th century that the stock-breeders of the United Kingdom found themselves in a position to prosecute their industry free from the fear of the introduction of contagious disease through the medium of store animals imported from abroad for fattening on the native pastures. By the Diseases of Animals Act 1896 (59 & 60 Vict. c. 15) it was provided that cattle, sheep and pigs imported into the United Kingdom should be slaughtered at the place of landing. The effect was to reduce to a *minimum* the risk of the introduction of disease amongst the herds and flocks of the country, and at the same time to confine the trade in store stock exclusively to the breeders of Great Britain and Ireland. This arrangement makes no difference to the food-supply of the people, for dead meat continues to arrive at British ports in ever-increasing quantity. Moreover, live animals are admitted freely from certain countries, provided such animals are slaughtered at the place of landing. At Deptford, for example, large numbers of cattle and sheep which thus arrive—mainly from Argentina, Canada and the United States—are at once slaughtered, and so furnish a steady supply of fresh-killed beef and mutton. The animals which are shipped in this way are necessarily of the best quality, because the freight on a superior beast is no more costly than on an inferior one, and the proportion of freight to sale price is therefore less. With this superior description of butchers' stock all classes of home-grown stock—good, bad and indifferent—have, of course, to compete. The Board of Agriculture has the power to close the ports of the United Kingdom against live animals from any country in which contagious disease is known to exist. This accounts for the circumstance that so few countries—none of them in Europe—enjoy the privilege of sending live animals to British ports. In 1900 the discovery early in the year of the existence of foot-and-mouth disease amongst cattle and sheep shipped from Argentina to the United Kingdom led to the issue of an order by which all British ports were closed against live animals from the country named. This order came into force on the 30th of April, and the result was a marked decline in the shipments of live cattle and sheep from the River Plate, but a decided increase in the quantity of frozen meat sent thence to the United Kingdom.

The last quarter of the 19th century witnessed an important change in the attitude of public opinion towards legislative control over the contagious diseases of animals. When, after the introduction of cattle plague or rinderpest in 1865, the proposal was made to resort to the extreme remedy of slaughter in order to check the ravages of a disease which was pursuing its course with ruinous results, the idea was received with public indignation and denounced as barbarous. Views have undergone profound modification since then, and the most drastic remedy has come to be regarded as the most effective, and in the long run the least costly. The Cattle Diseases Prevention Act 1866 (29 & 30 Vict. c. 2) made compulsory the slaughter of diseased cattle, and permitted the slaughter of cattle which had been exposed to infection, compensation being provided out of the rates. The Act 30 & 31 Vict. c. 125, 1867, is of historical interest, in that it contains the first mention of pleuro-pneumonia, and the exposure in any market of cattle suffering from that disease was made an offence. The Contagious Diseases (Animals) Act 1869 (32 & 33 Vict. c. 70) revoked all former acts, and defined disease to mean cattle plague, pleuro-pneumonia, foot-and-mouth disease, sheep-pox, sheep-scab and glanders, together with any disease which the Privy Council might by order specify. The principle of this act in regard to foreign animals was that of free importation, with power for the Privy Council to prohibit or subject to quarantine and slaughter, as circumstances seemed to require. The act of 1869 was at that time the most complete measure that had ever been passed for dealing with diseases of animals. The re-introduction of cattle plague into England in 1877 led to the passing of the Act 41 & 42 Vict. c. 74, 1878, which repealed the act of 1869, and affirmed as a principle the landing of foreign animals for slaughter only, though free importation or quarantine on the one hand and prohibition on the other were provided for in exceptional circumstances. By an order of council which came into operation in December 1878, swine fever was declared to be a disease for the purposes of the act of that year. It was not, however, till October 1886 that anthrax and rabies were officially declared to be contagious diseases for the purposes of certain sections of the act of 1878. In 1884 the Act 47 & 48 Vict. c. 13 empowered the Privy Council to prohibit the landing of animals from any country in respect of which the circumstances were not such as to afford reasonable security against the introduction of foot-and-mouth disease. After one or two other measures of minor importance came the Act 53 & 54 Vict. c. 14, known as the Pleuro-pneumonia Act 1890, which transferred the powers of local authorities to slaughter and pay compensation in cases of pleuro-pneumonia to the Board of Agriculture, and provided further for the payment of such compensation out of money specifically voted by parliament. This measure was regarded at the time as a marked step in advance, and was only carried after a vigorous campaign in its favour. In 1892 by the Act 55 & 56 Vict. c. 47 power was given to the Board of Agriculture to use the sums voted on account of pleuro-pneumonia for paying the costs involved in dealing with foot-and-mouth disease; under this act the board could order the slaughter of diseased animals and of animals in contact with these, and could pay compensation for animals so slaughtered. Under the provisions of the Contagious Diseases (Animals) Act 1893 (56 & 57 Vict. c. 43) swine fever in Great Britain was, from the 1st of November in that year, dealt with by the Board of Agriculture in the same way as pleuro-pneumonia, the slaughter of infected swine being carried out under directions from the central authority, and compensation allowed from the imperial exchequer. In 1894 was passed the Diseases of Animals Act (57 & 58 Vict. c. 57), the word "contagious" being omitted from the title. This was a measure to consolidate the Contagious Diseases (Animals) Acts 1878–1893. In it "the expression 'disease' means cattle plague (that is to say, rinderpest, or the disease commonly called cattle plague), contagious pleuro-pneumonia of cattle (in this act called pleuro-pneumonia), foot-and-mouth disease, sheep-pox, sheep-scab, or swine fever (that is to say, the disease known as typhoid fever of swine, soldier purples, red disease, hog cholera or swine plague)." The Diseases of Animals Act 1896 (59 & 60 Vict. c. 15) rendered compulsory the slaughter of imported live stock at the place of landing, a boon for which British stock-breeders had striven for many years. The ports in Great Britain at which foreign animals may be landed are Bristol, Cardiff, Glasgow, Hull, Liverpool, London, Manchester and Newcastle-upon-Tyne. Animals from the Channel Islands may be landed at Southampton.

The Diseases of Animals.

Under the Diseases of Animals Acts 1894 and 1896 weekly returns are issued by the Board of Agriculture of outbreaks of anthrax, foot-and-mouth disease, glanders (including farcy), pleuro-pneumonia, rabies and swine fever in the counties of Great Britain; also monthly returns of outbreaks of sheep-scab.

Cattle plague, or rinderpest, has not been recorded in Great

Britain since 1877. In that year there were 47 outbreaks distributed over five counties and involving 263 head of cattle.

The course of *foot-and-mouth* disease in Great Britain between 1877 and 1905 inclusive is told in Table XX., from which the years 1887 to 1891, 1895 to 1899 and 1903 to 1905 inclusive are omitted, because there was no outbreak during those periods. The disease is seen to have attained its maximum virulence in 1883.

Table XX.—*Outbreaks of Foot-and-Mouth Disease in Great Britain, 1877–1905.*

Year.	Counties.	Out-breaks.	Animals attacked.			
			Cattle.	Sheep.	Swine.	Other Animals.
1877	55	858	5,640	7,405	2,099	
1878	45	235	912	8,609	245	
1879	29	137	261	15,681	5	
1880	38	1,461	20,918	9,572	1,886	2
1881	49	4,833	59,484	117,152	6,330	80
1882	49	1,970	23,973	11,412	2,564	1
1883	75	18,732	219,289	217,492	24,332	32
1884	55	949	12,186	14,174	1,860	1
1885	10	30	354	34	30	
1886	1	1	10			
1892	15	95	1,248	3,412	107	
1893	2	2	30			
1894	3	3	7	261		
1900	9	21	214	50	2	
1901	3	12	43	626		
1902	1	1	2	118		

Sheep-scab is a loathsome skin disease due to an acarian parasite. Table XXI. shows the number of outbreaks and the number of counties over which they were distributed from 1877 to 1905. The recorded outbreaks were more numerous in the decade of the 'nineties than in that of the 'eighties, though possibly this may have been due to greater official activity in the later period. The largest number of sheep attacked was 68,715 (in 1877). It is compulsory on owners to notify the authorities as to the existence of scab amongst their sheep. By the Diseases of Animals Act (1903) powers to prescribe the dipping of sheep, irrespective of the presence or otherwise of sheep scab, were conferred upon the Board of Agriculture. An inspector of the board or of the local authority was by the same act authorized to enter premises and examine sheep. Each year the disorder runs a similar course, the outbreaks dwindling to a minimum in the summer months, June to August, and attaining a maximum in the winter months, December to February. It is chiefly in the "flying" flocks and not in the breeding flocks that the disease is rife, and it is so easily communicable that a drove of scab-infested sheep passing along a road may leave behind them traces sufficient to set up the disorder in a drove of healthy sheep that may follow. For its size and in relation to its sheep population Wales harbours the disease to a far greater extent than the other divisions of Great Britain.

Table XXI.—*Outbreaks of Sheep-Scab in Great Britain, 1877–1905.*

Year.	Counties.	Outbreaks.	Year.	Counties.	Outbreaks.
1877	77	3214	1890	75	1506
1880	70	1556	1895	88	3092
1885	69	1512	1900	78	1939
			1905	73	918

The fatal disease known as *anthrax* did not form the subject of official returns previous to the passing of the Anthrax Order of 1886. Isolated outbreaks are of common occurrence, and from the totals for Great Britain given in Table XXII. it would appear that there is little prospect of the eradication of this bacterial disorder.

Glanders (including farcy) was the subject during the twenty-four years 1877–1900 of outbreaks in Great Britain ranging between a minimum of 518 in 1877 and a maximum of 1657 in 1892; in the former year 758 horses were attacked, and in the latter 3001. A recrudescence of the disease marked the closing years of the 19th century, the outbreaks having been 748 in 1898, 853 in 1899 and 1119 in 1900. The counties of Great Britain over which the annual outbreaks have been distributed have ranged between 24 in 1890 and 52 in 1879. As a matter of fact, however, the disease is strongly centred upon the metropolitan area, more than half of the outbreaks being reported from the county of London alone.

Table XXII.—*Outbreaks of Anthrax in Great Britain, 1895–1905.*

Year.	Counties.	Outbreaks.	Animals attacked.			
			Cattle.	Sheep.	Swine.	Horses.
1895	66	434	604	158	140	32
1896	64	488	632	34	200	38
1897	67	433	521	39	284	38
1898	73	556	634	22	161	39
1899	67	534	634	69	253	30
1900	74	571	668	40	204	44
1901	63	651	708	76	152	35
1902	71	678	746	50	192	44
1903	78	767	809	48	234	51
1904	77	1049	1115	62	365	47
1905	84	970	1001	53	210	53

The *Rabies* order was passed in 1886, and the number of counties in Great Britain in which cases of rabies in dogs were reported in each subsequent year is shown in Table XXIII. In addition there have been some cases of rabies in animals other than dogs. The disease was very rife in 1895, but the extensive application of the muzzling restrictions of the Board of Agriculture was accompanied by so steady a diminution in the prevalence of the disease, that it was thought the latter had been extirpated. The entire revocation of the muzzling order, which accordingly followed, proved, however, to be premature, and it became necessary to reimpose it in the districts where it had last been operative, namely, certain parts of South Wales. No cases were reported in 1903, 1904 or 1905.

Table XXIII.—*Cases of Rabies in Dogs in Great Britain, 1887–1902.*

Year.	Counties.	Cases.	Year.	Counties.	Cases.
1887	28	217	1895	29	672
1888	19	160	1896	41	438
1889	20	312	1897	30	151
1890	20	129	1898	10	17
1891	17	79	1899	4	9
1892	12	38	1900	2	6
1893	18	93	1901	1	1
1894	17	248	1902	4	13

Pleuro-pneumonia in Great Britain was dealt with by the local authorities up to the year 1890. Between 1870 and 1889 the annual outbreaks had ranged between a minimum of 312 in 1884 and a maximum of 3262 in 1874, the largest number of cattle attacked in any one year being 7983 in 1872. The largest number of counties over which the outbreaks were distributed was 72 in 1873. On the 1st of September 1890 the Board of Agriculture assumed powers with respect to pleuro-pneumonia under the Diseases of Animals Act of that year. Their administration was attended by success, for from 192 outbreaks in Great Britain in 1891 the total fell to 35 in 1892 and to 9 in 1893. In the four subsequent years, 1894–1897, the outbreaks numbered 2, 1, 2, and 7 respectively. In January 1898 an outbreak was discovered in a London cow-shed. This proved to be the last case in the 19th century of what at one time had been a veritable scourge to cattle-owners and a source of heavy financial loss.

Between 1879 and 1892 inclusive, administration with regard to *swine-fever* was entrusted to local authorities. The largest number of outbreaks reported in any one of those years was 7926 in 1885, and the smallest 1717 in 1881. In 1893 the Board of Agriculture took over the management, and Table XXIV. shows the number of counties in which swine-fever existed, the number of outbreaks confirmed and the number of swine slaughtered by order of the board in each year since. The trouble with this disease has been mainly in England, the outbreaks in

Wales and Scotland being comparatively few. What are termed "swine-fever infected areas" are scheduled by the board when and where circumstances seem to require, and the movement of swine within such areas is prohibited, much inconvenience to trade resulting from restrictions of this kind. Frequently, moreover, the exhibition of pigs at agricultural shows has to be abandoned in consequence of these swine-fever regulations.

Table XXIV.—*Outbreaks of Swine Fever in Great Britain, 1894–1905.*

Year.	Counties.	Outbreaks confirmed.	Swine slaughtered as diseased, or as having been exposed to infection.
1894	73	5682	56,296
1895	73	6305	69,931
1896	77	5166	79,586
1897	74	2155	40,432
1898	72	2514	43,756
1899	71	2322	30,797
1900	62	1940	17,933
1901	71	3140	15,237
1902	67	1688	8,263
1903	63	1478	7,933
1904	64	1196	5,603
1905	58	817	3,876

The Trade in Live Stock between Ireland and Great Britain.

The compulsory slaughter at the place of landing does not extend to animals shipped from Ireland into Great Britain, and this is a matter of the highest importance to Irish stock-breeders, who find their best market close at hand on the east of St George's Channel. Table XXV. shows the number of cattle, sheep and pigs shipped from Ireland into Great Britain in each of the fifteen years 1891–1905, the numbers of horses similarly shipped being also indicated. On the average rather more than half the total of cattle is made up of store animals for fattening or breeding purposes, the fattening of Irish stores being a business of considerable magnitude in Norfolk and other counties. Calves constitute about one-twelfth of the total number of cattle.

Table XXV.—*Imports of Live Stock from Ireland into Great Britain, 1891–1905.*

Year.	Cattle.	Sheep.	Pigs.	Horses.
1891	630,802	893,175	503,584	33,396
1892	624,457	1,080,202	500,951	32,481
1893	688,669	1,107,960	456,571	30,390
1894	826,954	957,101	584,967	33,589
1895	791,607	652,578	547,220	34,560
1896	681,560	737,306	610,589	39,856
1897	746,012	804,515	695,307	38,422
1898	803,362	833,458	588,785	38,804
1899	772,272	871,953	688,553	42,087
1900	745,519	862,263	715,202	35,606
1901	642,638	843,325	596,129	25,607
1902	959,241	1,055,802	637,972	25,260
1903	897,645	825,679	569,920	27,719
1904	772,363	739,266	505,080	27,500
1905	749,131	700,626	363,823	30,723

Most of the pigs sent from Ireland into Great Britain are fat, the store pigs accounting for less than one-tenth of the total number. The returns from Ireland under the Diseases of Animals Acts 1894 and 1896 are less significant than those of Great Britain. Thus, in the year ending June 1905, they included 4 outbreaks of anthrax, 219 of swine-fever and 343 of sheep-scab, while there were no cases of rabies. Compared with the export trade in live stock from Ireland to Great Britain the reciprocal trade from Great Britain to Ireland is small, and is largely restricted to animals for breeding purposes. Owing to the reappearance of foot-and-mouth disease in Great Britain early in 1900 the importation of cattle, sheep, goats and swine therefrom into Ireland was temporarily suspended by the authorities in the latter country.

Exports of Animals from the United Kingdom.

The general export trade of the United Kingdom in living animals represented an aggregate average annual value over the five years 1896–1900 of £1,017,000 as against £935,801 over the five years 1901–1905. To these sums the value of horses alone contributed about three-fourths, Belgium taking more than half the number of exported horses. The export trade in cattle, sheep and pigs is practically restricted to pedigree animals required for breeding purposes, and though its aggregate value is not large it is of considerable importance to stock-breeders, as it is a frequent occurrence for buyers for export—to Argentina, Australasia, Canada, the United States and elsewhere—to bid freely at the sale rings, and often to pay the highest prices, thus stimulating the sales and encouraging the breeding of the best types of native stock. Details for the six years 1900–1905 are summarized in Table XXVI.

Table XXVI.—*Quantities and Value of Home-bred Live Stock exported from the United Kingdom, 1900–1905.*

Year.	Horses.	Cattle.	Sheep.	Pigs.	Other Animals.
1900	30,038	2,742	4,934	435	75,642
1901	27,612	1,648	2,761	378	68,012
1902	30,032	2,428	3,596	515	60,941
1903	34,798	2,736	5,579	776	52,095
1904	32,955	3,311	8,142	732	50,873
1905	47,708	3,938	8,378	931	50,307
	£	£	£	£	£
1900	681,927	118,337	53,306	3032	45,241
1901	605,699	61,812	25,727	3437	45,476
1902	635,661	96,153	29,069	5053	56,691
1903	734,598	140,244	67,758	7053	48,335
1904	581,339	146,210	88,421	7850	43,868
1905	875,647	190,406	133,413	8024	41,061

Implements and Machinery.

It is the custom of the Royal Agricultural Society of England to invite competitions at its annual shows in specified classes of implements, and an enumeration of these will indicate the character of the appliances which were thus brought into prominence in the latter years of the 19th and the early years of the 20th century. These trials taking place, with few intermissions, year after year serve to direct the public mind to the development, which is continually in progress, of the mechanical aids to agriculture. The awards here summarized are quite distinct from those of silver medals which are given by the society in the case of articles possessing sufficient merit, which are entered as "new implements for agricultural or estate purposes."

In 1875, at Taunton, special prizes were awarded for one-horse and two-horse mowing-machines, hay-making machines, horse-rakes (self-acting and not self-acting), guards to the drums of threshing-machines, and combined guards and feeders to the drums of threshing-machines. In 1876, at Birmingham, the competitions were of self-delivery reapers, one-horse reapers and combined mowers and reapers without self-delivery. In 1878, at Bristol, the special awards were all for dairy appliances—milk-can for conveying milk long distances, churn for milk, churn for cream, butter-worker for large dairies, butter-worker for small dairies, cheese-tub, curd knife, curd mill, cheese-turning apparatus, automatic means of preventing rising of cream, milk-cooler and cooling vat. A gold medal was awarded for a harvester and self-binder (McCormick's). In 1879, at Kilburn, the competition was of railway waggons to convey perishable goods long distances at low temperatures. In 1880 at Carlisle, and in 1881 at Derby, the special awards were for broadside steam-diggers and string sheaf-binders respectively. In 1882, at Reading, a gold medal was given for a cream separator for horse power, whilst a prize of 100 guineas offered for the most efficient and most economical method of drying hay or corn crops artificially, either before or after being stacked, was not awarded. In 1883, at York, a prize of £50 was given for a butter dairy suitable for not more than twenty cows. In 1884, at Shrewsbury, a prize of £100 was awarded for a sheaf-binding reaper, and one of £50 for a similar machine. In 1885, at Preston, the competitions were concerned with two-horse, three-horse and four-horse whipple-trees, and packages for conveying fresh butter by rail. In 1886, at Norwich, a prize of £25 was awarded for a thatch-making machine. In 1887, at Newcastle-on-Tyne, a prize of £200 went to a compound portable agricultural engine, one of £100 to a simple portable agricultural engine, and lesser prizes to a weighing-machine for horses and cattle, a weighing-machine for sheep and pigs, potato-raisers and one-man-power cream separators. In 1888, at Nottingham, hay and straw presses for steam-power, horse-power and hand-power were the subjects of competition. In 1889, at Windsor, prizes were awarded for a fruit and vegetable evaporator, a paring and coring machine, a dairy thermometer, parcel post butter-boxes to carry different weights, and a vessel to contain preserved butter. In 1890, at Plymouth, competitions took place of light portable engines (*a*) using solid fuel, (*b*) using liquid or gaseous fuel, grist mills for use on a farm, disintegrators, and cider-making plant for use on a farm. In 1891, at Doncaster, special prizes were given for combined portable threshing and finishing machines, and cream separators (hand and power). In 1892, at Warwick, the competitions related to ploughs—single furrow (*a*) for light land, (*b*) for strong land, (*c*) for press drill and broad-cast sowing; two-furrow; three-furrow; digging (*a*) for light land, (*b*) for heavy land; and one-way ploughs. In 1893, at Chester, self-binding harvesters and sheep-shearing machines (power) were the appliances respectively in competition. In 1894, at Cambridge, the awards were for fixed and portable oil engines, potato-spraying and tree-spraying machines, sheep-dipping apparatus and churns. In 1895, at Darlington, the competitions were confined to hay-making machines and clover-making machines. In 1896, at Leicester, prizes were awarded after trial to potato-planting machines, potato-raising machines and butter-drying machines. In 1897, at Manchester, special awards were made for fruit baskets and milk-testers. In 1898, at Birmingham, a prize of £100 was given for a self-moving vehicle for light loads, £100 and £50 for self-moving vehicles for heavy loads, and £10 for safety feeder to chaff-cutter, in accordance with the Chaff-cutting Machines (Accidents) Act 1897. In 1899, at Maidstone, special prizes were offered for machines for washing hops with liquid insecticides, cream separators (power and hand), machines for the evaporation of fruit and vegetables, and packages for the carriage of (*a*) soft fruit, (*b*) hard fruit. In 1900, at York, the competitions were concerned with horse-power cultivators, self-moving steam diggers, milking machines and sheep-shearing machines (power and hand). In 1901, at Cardiff, competition was invited in portable oil engines, agricultural locomotive oil engines and small ice-making plant suitable for a dairy. In the years 1903 and 1904 petrol motors adapted for ploughing and other agricultural operations formed a prominent feature of the exhibits.

The progress of steam cultivation has not justified the hopes that were once entertained in the United Kingdom concerning this method of working implements in the field. It was about the year 1870 that its advantages first came into prominent notice. At that time, owing to labour disputes, the supply of hands was short and horses were dear. The wet seasons that set in at the end of the 'seventies led to so much hindrance in the work on the land that the aid of steam was further called for, and it seemed probable that there would be a lessened demand for horse power. It was found, however, that the steam work was done with less care than had been bestowed upon the horse tillage, and the result was that steam came to be regarded as an auxiliary to horse labour rather than as a substitute for it. In this capacity it is capable of rendering most valuable assistance, for it can be utilized in moving extensive areas of land in a very short time. Accordingly, when a few days occur early in the season favourable to the working of the land, much of it can be got into a forward condition, whilst horses are set free for the lighter operations. The crops can then be sown in due time, which in wet years, and with the usual teams of horses kept on a farm, is not always practicable. Much advantage arises from the steam working of bastard fallows in summer, and after harvest a considerable amount of autumn cultivation can be done by steam power, thus materially lightening the work in the succeeding spring. On farms of moderate size it is usual to hire steam tackle as required, the outlay involved in the purchase of a set being justifiable only in the case of estates or of very big farms where, when not engaged in ploughing, or in cultivating, or in other work upon the land, the steam-engine may be employed in threshing, chaff-cutting, sawing and many similar operations which require power. The labour question again became acute in the early years of the 20th century, when, owing to the scarcity of hands and the high rate of wages, self-binding harvesters were resorted to in England for the ingathering of the corn crops to a greater extent than ever before. For the same reason potato-planting and potato-lifting machines were also in greater requisition.

Agricultural Population and Wages.

The last half of the 19th century witnessed a remarkable diminution of the British rural population. The decrease has assumed serious proportions since 1871, as before that date the supply of rural labour exceeded the demand. A large number of agricultural labourers were thus only in partial employment, and their withdrawal from the land was of minor importance as compared with the shrinkage in the number of those permanently employed. The following tables indicate the extent of rural depopulation:—

Number of "Persons engaged in Agriculture" in the United Kingdom, 1851–1901.

1851.	1861.	1871.	1881.	1891.	1901.
3,453,500	3,080,500	2,744,000	2,573,900	2,394,500	2,262,600

The number of "agricultural labourers and shepherds," which affords a more precise index, declined in a still more marked degree.

1851.	1861.	1871.	1881.	1891.	1901.
1,110,311	1,098,261	923,332	830,452	756,557	609,105

The decrease in the demand for labour is attributable chiefly to the reduction of the cultivated area and the laying down to pasture of land once under the plough, and to the increasing use of agricultural machinery. It may, however, be noticed that the period 1850–1903 was marked by a steady increase of the cash wages of the farm labourer, as indicated in the following table from the Report on the Earnings of Agricultural Labourers issued by the Board of Trade in 1905.

Average Weekly Cash Wages of ordinary Agricultural Labourers employed on certain Farms in England and Wales.

Year.	England and Wales, 69 farms.	Eastern counties, 12 farms.
	s. d.	s. d.
1850	9 3½	8 8
1855	10 11¾	11 5
1860	10 11	10 8
1865	11 3	10 5
1870	11 10¼	11 1½
1875	13 7	12 11¾
1880	13 2¼	12 1
1885	13 1	11 5
1890	13 0¼	11 0½
1895	13 2¾	11 0
1900	14 5¾	13 1½
1903	14 7	13 2¼

(See also ALLOTMENTS AND SMALL HOLDINGS.)

Agricultural Education.

In Great Britain agricultural education as a whole lacks the scope and co-ordination which it has in some continental countries. Centres at which higher agricultural education is given are, however, numerous. The chief are:—

The Royal Agricultural College, Cirencester.
Aspatria Agricultural College, Carlisle.
Tamworth Agricultural College.
*Agricultural and Horticultural College, Uckfield, Sussex.
*Agricultural and Horticultural College, Holme Chapel, Cheshire.

*Midland Agricultural and Dairy College, Kingston, Derby.
*Harper-Adams Agricultural College, Newport, Monmouth.
*Lancashire County School, Harris Institute, Preston.
*University College of North Wales, Bangor.
*University of Leeds.
*Armstrong College, Newcastle-on-Tyne.
*Cambridge University.
*University College, Reading.
*South-Eastern Agricultural College, Wye.
*University College of Wales, Aberystwyth.
*Agricultural Institute, Ridgmont (Bedfordshire County Council).
*Essex County Technical Laboratories, Chelmsford.

In the year 1904–1905 £10,600 was devoted by the Board of Agriculture to agricultural instruction and experiments. Of this sum the greater part was divided amongst the institutions marked with an asterisk in the above list. The first three named are private establishments. The county councils also expend sums varying at their own discretion on instruction in dairy-work, poultry-keeping, farriery and veterinary science, horticulture, agricultural experiments, agricultural lectures at various centres, scholarships at, and grants to, agricultural colleges and schools; the whole amount in 1904–1905 reaching £87,472.[1] The sum spent by individual counties varies considerably. In 1904–1905 Lancashire (£8510), Kent (£5922) and Cheshire (£4310) spent most in this direction. In some instances colleges are supported entirely by one county, as is the Holmes Chapel College, Cheshire; in others a college is supported by several affiliated counties, as in the case of the agricultural department of the University College, Reading, which acts in connexion with the counties of Berks, Oxon, Hants and Buckingham. The organization and supply of county agricultural instruction is often carried out through the medium of the institution to which the county is affiliated. In Scotland higher agricultural instruction is given at:—

Edinburgh and East of Scotland Agricultural College.
Edinburgh University, Agriculture Department.
West of Scotland Agricultural College, Glasgow.
Aberdeen and North of Scotland Agricultural College.
University of St. Andrews.

A typical course at one of the higher colleges lasts for two years and includes instruction under the heads of soils and manure, crops and pasture, live stock, foods and feeding, dairy work, farm and estate management and farm bookkeeping, surveying, agricultural buildings and machinery, agricultural chemistry, agricultural botany, veterinary science and agricultural entomology. Experimental farms are attached to the colleges.

The facilities for intermediate are far inferior to those for higher agricultural education. Schools for farmers' sons and daughters, and others, answering to the *écoles pratiques d'agriculture* (see FRANCE), are few, the principal being the Dauntsey Agricultural School, Wiltshire, the Hampshire Farm School, Basing, and the Farm School at Newton Rigg, Penrith, Cumberland, maintained by the county councils of Cumberland and Westmorland. Occasionally grammar schools have agricultural sides, and in evening continuation schools agricultural classes are sometimes held. Both elementary day schools and continuation schools are in many cases provided with gardens in which horticultural teaching is given.

In Ireland agricultural education is under the supervision of the Department of Agriculture and Technical Instruction for Ireland, founded in 1899. Higher education is given at the Royal College of Science, Dublin; the Albert Agricultural College, Glasnevin; and the Munster Institute, Cork, for female students, where dairying and poultry-keeping are prominent subjects. Winter classes for boys over sixteen years of age are held at centres in some counties, and there are winter schools of agriculture at Downpatrick, Monaghan and Mount Bellew (Co. Galway); while lectures are given at farmers' meetings by itinerant instructors. The Department carries on agricultural experiment-stations at Athenry (Co. Galway), Ballyhaise (Co. Cavan) and Clonakilty (Co. Cork), where farm apprentices are received and instructed.

AGRICULTURE IN THE UNITED STATES

Agriculture has been the chief and most characteristic work of the American people, that in which they have achieved the greatest results in proportion to the resources at command, that in which their economic superiority has been most strikingly manifest. In ten years from 1790, the mean population of the period being 4,500,000, 65,000 sq. m. were for the first time brought within the limits of settlement, crossed with roads and bridges, covered with dwellings, both public and private, much of it also cleared of primeval forest; and this in addition to keeping up and improving the whole extent of previous settlements, and building towns and cities, at a score of favoured points. In the next decade, the mean number of inhabitants being about 6,500,000, population extended itself over 98,000 sq. m. of absolutely new territory, an area eight times as large as Holland. Between 1810 and 1820, besides increasing the density of population on almost every league of the older territory, besides increasing their manufacturing capital twofold, in spite of a three years' war, the people of the United States advanced their frontier to occupy 101,000 sq. m., the mean population being 8,250,000. Between 1820 and 1830, 124,000 sq. m. were brought within the frontier and made the seat of habitation and cultivation; between 1830 and 1840, 175,000 sq. m.; between 1840 and 1850, 215,000 sq. m. The Civil War, indeed, checked the westward flow of population, though it caused no refluence, but after 1870 great progress was made in the creation of new farms and the development of old.

That which has allowed this great work to be done so rapidly and fortunately has been, first, the popular tenure of the soil, and, secondly, the character of the agricultural class. At no time have the cultivators of the soil north of the Potomac and Ohio constituted a peasantry in the ordinary sense of that term. They have been the same kind of men, out of precisely the same homes, generally with the same early training, as those who filled the learned professions or who were engaged in manufacturing or commercial pursuits. Switzerland and Scotland have, in a degree, approached the United States in this particular; but there is no other considerable country where as much mental activity and alertness has been applied to the cultivation of the soil as to trade and manufactures.

But even the causes which have been adduced would have failed to produce such effects but for the exceptional inventive ingenuity of the American. The mechanical genius which has entered into manufacturing in the United States, the engineering skill which has guided the construction of the greatest works of the continent, have been far exceeded in the hurried "improvements" of the pioneer farm; in the housing of women, children and live stock and gathered crops against the storms of the first few winters; in the rough-and-ready reconnaissances which determined the "lay of the land" and the capabilities of the soil; in the preparation for the thousand exigencies of primitive agriculture. It is no exaggeration to say that the chief manufacture of the United States, prior to 1900, was the manufacture of 5,740,000 farms, comprising 841,200,000 acres.

The people of the United States, finding themselves on a continent containing an almost limitless extent of land of fair average fertility, having at the start but little accumulated capital and urgent occasions for the economy of labour, have elected to regard the land in the earliest stages of occupation as practically of no value, and to regard labour as of high value. In pursuance of this view they have freely sacrificed the land, so far as was necessary, in order to save labour, systematically cropping the fields on the principle of obtaining the largest results with the least expenditure, limiting improvements to what was demanded for immediate uses, and caring little about returning to the soil an equivalent for the properties taken from it in the harvests of successive years. But, so far as the northern states are concerned, the enormous profits of this alleged wasteful cultivation have in the main been applied, not to personal consumption, but to permanent improvements,—not indeed to improvements of the land, but to what were still more needed in the situation, namely, improvements upon the land. The first-fruits of a virgin soil have been expended in forms which have vastly enhanced the productive power of the country. The land, doubtless, as one factor of that productive power, became temporarily less efficient than it would have been under a conservative European treatment; but the joint product of the three factors—land, labour and capital—was for the time enormously increased. Under this regimen the fertility of the land, of course, in time necessarily declined, sooner or later, according to the nature of the crops grown and to the degree of original strength in the soil. Resort was then had to new fields farther west. The granary of the continent moved first to western New York, thence into the Ohio valley, and then, again, to the banks of the Mississippi. The north and south line dividing the wheat product of the United States into two equal parts was in 1850 drawn along the 82nd meridian (81° 58′ 49″). In 1860 that line was drawn along the 86th (86° 1′ 38″), in 1870 along the 89th (88° 48′ 40″), in 1880 along the 90th (90° 30′ 46″), in 1890 along the 93rd (93° 9′ 18″), and in 1900 along the 95th (94° 59′ 23″). Meanwhile one portion of the inhabitants of the earlier settlements joined in the movement across the face of the continent. As the grain centre passed on to the west they followed it, too restless by character and habit to find pleasure in the work of stable communities. A second portion of the inhabitants became engaged in raising, upon limited areas, small crops, garden vegetables and orchard fruits, and in producing butter, milk, poultry and eggs, for the supply of the cities and manufacturing towns which had been built up out of the abundant profits of the primitive agriculture. Still another portion of the agricultural population gradually became occupied in the more careful and intense culture of the cereal crops upon the better lands, the less eligible fields being allowed to spring up in brush and wood. Deep ploughing and thorough drainage were resorted to; fertilizers were employed to bring up and to keep up the soil; and thus began the serious systematic agriculture of the older states. Something continued to be done in wheat, but not much. New York raised 13 million bushels in 1850; thirty years later she raised 11½ million bushels; and fifty years later 10½ million bushels. Pennsylvania raised 15½ million bushels in 1850; in 1880 she raised 19½ million bushels; and in 1900 20½ million bushels. More is done in Indian corn (maize), that most prolific cereal, the backbone of American agriculture; still more is done relatively in buckwheat, barley and rye. Pennsylvania, though the eleventh state in wheat production in 1905, stood first in rye and second in buckwheat (ninth in oats). New York was only twenty-first in wheat, but first in buckwheat (tenth in barley), fourth in rye. We do not, however, reach the full significance of the situation until we account for the fourth portion of the former agricultural population, in noting how naturally and fortunately commercial and manufacturing cities spring up in the sites which have been prepared for them by the lavish expenditure of the enormous profits of a primitive agriculture upon permanently useful improvements of a constructive character. These towns are the gifts of agriculture.

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[1] This sum was furnished out of a total of £693,851, forming the residue grant allocated for the purposes of education to the various county councils of England and Wales under the Local Taxation (customs and Excise) Act 1890.

Besides the extension of cultivated area, very little was accomplished in the way of agricultural improvement before 1850. With some few exceptions the methods of cultivation were substantially the same as those of colonial days, and were marked by crudeness, waste and a general adherence to rule-of-thumb principles. The year 1850 roughly marks the beginning of a period of improvement and development. The Irish famine of 1846 and the German political troubles of 1848 were followed by an unprecedented emigration to America of highly desirable European labourers, for whom there were cheap and abundant lands. The period from 1850 to 1870 was marked by a steady growth, which, in the western states, was highly stimulated by the Civil War. While this conflict withdrew a certain amount of productive energy from agricultural pursuits, it tended at the same time to increase the value of farm labour and of farm products and to extend the use of machinery in order to offset the deficient labour supply. Agricultural machinery had been employed before the war, but only to a very small extent. In 1864, 70,000 reapers and mowers were manufactured, twice as many as in 1862, and manufacturers were unable to supply the demand. Moreover, in the years 1860, 1861 and 1862 the wheat crops of Great Britain and the European continent were failures, while those of the United States, far removed from the theatre of military operations, were unusually large. The wheat exports to Great Britain in 1861 were three times as great as those of any previous year, and the strong demand from abroad was an additional stimulus to higher prices. In 1864 agricultural prices were from 100 to 200% higher than in 1861, while transportation charges had only slightly advanced and in some instances had actually decreased. In the middle of the war the farmers' profits were normal; toward the end they had increased enormously. This marvellous agricultural prosperity of a nation engaged in one of the world's most formidable wars has no counterpart in modern history. In the decade from 1860 to 1870 there was a steady increase in cultivated area, in agricultural products and in population. The value of the farm lands in the northern states in 1870 exceeded that of 1860 by five dollars an acre. On the other hand, the farm lands of the southern states had declined in value to an almost equal amount; but after 1870 these states also made substantial progress, and in 1880 they produced more cotton than in 1860, when the greatest crop under the slave system was grown.

Since 1870 the most important factors in this development have been the employment of more scientific methods of production and the more extensive use of machinery. The study of soils with a view of adapting to them the most suitable crops and fertilizers; the increased attention given to diversified farming and crop rotation; the introduction and successful growth of new plants (*e.g.* the date palm in Arizona and California, and tea in South Carolina); tile drainage; the ensilage of forage; more careful selection in breeding; the use of inoculation to prevent Texas fever in cattle and cholera in swine, of tuberculin to discover the presence of tuberculosis in cows, of organic ferments to hasten the progress of butter-making, of the "Babcock test" for ascertaining the amount of fat in milk, of fungicides and insecticides to destroy fruit and vegetable pests,—such are but a few manifestations of the spread of scientific knowledge among the farming population of the United States. Nearly every county has some sort of agricultural society; in 1899 there were about 1500 of these organizations, some of which, especially those holding annual fairs, received state aid.

With the improvement in technical processes of production came the conquest of the arid regions of the western states. Irrigation was first employed in the west by the Mormons in 1847; but as late as 1870 only about 20,000 acres had been irrigated. In 1880 the irrigated area was approximately 1,000,000 acres, and in the decade from 1889 to 1899 it increased from 3,631,381 to 7,539,545 acres, a gain of 107·6 %. By 1902 there had been a still further increase to 9,478,852 acres, a gain of 25·7 % in three years. As many of the streams available for irrigation purposes lie within more than one state, the control of water supply is a proper matter for federal jurisdiction, and in June 1902 Congress provided for an extensive system of irrigation works in thirteen states and three territories. The cost of the work is defrayed from the proceeds of the sales of government lands within the states and territories affected by the act. The measure is not paternalistic; the settlers on the lands, which are divided into farms of not less than 40 nor more than 160 acres, are required to make annual payments to the government in proportion to the water service they have received, until the original cost of the works has been met. The first of these works, the so-called Truckee-Carson project, of Nevada, was completed in June 1905, and at the end of that year eight projects, in as many different states, were under construction; bids had been received for three more, and the seven others had received the approval of the secretary of the interior. With these initial undertakings it was estimated that 1,000,859 acres could be reclaimed. In addition to supplying the soils with water, means have been found of ridding them of their alkali, or of rendering it harmless; and this is an element of reclamation hardly less important than irrigation itself. A third step in the reclamation of desert lands is arid farming—that is, the adapting to the soils of crops that require a minimum amount of moisture, and the utilization, to the fullest possible extent, of the meagre amount of rainfall in the region. Experiments conducted in this direction in Utah produced promising results.

The development of farming machinery has kept pace with the general progress in scientific agriculture. Although numerous patents were issued for such machinery before 1850, its use, with the exception of the cotton gin, was very restricted before that date. Even iron ploughs were not in general use until 1842, and a really scientific plough was practically unknown before 1870. Thirty years later the large farms of the Pacific states were ploughed, harrowed and sowed with wheat in a single operation by fifty-horse-power traction engines drawing ploughs, harrows and press drills. Since 1850 there has been a transition from the sickle and the scythe to a machine that in one operation mows, threshes, cleans and sacks the wheat, and in five minutes after touching the standing grain has it ready for the market. Hay-stackers, potato planters and diggers, feed choppers and grinders, manure-spreaders, check-row corn planters and ditch-digging machines are some of the common labour-saving devices. By the 28th of August 1907 the United States Patent Office had issued patents for 13,212 harvesting machines, 6352 threshers, 6680 harrows and diggers, 9649 seeders and planters, and 13,171 ploughs. In the manufacture of agricultural machinery the United States leads the world. The total value of the implements and machinery used by farmers of the United States in 1880 was $406,520,055; in 1890 $494,247,467; in 1900 $761,261,550, a gain in this last decade of 54%. The total value of the implements and machinery manufactured in 1850 was $6,842,611; in 1880 $68,640,486; in 1890 $81,271,651; in 1900 $101,207,428. These figures, however, are a very poor indication of the actual use of machinery, on account of the rapid decrease in prices following its manufacture on a more extensive scale and by improved methods.

The effects of the new agriculture are apparent from the following figures: By the methods of 1830 it required 64 hours and 15 minutes of man-labour and cost $3·71 to produce an acre of wheat; by the methods employed in 1896 it required 2 hours and 58 minutes of man-labour and cost 72 cents. To produce an acre of barley in 1830 required 63 hours of man-labour and cost $3·59; in 1896 it required 2 hours and 43 minutes and cost 60 cents. An acre of oats produced by the methods of 1830 required 66 hours and 15 minutes of man-labour and cost $3·73; the methods of 1893 required only 7 hours and 6 minutes and cost $1·07. With the same unit of labour the average quantity of all leading crops produced by modern methods is about five times as great as that produced by the methods employed in 1850, and the cost of production is reduced by one half. From 1880 to 1900 the average number of acres of leading crops per male worker increased from 23·3 to 31·0, or 34%; the number of horses per worker from 1·7 to 2·3, or 35%; and the value of agricultural product per person employed from $286·82 to $454·37, or 58·4%.

There are numerous other factors that have operated to the benefit of the agriculturist. Increased transportation facilities and lower freight charges have widened his market. The processes of canning, packing, preserving and refrigerating have produced a similar effect, and have also provided a means for the disposal of surplus perishable products that otherwise would be lost. The utilization of by-products, as, for example, the conversion of cotton seed into oil, fertilizers and food for live stock, has become another source of profit.

Great economic and social changes have resulted from this progress. There has been a great division of labour in agriculture. Makers of agricultural implements, of butter and cheese, cotton ginners, grist and wheat millers, are now classed in the United States census reports as manufacturers, but all their work was once done on the farm. The farmer is now more of a specialist and more dependent on other industries than formerly. He has changed from a producer for home consumption or a local market to a producer for a world market. Unfortunately, his knowledge of economic laws has lagged behind his progress in scientific agriculture. The farming class at times have experienced periods of great depression, largely on account of their inability to adjust their crops to changing conditions in the world's markets, and in such cases have been prone to seek a remedy in radical legislation. Periods of agricultural discontent at different times have been marked by the political activity of the "Grangers" and of the "Farmers' Alliance," and even by the formation of new political parties such as the Greenback party in 1874 and the Populist or People's party in 1892—whose strength lay mainly in the agricultural states. The new industrial conditions that produced combinations among manufacturers were much slower in their effect upon the farming element, but gradually led to increasing co-operation and to the organization of the growers of various commodities for marketing their crops. The fruit growers of California and the tobacco growers of Kentucky have furnished interesting examples of such organizations. Under the improved conditions there is less drudgery on the farm; the farmer does more work, produces more, and yet has more leisure than formerly. Better roads, rural free mail delivery, telephone and electric lines are removing the isolation of country life, and to some extent are diminishing the attractions of the cities for the rural population.

Covering as it does the breadth of the North American continent, with 3,000,000 sq. m. of land surface, not including Alaska and the islands, of which over 800,000,000 acres are in farms and over 400,000,000 in actual cultivation, representing every variety of soil and all the climatic life zones of the world, except the extreme boreal and the hottest tropical, the United States affords an important subject of study in respect of agriculture. Its cotton, wheat and meat are large factors in all markets, and its many other agricultural products are distributed throughout the civilized world. To the student the equipment and methods of agriculture in the United States form as interesting a subject of examination as do its resources and production. In quantity, distribution and inter-relation of heat and moisture—the chief factors in agricultural production—the United States is greatly blessed. We find in this vast territory all the agricultural belts mapped by the biologist, producing all varieties of cereals, fruits and breeds of live stock, whilst all kinds of soils, adapted to different crops, are spread out at all altitudes from 8000 ft. down to sea-level.

The story of the vast and varied agriculture of the United States can be outlined by extracts from the figures published by the Census, the Agricultural and other government departments.

Farms.

As a result of the great supply of available land the number of farms in the United States increased between 1850 and 1900 from 1,449,073 to 5,739,657; their total acreage increased from 293,560,614 to 841,201,546 acres; their improved acreage increased from 113,032,614 to 414,793,191 acres; and their unimproved[1] acreage from 180,528,000 to 426,408,355 acres. Table XXVII. exhibits the increases of number of farms, total and improved acreage by decades.

The largest percentage of increase of improved land was 50·7, from 1870 to 1880; the lowest was in the decade 1860 to 1870, the period of the Civil War, and was 15·8. The chief cause of this wonderful development of agriculture is the large area of cheap public lands which has been available for immigrants and natives alike. Up to 1906, under the Homestead Act of the 20th of May 1862, the number of entries, both final and pending, covered 185,385,000 acres. Between 1875 and 1905 the public and Indian lands sold for cash and under homestead and timber culture laws, as well as those allotted by scrip, granted to the colleges of agriculture and mechanic arts and other institutions, and by military bounty land warrants, and selected by states and railroad corporations, covered about 430,000,000 acres. In addition to this, the states and railroad corporations sold a large amount of land to farmers of which we have no accurate record. This vast territory, greater in extent than Germany and France combined, was added to the farms of the country in thirty years. In many cases railroad building has made the settlement of the public lands possible for the first time, and the building of branch lines, by providing means for transporting products to market, has greatly facilitated the acquisition of other lands. The mileage of railways increased 310·7 % between 1870 and 1905. The interesting fact is that this increase corresponds geographically to the increase in farms.

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[1] "Unimproved" land includes land which has never been ploughed, mown or cropped, and also land once cultivated but now overgrown with trees or shrubs.

TABLE XXVII.—*Percentage of Increase of Number and Acreage of Farms by Census Decades.*

The United States.	Number of Farms.	Acreage.	
		Total.	Improved.
1850 to 1860 . .	41·1	38·7	44·3
1860 ,, 1870 . .	30·1	0·1	15·8
1870 ,, 1880 . .	50·7	31·5	50·7
1880 ,, 1890 . .	13·9	16·2	25·6
1890 ,, 1900 . .	25·7	35·0	16·0
1850 to 1900 . .	296·0	186·5	267·1

The agricultural statistics do not include any farm of less than three acres unless it produced at least $500 worth of products in the preceding year. The census of 1900 showed that the average size of farms was 146 acres, or nine acres more than in 1890 and 57 acres less than in 1850. This fact, however, does not indicate a general tendency toward the consolidation of holdings. The increase in the average size of farms in the whole country is due to the extension of grazing lands in the Rocky Mountain region and in Texas, and to the enlargement of the wheat fields in the Mississippi valley. On the other hand, in the southern states there has been a steady breaking up of holdings and decrease in the average size of farms since the close of the Civil War. In the New England states, where dairying has become the leading agricultural industry, there was an increase of 2·2 acres in the size of farms during the decade 1890–1900. This increase was more than offset by the decrease in the Atlantic states from New York to Maryland inclusive (2·8 acres), where there has been a subdivision of farms following the increased attention given to the growing of fruits and vegetables for cities. The same tendency is noted in the states of Ohio, Indiana and Illinois. As will be seen from Table XXVIII., the average farm, which steadily diminished in size from 1850 to 1880, increased between 1880 and 1900.

TABLE XXIX.—*Number of Farms of Specified Tenure.*

Year.	Number of Farms.	Number of farms operated by			Percentage of farms operated by		
		Owners.[1]	Cash Tenants.	Share Tenants.[2]	Owners.	Cash Tenants.	Share Tenants.
1880	4,008,907	2,984,306	322,357	702,244	74·5	8·0	17·5
1890	4,564,641	3,269,728	454,659	840,254	71·6	10·0	18·4
1900	5,737,372	3,712,408	751,665	1,273,299	64·7	13·1	22·2

TABLE XXVIII.—*Average Acreage of Farms and Proportion of Improved Land therein.*

	Whole Farm.	Proportion of Improved Land.
1850	202·6	38·5
1860	199·2	40·1
1870	153·3	46·3
1880	133·7	53·1
1890	136·5	57·4
1900	146·6	49·3

The acreage of North Atlantic farms decreased from 112·6 in 1850 to 95·3 in 1890, and increased in 1890–1900 to 96·5 acres. In the South Atlantic states the average was 376·4 acres in 1850, and there has been steady decrease, so that in 1900 it was 108·4, or one-third less than the average for the entire country. In the north central states the averages of 1850 and 1900 were nearly the same (143·3 and 144·5 respectively), with the minimum (121·9 acres) in 1880. The south central states averaged 291 acres in 1850, 321·3 in 1860, 144 in 1890, and 155·4 in 1900. The maximum decade for the western states was that ending in 1850 (694·9 acres), and the minimum 1880 (312·9); and the average in 1900 was 386·1 acres.

Table XXIX. gives the number of farms, together with their distribution, under different forms of tenure in the years 1880, 1890 and 1900.

The steady drift towards farm tenancy of late is believed to be injurious to production; but it is impossible to prove this, so great has been the aggregate increase in products.

Agricultural occupations.

The number of persons engaged in agriculture as a business in 1900 was 10,381,765, or 36 % of all persons in gainful occupations. It is interesting to note that 977,336 of these were women. This is an increase of 2,667,890 persons over 1880. Thus, if the farm family is the same size as that of the remainder of the population—it is probably slightly larger—the agricultural population would be 36 % of the whole. Statisticians usually put it at 40 %, and this is probably more nearly correct (Table XXX.).

The wages paid farm labourers, as ascertained by the Department of Agriculture, are rather low compared with the average wages of labour, but not lower than the wages of other unskilled labour. The average monthly wage of the agricultural labourer, without board, was $19·50 in 1870, $16·42 in 1880, $18·33 in 1890, $17·70 in 1895, and $20·23 in 1899, when the maximum for any state was $45·10 in Nevada, the minimum $10·06 in South Carolina. The wages of the American farm labourer were at this last date named (1899) higher than for any other farm labourer save in Canada and the British colonies of Australasia; though lower than wages paid in American cities, they have greater purchasing power. J. R. Dodge, in "Farm Labour in the United States" (vol. xi., *Report of Industrial Commission on Agriculture, &c.*, 1901), says: "In addition to wages the married labourer has a house free of rent, a garden, firewood, pasturage and other perquisites. The enterprising labourer usually becomes a tenant and afterwards a farm-owner."

Value of farms and products.

The figures for farm capital and the value of agricultural products are so vast that it is extremely difficult to put them in an intelligible form. The farm capital of the United States reported by the census of 1900 reached $20,514,002,000, a sum more than four times the capital invested in manufactures, the main classes being, in round numbers:—Land, fences and buildings, $16,674,690,000; machines and implements, $761,262,000; live stock $3,078,050,000. The products of the farms in the census year 1899 were valued at $4,739,119,000. Between 1850 and 1900 the aggregate farm capital increased 416 %. The greatest increase of farm capital was between 1850 and 1860, 101 %; the next was the decade 1880–1890, when the increase was 32 %. Between 1890 and 1900 the increase was 28%.

TABLE XXX.—*Number of Persons of Ten Years of Age and over in the different Agricultural Pursuits in 1900.*

Occupation.	Total Persons.
Dairymen and women	10,875
Farmers and farm superintendents . . .	5,674,875
Farm labourers	4,410,877
Gardeners, nurserymen and viticulturists .	61,788
Lumbermen and raftsmen	72,020
Stock-raisers, herders, &c.	84,988
Turpentine-farmers and labourers . . .	24,737
Wood-choppers	36,075
Other pursuits	5,530
Total . .	10,381,765

The growth of farm area and of capital invested in agriculture was followed by a proportionate increase in the chief crops (Table XXXI.).

The distinguishing feature of the period 1870–1880 was the rate of increase of barley, Indian corn, wheat and oats. Since 1870 the production of nearly all of the farm crops increased more rapidly than the population, the most absolute proof of the substantial prosperity of the people. The increase in population for the fifty years from 1840 to 1890 was 267 %; from 1870 to 1880, 30 %; from 1880 to 1890, 25 %; from 1890 to 1900, 21 %; but the food and other supplies far exceeded the demands of even this great population.

TABLE XXXI.—*Production of certain Farm Crops from 1870 to 1905—Millions of Bushels.*

	Indian Corn.	Wheat.	Oats.	Barley.
1870	1094	235	247	26
1880	1717	498	418	45
1890	1489	399	523	67
1900	2105	522	809	58
1905	2707	693	953	136

Table XXXII. gives important facts with regard to the cereal production of the United States between 1870 and 1905.

The average farm price of wheat declined, as is shown in that table, from $1·05 per bushel for the decade 1870–1880 to 65·3 cents for the period 1890–1899. The farm prices of the other cereals declined less during the thirty years. Corn declined from an average farm price of 42·6 cents per bushel for 1870–1880 to 34·4 cents in 1890–1899. The average production per acre shows nothing conclusive with regard to the fertility of the soil of the country. The expansion of the crop area usually causes a lowering of the average yield per acre by distributing the culture, fertilizers, &c., over more surface. Likewise the contraction of crop area will usually increase the average yield per acre of the entire country.

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[1] Includes farms operated by owners, part-owners, owners and tenants, and managers.

[2] Tenants of farms rented for a share of the products.

Table XXXII.—*Average Yield and Value of Cereal Crops in the United States, by Periods of Years, 1870–1905.*

Period.	Indian Corn.		Wheat.		Oats.	
	Average Farm Price per Bushel.	Average Yield per Acre.	Average Farm Price per Bushel.	Average Yield per Acre.	Average Farm Price per Bushel.	Average Yield per Acre.
	Dollars.	Bushels.	Dollars.	Bushels.	Dollars.	Bushels.
1870 to 1880 . .	0·426	27·1	1·05	12·4	0·353	28·4
1880 „ 1889 . .	·393	24·1	·827	12·1	·309	26·6
1890 „ 1899 . .	·344	24·1	·653	13·1	·277	26·2
1900 „ 1905 . .	·440	24·9	·706	13·6	·318	30·7
	Barley		Rye		Buckwheat	
1870 „ 1880 . .	0·738	22·1	0·701	14·1	0·715	17·7
1880 „ 1889 . .	·589	21·7	·622	11·9	·642	12·8
1890 „ 1899 . .	·433	23·3	·522	14·0	·507	16·8
1900 „ 1905 . .	·433	25·9	·570	15·7	·588	17·9

The average yield of wheat per acre was 12·4 bushels in the decade 1870–1880, and 13·1 in the period 1890–1899; of Indian corn, 27·1 in 1870–1880, and 24·1 in 1880–1899 continuously. Oats fell off from 28·4 in 1870–1880 to 26·2 bushels per acre in 1890-1899. The averages for the years 1900–1905 show an increase over the previous decade both in yields and (with the exception of the price of barley) in prices of all the cereals.

The agricultural returns for 1890–1905 may be taken as an illustration of the cereal production of the United States. The figures for wheat, oats and Indian corn are presented in Tables XXXIII., XXXIV. and XXXV.

The acreage and production of wheat have steadily increased. The acreage in Indian corn, the great American crop, reached its highest in 1902, 94,043,613 acres, and its production its highest figure in 1905, 2,707,993,540 bushels.

Producing as the United States does so much more than its people can consume, its exports form a large percentage of some of the crops, as Table XXXVI. shows.

Large portions of some of these crops, like Indian corn and oats, are exported in the form of animals and animal products (meats, lard, hides, &c.). The hay crop is almost entirely used in this way, and the tendency is to convert more and more of these crops into these higher-priced products. Still, the time is far distant when domestic consumption will come anywhere near overtaking domestic production, especially of wheat and the other cereals. The certain extension of acreage with the growth of demand and price, the increased use of agricultural implements, and the improvement of methods will be sure to keep up a large surplus for export for many years to come. The Department of Agriculture has found that for home use there were required per head 5·5 bushels of wheat, 28·6 bushels of Indian corn, and 10·7 bushels of oats, the computations being made from the figures for population, production and exports for 1888–1892; in 1905, 6·15 bushels of wheat and wheat-flour, 28·59 bushels of Indian corn and corn-meal. The following number of acres in these crops was required, therefore, to supply the home demand for 1888–1892:—0·43 of an acre in wheat, 1·15 acre in corn, and 0·43 acre in oats per head of the population. Taking the year

Table XXXIII.—*Acreage, Production, Value, Prices and Exports of Wheat in the United States in 1890–1905.*

Year.	Acreage.	Average Yield per Acre.	Production.	Average Farm Price per Bushel, 1st Dec.	Farm Value, 1st Dec.	Domestic Exports, including Flour, Fiscal Years beginning 1st July.
	Acres.	Bushels.	Bushels.	Cents.	Dollars.	Bushels.
1890	36,087,154	11·1	399,262,000	83·8	334,773,678	106,181,316
1891	39,916,897	15·3	611,780,000	83·9	513,472,711	225,665,812
1892	38,554,430	13·4	515,949,000	62·4	322,111,881	191,912,635
1893	34,629,418	11·4	396,131,725	53·8	213,171,381	164,283,129
1894	34,882,436	13·2	460,267,416	49·1	225,902,025	144,812,718
1895	34,047,332	13·7	467,102,947	50·9	237,938,998	126,443,968
1896	34,618,646	12·4	427,684,346	72·6	310,602,539	145,124,972
1897	39,465,066	13·4	530,149,168	80·8	428,547,121	217,306,005
1898	44,055,278	15·3	675,148,705	58·2	392,770,320	222,694,920
1899	44,592,516	12·3	547,303,846	58·4	319,545,259	186,096,762
1900	42,495,385	12·3	522,229,505	61·9	323,515,177	215,990,073
1901	49,895,514	15·0	748,460,218	62·4	467,350,156	234,772,516
1902	46,202,424	14·5	670,063,008	63·0	422,224,117	202,905,598
1903	49,464,967	12·9	637,821,835	69·5	443,024,826	120,727,613
1904	44,074,875	12·5	552,399,517	92·4	510,489,874	44,112,910
1905	47,854,079	14·5	692,979,489	74·8	518,372,727	. .

Table XXXIV.—*Acreage, Production, Value, Prices, Exports and Imports of Oats in the United States in 1890–1905.*

Year.	Acreage.	Average Yield per Acre.	Production.	Average Farm Price per Bushel, 1st Dec.	Farm Value, 1st Dec.	Domestic Exports, including Oatmeal, Fiscal Years beginning 1st July.	Imports during Fiscal Years beginning 1st July.
	Acres.	Bushels.	Bushels.	Cents.	Dollars.	Bushels.	Bushels.
1890	26,431,369	19·8	523,621,000	42·4	222,048,486	1,382,836	41,848
1891	25,581,861	28·9	738,394,000	31·5	232,312,267	10,586,644	47,782
1892	27,063,835	24·4	661,035,000	31·7	209,253,611	2,700,793	49,433
1893	27,273,033	23·4	638,854,850	29·4	187,576,092	6,290,229	31,759
1894	27,023,553	24·5	662,036,928	32·4	214,816,920	1,708,824	330,317
1895	27,878,406	29·6	824,443,537	19·9	163,655,068	15,156,618	66,602
1896	27,565,985	25·7	707,346,404	18·7	132,485,033	37,725,083	893,908
1897	25,730,375	27·2	698,767,809	21·2	147,974,719	73,880,307	25,093
1898	25,777,110	28·4	720,906,643	25·5	186,405,364	33,534,264	28,098
1899	26,341,380	30·2	796,177,713	24·9	198,167,975	45,048,857	54,576
1900	27,364,795	29·6	809,125,989	25·8	208,669,233	42,268,931	32,107
1901	28,541,476	25·8	736,808,724	39·9	293,658,777	13,277,612	38,978
1902	28,653,144	34·5	987,842,712	30·7	303,584,852	8,381,805	150,065
1903	27,638,126	28·4	784,094,199	34·1	267,661,665	1,960,740	183,983
1904	27,842,669	32·1	894,395,552	31·3	279,900,013	8,394,692	55,699
1905	28,046,746	34·0	953,216,197	29·1	277,047,537	. .	. .

TABLE XXXV.—*Acreage, Production, Value, Prices and Exports of Indian Corn in the United States in 1890–1905.*

Year.	Acreage.	Average Yield per Acre.	Production.	Average Farm Price per Bushel, 1st Dec.	Farm Value, 1st Dec.	Domestic Exports, including Corn-Meal, Fiscal Years beginning 1st July.
	Acres.	Bushels.	Bushels.	Cents.	Dollars.	Bushels.
1890	71,970,763	20·7	1,489,970,000	50·6	754,433,451	32,041,529
1891	76,204,515	27·0	2,060,154,000	40·6	836,439,228	76,602,285
1892	70,626,658	23·1	1,628,464,000	39·4	642,146,630	47,121,894
1893	72,036,465	22·5	1,619,496,131	36·5	591,625,627	66,489,529
1894	62,582,269	19·4	1,212,770,052	45·7	554,719,162	28,585,405
1895	82,075,830	26·2	2,151,138,580	25·3	544,985,534	101,100,375
1896	81,027,156	28·2	2,283,875,165	21·5	491,006,967	178,817,417
1897	80,095,051	23·8	1,902,967,933	26·3	501,072,952	212,055,543
1898	77,721,781	24·8	1,924,184,660	28·7	552,023,428	117,255,046
1899	82,108,587	25·3	2,078,143,933	30·3	629,210,110	213,123,412
1900	83,320,872	25·3	2,105,102,516	35·7	751,220,324	181,405,473
1901	91,349,928	16·7	1,522,519,891	60·5	921,555,768	28,028,688
1902	94,043,613	26·8	2,523,648,312	40·3	1,017,017,349	76,639,261
1903	88,091,993	25·5	2,244,176,925	42·5	952,868,801	58,222,061
1904	92,231,581	26·8	2,467,480,934	44·1	1,087,461,440	90,293,483
1905	94,011,369	28·8	2,707,993,540	41·2	1,116,696,738	..

1890 as an illustration, this gave a surplus area in wheat of 11,264,478 acres, of 2,648,404 acres in Indian corn, and of 238,162 acres in oats.

Tables XXXVII. and XXXVIII. give the number, total value and average price of farm animals in 1880, 1890, 1900 and 1906.

TABLE XXXVI.—*Percentage of Crops Exported. Averages for Period 1878–1905.*

Crop.	Annual Average.				1905.
	1878–1882.	1888–1892.	1894–1896.	1896–1904.	
Wheat	27·84	17·68	15·96	29·9	7·99
Indian corn	4·82	3·49	5·39	6·4	3·66
Rye	10·30	. .	12·21	19·5	. .
Oats	·37	·80	2·22	3·7	. .
Barley	1·55	. .	12·96	12·15	. .
Potatoes	·37	. .	·30	0·31	. .
Cotton	72·80	66·79	73·60	66·3[1]	61·55

TABLE XXXVII.—*Number and Value of Farm Animals in the United States*, 1880–1906.

January 1.	Horses.		Mules.		Milch Cows.	
	Number.	Value.	Number.	Value.	Number.	Value.
1880	11,201,800	$613,296,611	1,729,500	$105,948,319	12,027,000	$279,899,420
1890	14,213,837	978,516,562	2,331,027	182,394,099	15,952,883	352,152,133
1900	13,537,524	603,969,442	2,086,027	111,717,092	16,292,360	514,812,106
1906	18,718,578	1,510,889,906	3,404,061	334,680,520	19,793,866	582,788,592

January 1.	Other Cattle.		Sheep.		Swine.		Total Value of Farm Animals.
	Number.	Value.	Number.	Value.	Number.	Value.	
1880	21,231,000	$341,761,154	40,765,900	$90,230,537	34,034,100	$145,781,515	$1,576,917,556
1890	36,849,024	560,625,137	44,336,072	100,659,761	51,602,780	243,418,336	2,418,766,028
1900	27,610,054	689,486,260	41,883,065	122,665,913	37,079,356	185,472,321	2,228,123,134
1906	47,067,656	746,171,709	50,631,619	179,056,144	52,102,847	321,802,571	3,675,389,442

TABLE XXXVIII.—*Average Value of Farm Animals in the United States on 1st January*, 1880–1906.

Year.	Horses.	Mules.	Milch Cows.	Other Cattle.	Sheep.	Swine.
1880	$54·75	$61·26	$23·27	$16·10	$2·21	$4·28
1890	68·84	78·25	22·14	15·21	2·27	4·72
1900	44·61	53·56	31·60	24·97	2·93	5·00
1906	80·72	98·31	29·44	15·85	3·54	6·18

After the Civil War the number of horses increased and prices gradually declined. In 1893 the number of horses reached 16,206,802 (an increase of over 5,005,002 or 44·6 % over the number in 1880), and in 1906, 18,718,578. The average farm price of horses increased from $54·75 in 1880 to $74·64 in 1884, after which there was a decrease to $31·51 in 1896, followed by a rise to $80·72 in 1906. The extension of street-car lines, and the substitution of cable and electric power for that of horses, the use of bicycles and, later, of automobiles, and the improvement of farm-machinery, in which horses are less and less used as power-producers and steam is more common, have been factors in decreasing the demand for these animals. The fluctuation in prices of mules has been parallel to that for horses.

The returns for milch cows show an increase throughout the period 1880–1899 in every year, with the exception of 1895–1899, after which there was a steady rise in numbers. For the first ten years the numbers increased 32·6 %, and from 1890 to 1899, ·2 %. The total value of milch cows increased each year until 1884, then decreased until 1891, with a gradual increase until the end of the period. The farm price of milch cows rose from $23·27 in 1880 to $31·37 in 1884, then fell to $21·40 in 1892, after which there was a steady increase to $31·60 in 1899, and afterwards a slight fall, $29·44 being the average farm value on the 1st of January 1906.

No marked changes in the numbers of sheep have taken place. During the period 1880–1890 there was an increase in numbers amounting to about 8·8 %. After 1893 there was a rather steady decrease, with fluctuations amounting to a marked depression after 1894. This industry is very susceptible to adverse influences, and felt keenly a depression in the price of wool. The increase began again in 1898, and in 1903 the figure of 63,964,876 was reached; in 1906 it was 50,631,619.

The numbers and values of swine constantly fluctuate with the movement and value of the Indian corn crops. The returns for 1890 (51,602,780) showed a numerical increase of 51·6 % over those of 1880; then followed a steady decrease in numbers down to 1900 (37,079,356), since which time there has been considerable increase, so that in 1906 there were 52,102,847—the maximum excepting 1901, when there were 56,982,142 swine on farms. The movement in values was similar to that in numbers. From $4·28 in 1880, the average farm price of hogs increased steadily to $6·75 in 1883. The lowest figure, $4·15, was reached in 1891, and after numerous fluctuations it became $4·40 in 1899 and $7·78 in 1903; in 1906 it was $6·18.

The total value of farm animals showed a steady increase from 1880 to 1890, with slight variations in 1885 and 1886. Following 1890 there was a steady decrease with the exception of slight increases in 1892 and 1893. In 1880 the total value of farm animals in the United States was $1,576,917,556. In 1890 it had increased to $2,418,766,028, or 53·4 %. In 1896 the value had diminished to $1,727,926,084—a decrease of 28·6 % from the 1890 values, and an increase of 9·6 % over those of 1880. The value in 1906 showed an increase of 133 % over that of 1880.

The exports of live stock and its products have increased enormously in recent years, both in quantity and value. This is especially true of the exportation of beef, cattle and meat products. The exports of cattle increased from 182,750 in 1880 to 331,720 in 1895, or 81¼ %, and to 567,806 in 1905 or 210 % over 1880, and values from $13,340,000 in 1880 to $30,600,000 in 1895, an increase of 129 %, and to $40,590,000 in 1905 or 204 %. The average value of cattle exported increased from $19 in 1870 to $73 in 1880 and $92 in 1895, decreasing to $71·50 in 1905. Only the best and heaviest cattle are exported, these, of course, commanding a much higher price than the average of the country.

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[1] For 1899-1900 to 1904-1905

The total value of farm animals exported from the United States has fluctuated greatly. On the whole, however, the value increased from $16,000,000 in round numbers in 1880 to $46,500,000 in 1905, or 190 %. Table XXXIX. shows the number and value of live animals exported between 1880 and 1905.

TABLE XXXIX.—*Number and Value of Farm Animals exported from the United States*, 1880–1905.

Year ending 30th June.	Horses.		Mules.		Cattle.		Sheep.		Swine.		Total Value.
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	
1880	3,060	$675,139	5,198	$532,362	182,756	$13,344,195	209,137	$892,647	83,434	$421,089	$15,865,432
1885	1,947	377,692	1,028	127,580	135,890	12,906,690	234,509	512,568	55,025	579,183	14,503,713
1890	3,501	680,410	3,544	447,108	394,836	31,261,131	67,521	243,077	91,148	909,042	33,540,768
1894	5,246	1,108,995	2,063	240,961	359,278	33,461,922	132,370	832,763	1,553	14,753	35,659,394
1895	13,984	2,209,298	2,515	186,452	331,722	30,603,796	405,748	2,630,686	7,130	72,424	35,702,656
1900[1]	64,722	7,612,616	43,369	3,919,478	397,286	30,635,153	125,772	733,477	51,180	394,813	43,295,537
1901[1]	82,250	8,873,845	34,405	3,210,267	459,218	37,566,980	297,925	1,933,000	22,318	238,465	51,822,557
1902[1]	103,020	10,048,046	27,586	2,692,298	392,884	29,902,212	358,720	1,940,060	8,368	88,330	44,670,946
1903	34,007	3,152,159	4,294	521,725	402,178	29,848,936	176,961	1,067,860	4,031	40,923	34,631,603
1904	42,001	3,189,100	3,658	412,971	593,409	42,256,291	301,313	1,954,604	6,345	53,780	47,866,746
1905	34,822	3,175,259	5,826	645,464	567,806	40,598,048	268,365	1,687,321	44,496	414,692	46,520,784

Since 1890 there has been a great development in the production of fruit and vegetables. Local market gardens are numerous in the vicinity of all cities, and highly specialized "truck gardening," that is, the growing of early fruits and vegetables for transportation to distant markets where the seasons are later, has made rapid progress in the South Atlantic states. The census reports of 1900 use the potato acreage in these states as an index of the rate of development of truck gardening; the southern potato being largely a truck garden crop. In seven counties of Virginia the increase in acreage from 1889 to 1899 was 100 %; in eleven counties of North Carolina, 314 %; in five counties of South Carolina, 134 %; in nine counties of Georgia, 111 %; in six counties of Florida, 309 %; in five counties of Alabama, 277 %. Irish and sweet potatoes are the most important vegetables raised; the North Central states leading in the production of the former and the South Atlantic states in the production of the latter. The growth of the Irish potato industry is shown by the following table:—

Year.	Acreage.	Yield (bushels).
1870	1,325,119	114,775,000
1880	1,842,510	167,659,570
1890	2,651,579	148,289,696
1900	2,611,054	210,926,897
1905	2,996,757	260,741,294

The production of sweet potatoes, as reported in census years, was as follows:—

Year.	Acreage.	Yield (bushels).
1869	. .	21,709,824
1879	444,817	33,378,693
1889	524,588	43,950,261
1899	537,447	42,526,696

The total acreage in vegetables reported in 1899 was 5,753,191 or 2 % of the acreage in all crops; the value of the yield was $242,170,148 or 8·3 % of the value of all crops.

The value of the fruit crop of 1899 was $131,423,517; the value of orchard fruits was $83,751,840; of grapes, $14,090,937; of small fruits, $25,030,877; of sub-tropical fruits, $8,549,863. The development of fruit-growing during the decade 1889–1899 appears from the following table:—

Crop.	Yield (bushels).	
	1889.	1899.
Apples	143,105,689	175,397,626
Apricots	1,001,482	2,642,128
Cherries	1,476,719	2,873,499
Peaches	36,367,747	15,433,623[2]
Pears	3,064,375	6,625,417
Plums and Prunes .	2,554,392	8,764,032

In 1899 California contributed 21.5 % of the fruit crop; New York, 12·1%; Pennsylvania, 7·5 %; Ohio, 6·8 %; and Michigan 4·5 %.

Agricultural Education.

The agricultural schools of the United States owe their origin to the movement against the old classical school and in favour of technical education which began in most civilized nations about the middle of the 19th century. A rapidly growing country with great natural resources needed men educated in the sciences and arts of life, and this want was first manifested in the United States by a popular agitation on behalf of agricultural schools. A number of so-called agricultural schools were started between 1850 and 1860 in the eastern and middle states, where the movement made itself most felt, but without trained teachers and suitable methods they accomplished very little. They were only ordinary schools with farms attached. The second constitution of the state of Michigan, adopted in 1850, provided for an agricultural school, and this was the first one established in the United States. The General Assembly of the state of Pennsylvania incorporated the Farmers' High School, now the State College, in 1854. Maryland incorporated her agricultural college in 1856, and Massachusetts chartered a school of agriculture in the same year. The agitation, which finally reached Congress, led to the establishment of the so-called "land-grant" or agricultural colleges. The establishment of these colleges was due chiefly to the wisdom and foresight of Justin S. Morrill, who introduced the first bill for their endowment in the House of Representatives on the 14th of December 1857, saw the latest one approved by the president on the 30th of August 1890, and is justly known, therefore, as the father of the American agricultural colleges. The first act for the benefit of these colleges, passed in 1862, was entitled "An Act donating public lands to the several states and territories which may provide colleges for the benefit of agriculture and the mechanic arts," and granted to each state an amount of land equal to 30,000 acres for each senator and representative in Congress to which the state was entitled at that time. The object of the grant was stated to be "the endowment, support and maintenance of at least one college" (in each state), "where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts . . . in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." The total number of acres of land granted to the states under this act was 10,320,843, of which by far the greater part is sold. This grant has produced an endowment fund amounting to $12,045,629. The land still unsold in 1905 amounted to 844,164 acres, valued at $4,168,746. The invested land-grant funds yielded these colleges a total annual income of $855,083 in 1905. Including the United States appropriation under a supplementary act of 1890, commonly known as the Second Morrill Act, which now gives each college $25,000 a year, the interest on the land-grant and all other invested funds, all state appropriations and other sources of revenue, these colleges had in 1904–1905 a total income of $11,659,955. Sixty-six institutions had been organized under this act up to 1905, of which sixty-three maintain courses in agriculture; twenty-one are departments of agriculture and engineering in state universities; twenty-seven are separate colleges of agriculture and mechanic arts; and the remainder are organized in various other ways. Separate schools for persons of African descent had been established under this act in sixteen southern states. These colleges take students prepared in the common schools and give them a course of from two to four years in the sciences pertaining to agriculture. Many of them offer short courses, varying from four to twelve weeks in length, in agriculture, horticulture, forestry and dairying, which are largely attended. Agricultural experiment stations are connected with all the colleges, and many of them conduct farmers' institutes, farmers' reading clubs and correspondence classes.

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[1] The demand for horses for the British troops in South Africa affected these years.

[2] Decrease due to a severe frost in the winter of 1898–1899, which destroyed the peach crop in most of the states.

The agricultural experiment stations of the United States grew up in connexion with the agricultural colleges. Several of the colleges early attempted to establish separate departments for research and practical experiments, on the plan of the German stations. The act establishing the Agricultural College of Maryland required it to conduct "a series of experiments upon the cultivation of cereals and other plants adapted to the latitude and climate of the state of Maryland." This was the first suggestion of an experiment station in America, but resulted in little. The first experiment station was established at Middletown, Connecticut, in 1875, partly under state aid, partly through a gift from Orange Judd, partly in connexion with the Sheffield Scientific School, which from 1863 to 1892 was the College of Agriculture and Mechanic Arts for the state of Connecticut, and partly under control of Wesleyan University, which contributed the use of its chemical laboratory; in 1877 it was removed to New Haven. The state of Connecticut made in 1875 an appropriation of $2800 (and in 1877 $5000 per annum) for this school—the first state appropriation of the kind. The state of North Carolina established, on the 12th of March 1877, an agricultural experiment and fertilizer control station in connexion with its state university. The Cornell University experiment station was organized by that institution in 1879. The New Jersey station was organized in 1880 and the station of the University of Tennessee in 1882. From these beginnings the experiment stations multiplied until, when Congress passed the National (or Hatch) Experiment Station Act in 1887, there were seventeen already in existence. The Hatch Experiment Station Act, so called from the fact that its leading advocate was William Henry Hatch (1833–1896) of Missouri, appropriated $15,000 a year to each agricultural college for the purpose of conducting an agricultural experiment station. The object of the stations was declared to be, "to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states or territories." The stations were authorized to publish annual reports and also bulletins of progress for free distribution to farmers. The franking privilege was given to these publications. The office of experiment stations, in the Department of Agriculture, was established in 1888 to be the head office and clearing-house of these stations. Agricultural experiment stations are now in operation in all the states and territories, including Alaska, Hawaii, Porto Rico and the Philippines. Alabama, Hawaii, Connecticut, New Jersey and New York each maintain separate stations, supported wholly or in part by state funds; Louisiana has a station for sugar, and Missouri for fruit experiments. Excluding all branch stations, the total number of experiment stations in the United States is sixty, and of these fifty-five receive the national appropriation. The total income of the stations during 1904 was $1,508,820, of which $720,000 was received from the national government and the remainder was derived from societies, fees for analyses of fertilizers, sale of products, &c. The stations employed 795 persons in the work of administration and research; the chief classes being—directors, 71; chemists, 163; agriculturists, 47; agronomists, 41; besides numerous horticulturists, botanists, entomologists, physicists, bacteriologists, dairymen, weather observers and irrigation experts. The stations publish annual reports and bulletins, besides a large number of "press" bulletins, which are reproduced in the agricultural and county papers. They act as bureaus of information on all farm questions, and carry on an extensive correspondence covering all conceivable questions. Their mailing lists aggregate half a million names. In addition to the experiment stations there is in nearly every state an officer or a special board whose duty is to look after its agricultural interests. Eighteen states, one territory, Porto Rico and the Philippine Islands have a single official, usually called the Commissioner of Agriculture. Twenty-six states, one territory and Hawaii, have Boards of Agriculture. Information concerning the Agricultural Department of the United States will be found under Agriculture, Board of.

See the articles on the various sorts of crops; also Cattle, Horse, Pig, Sheep, &c.; Dairy and Dairy-Farming, Horticulture, Fruit and Flower-Farming, Poultry and Poultry-Farming; Soil, Grass and Grassland, Manure, Drainage of Land, Irrigation, Sowing, Reaping, Hay and Hay-Making, Plough, Harrow, Threshing.

Literature.—Besides the contemporary works cited in the text, see the article "Agricultura" in Smith's *Dictionary of Greek and Roman Antiquities* (1890), and the article "Agriculture" in J. A. Barral's *Dictionnaire d'Agriculture* (1885–1892); R. E. Prothero, *Pioneers and Progress of English Farming* (1888); sections on agriculture by W. J. Corbett, R. E. Prothero and W. E. Bear in Traill's *Social England* (1901–1904); J. E. T. Rogers, *History of Agriculture and Prices in England from 1259 to 1793* (7 vols., 1866–1902); W. Cunningham, *Growth of English Industry and Commerce during the Early and Middle Ages* (2 vols., 1905 and 1907); D. M'Donald, *Agricultural Writers from Sir Walter of Henley to Arthur Young, 1200–1800* (London, 1908); H. Rider Haggard, *Rural England*, 2 vols. (1902); *Encyclopaedia of Agriculture*, ed. by C. E. Green and D. Young (Edinburgh, 1907–1908); *Cyclopaedia of American Agriculture*, ed. by L. H. Bailey (New York and London, 1907–1908); W. S. Harwood, *The New Earth* (New York, 1906); T. B. Collins, *The New Agriculture* (New York, 1906); Journals of the Royal Agricultural Society of England and other agricultural societies. Amongst general works on practical agriculture the following may be mentioned:—Stephens's *Book of the Farm*, 3 vols., revised by J. Macdonald (Edinburgh, 1908); William Fream, *Elements of Agriculture* (London, 1905); *Rural Science Series*, ed. by L. H. Bailey (New York and London, 1895, &c.); *Morton's Handbooks of the Farm* (London); R. Wallace, *Farm Livestock of Great Britain* (Edinburgh, 1907); *Youatt's Complete Grasier*, rewritten by W. Fream (London, 1900); E. V. Wilcox, *Farm Animals* (New York, 1907).

(W. Fr.; R. Tr.)

AGRICULTURE, BOARD OF. The Board of Agriculture and Fisheries, in England, owes its foundation to the establishment of a veterinary department of the privy council in 1865, when the country was ravaged by cattle plague. An order in council abolished the name "veterinary department" in 1883 and substituted that of "agricultural department," but no alteration was effected in the work of the department, so far as it related to animals. In 1889 the Board of Agriculture (for Great Britain) was formed under an act of parliament of that year, and the immediate control of the agricultural department was transferred from the clerk of the privy council to the secretary of the Board of Agriculture, where it remains.

A minister of agriculture had for years been asked for in the interests of the agricultural community, and the functions of this office are discharged by the president of the Board of Agriculture and Fisheries, whose appointment is a political one, and may or may not carry with it a seat in the cabinet. The board consists of the lord president of the council, the five principal secretaries of state, the first lord of the treasury, the chancellor of the exchequer, the chancellor of the duchy of Lancaster and the secretary for Scotland. The establishment consists of a president, secretary, assistant secretaries, &c. The salary of the president is £2000 a year, and that of the secretary £1500 a year.

The Board of Agriculture on its establishment took over from the privy council the responsibilities of the Contagious Diseases (Animals) Acts, besides the comprehensive duties of the Land Commission. The board, through its intelligence division, collects and prepares statistics relating to agriculture and forestry, and in 1904 appointed a number of honorary agricultural correspondents throughout the country for the purpose of bringing to the notice of the board any special circumstances affecting the practice of agriculture, horticulture and forestry, or the transport of farm, garden and forest produce in their districts. The land division of the board prepares the annual agricultural and produce returns, and the three divisions, the animals, intelligence and land, take proceedings under the following acts:—the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, the Sale of Food and Drugs Acts 1875 to 1899, the Merchandise Marks Acts 1887 to 1905, the Fertilizers and Feeding Stuffs Act 1893, the Tithe Acts 1836 to 1891, the Copyhold Act 1894, the Inclosure Acts 1845 to 1899, the Agricultural Holdings Acts 1883 to 1900, the Drainage and Improvement of Land Acts, the Universities and College Estates Acts 1858 to 1898, the Glebe Lands Act 1888, &c. The board also has charge of the inspection of schools (not being public elementary schools) in which technical instruction is given in agriculture or forestry, and institutes such experimental investigations as may be deemed conducive to the progress of agriculture and forestry.

The Ordnance Survey of the United Kingdom is under the control of the board, as well as the arrangements for the advertisement and sale of the publications of the Geological Survey. In 1903 the powers and duties formerly vested in the commissioners of the Office of Works, relating to the Royal Botanic Gardens, Kew, were transferred to the board. The various departments of the board are (1) chief clerk's branch and indoor branch of animals division; (2) outdoor branch of the animals division; (3) veterinary department; (4) fisheries branch; (5) intelligence department; (6) educational branch; (7) accounts branch; (8) inclosure and common branch; (9) copyhold and tithe branch; (10) statistical branch; (11) law branch; (12) survey, land improvement and land drainage branch.

In 1903, in pursuance of the Board of Agriculture and Fisheries Act 1903, the powers and duties of the Board of Trade under the Salmon and Freshwater Fisheries Acts, the Sea Fisheries Regulation Acts and other acts relating to the industry of fishing, were transferred from that department to the Board of Agriculture, and its name was changed to its present form. The Department of Agriculture and Technical Instruction for Ireland covers much the same ground. The *Annual Report of the Proceedings of the Board of Agriculture under the Tithe and other Acts for 1902* contains a full account of its powers and duties.

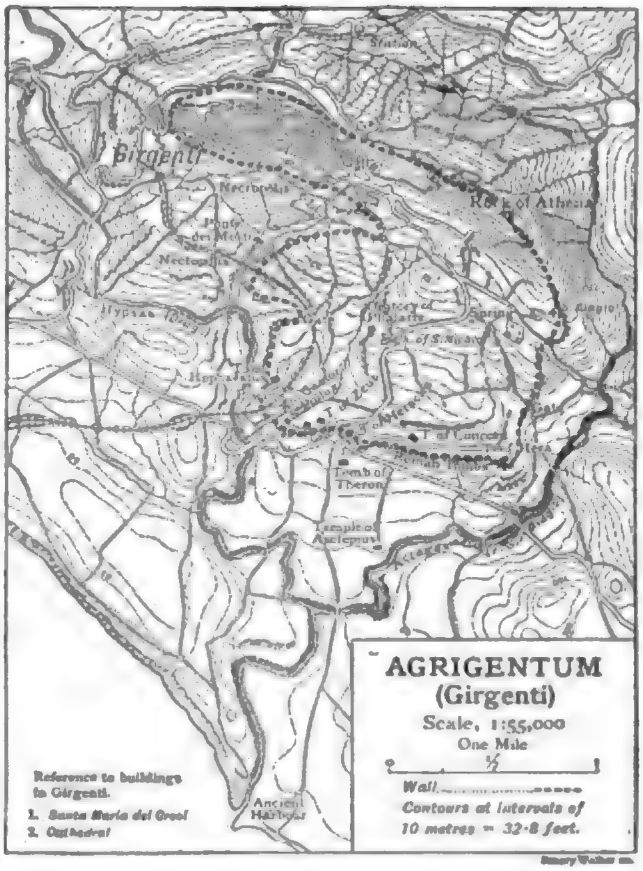
In the British colonies the interests of agriculture are looked after—in New South Wales, by an under-secretary for mines and agriculture; in Victoria, by a member of the executive council who holds the portfolio of lands and agriculture; in Queensland, by an under-secretary for agriculture; in New Zealand, by a minister for lands and agriculture; in Canada (see, for more detail, the article Canada, *Canadian Agriculture*), by a minister for agriculture (the various provinces have also departments of agriculture). The government of India has a secretary of revenue and agriculture. Cape Colony has a secretary for agriculture, a member of the cabinet; in the Transvaal Colony the director of agriculture is a departmental secretary; in Natal, the minister for agriculture is a member of the executive council, and the establishment consists, in addition, of a secretary, a director of agriculture, an entomologist, a dairy expert and a conservator of forests. Cyprus has a director of agriculture.

United States.—The Department of Agriculture dates its rank as an executive department from 1889. It was first established as a department in 1862, ranking as a bureau, with a commissioner in charge. In addition to the commissioner there were appointed a statistician, chemist, entomologist and superintendent of a propagatory and experimental farm. Its scope was then somewhat limited, but its work was gradually enlarged by the appointment of a botanist in 1868, a microscopist in 1871, the creation of a forestry department in 1877, a bureau of animal industry in 1884 and the establishment of agricultural experiment stations throughout the country in 1887. In 1889 the department became an executive department, the principal official being designated Secretary of Agriculture, with a seat in the president's cabinet. His salary is $8000 a year. The secretary is now charged with the supervision of all business relating to the agricultural and productive industries. The fisheries have a separate bureau, and the public lands and mining interests are cared for in the Department of the Interior; but with these exceptions, all the productive interests are looked after by the Department of Agriculture. The department now comprises (1) the weather bureau, which has charge of the forecasting of weather; the issue of storm warnings; the display of weather and flood signals for the benefit of agriculture, commerce and navigation; the gauging and reporting of rivers; the reporting of temperature and rainfall conditions for the cotton, rice, sugar and other interests; the display of frost and cold waves signals; and the distribution of meteorological information in the interest of agriculture and commerce; (2) the bureau of animal industry, which makes investigations as to the existence of contagious pleuro-pneumonia and other dangerous and communicable diseases of live stock, superintends the measures for their extirpation, makes original investigations as to the nature and prevention of such diseases, and reports on the conditions and means of improving the animal industries of the country; (3) the bureau of plant industry, which studies plant life in all its relations to agriculture. Its work is classified under the general subjects of pathological investigations, physiological investigations, taxonomic investigations, agronomic investigations, horticultural investigations and seed and plant introduction investigations; (4) the forest service, which is occupied with experiments, investigations and reports dealing with the subject of forestry, and with the dissemination of information upon forestry matters; (5) the bureau of chemistry, which investigates methods proposed for the analysis of plants, fertilizers and agricultural products, and makes such analyses as pertain in general to the interests of agriculture; (6) the bureau of soils, which is entrusted with the investigation, survey and mapping of soils; the investigation of the cause and prevention of the rise of alkali in the soil and the drainage of soils; and the investigation of the methods of growing, curing and fermentation of tobacco in the different tobacco districts; (7) the bureau of entomology, which obtains and disseminates information regarding insects injurious to vegetation; (8) the bureau of biological survey, which studies the geographic distribution of animals and plants, and maps the natural life zones of the country; it also investigates the economic relations of birds and mammals, and recommends measures for the preservation of beneficial, and the destruction of injurious, species; (9) the division of accounts and disbursements; (10) the division of publications; (11) the bureau of statistics, which collects information as to the condition, prospects and harvests of the principal crops, and of the number and status of farm animals. It records, tabulates and co-ordinates statistics of agricultural production, distribution and consumption, and issues monthly and annual crop reports for the information of producers and consumers. The section of foreign markets makes investigations and disseminates information concerning the feasibility of extending the demands of foreign markets for the agricultural products of the United States; the bureau also makes investigations of land tenures, cost of producing farm products, country life education, transportation and other lines of rural economies; (12) the library; (13) the office of experiment stations which represents the department in its relations to the experiment stations which are now in operation in all the states; it collects and disseminates general information regarding agricultural schools, colleges, stations, and publishes accounts of agricultural investigations at home and abroad; it also indicates lines of inquiry for the stations, aids in the conduct of co-operative experiments, reports upon their expenditures and work, and in general furnishes them with such advice and assistance as will best promote the purposes for which they were established; it conducts investigations relative to irrigation and drainage; (14) the office of public roads, which collects information concerning systems of road management, conducts investigations regarding the best method of road-making, and prepares publications on this subject.

In the following countries there are state departments of agriculture:—Argentina, Belgium, Brazil, (industry, agriculture and public works), Bulgaria (commerce and agriculture), Denmark, France, Norway (agriculture and public accounts), Italy, Japan (agriculture and commerce), Prussia (agriculture, woods and forests), Russia (agriculture and crown domains), Sweden.

AGRIGENTUM (Gr. Ἀκράγας, mod. *Girgenti* (*q.v.*)), an ancient city on the south coast of Sicily, 2½m. from the sea. It was founded (perhaps on the site of an early Sicanian settlement) by colonists from Gela about 582 B.C., and, though the lastest city of importance founded by the Greeks in Sicily, soon acquired a position second to that of Syracuse alone, owing to its favourable situation for trade with Carthage and to the fertility of its territory. Pindar (*Pyth.* xii. 2) calls it *καλλίστα βροτεᾶν πολίων.* The buildings for which it is famous all belong to the first two centuries of its existence. Phalaris, who is said to have roasted his enemies to death in a brazen bull (Pindar, *Pyth.* i. 184), ruled as tyrant from 570 to 554. What form of government was established after his fall is uncertain; we know only that, after a long interval, Theron became tyrant (488–473); but his son Thrasydaeus was expelled after an unsuccessful war with Hiero in 472 and a democracy established. In the struggle between Syracuse and Athens (415–413) the city remained absolutely neutral. Its prosperity continued to increase (its population is given at over 200,000) until in 405 B.C., despite the help of the Siceliot cities, it was captured and plundered by the Carthaginians, a blow from which it never entirely recovered. It was colonized by Timoleon in 338 B.C. with settlers from Velia in Lucania, and in the time of the tyrant Phintias (289–279) it had regained some of its power. In the First Punic War, however, it was sacked by the Romans (261) and the Carthaginians (255), and finally in the Second Punic War by the Romans (210). But it still retained its importance as a trading and agricultural centre, even in the Roman period, exporting not only agricultural products but textile fabrics and sulphur. In the local museum are tiles used for stamping cakes of sulphur, which show that the mines, at any rate from the 3rd century, were imperial property leased to contractors.

The site is one of great natural strength and remarkable beauty, though quite unlike that of other Greek cities in Sicily. The northern portion of it consists of a lofty ridge with two summits, the westernmost of which is occupied by the modern town (985 ft.), while the easternmost, which is slightly higher, bears the name of Rock of Athena, owing to its identification in modern days with the acropolis of Acragas as described by Polybius, who places upon it the temple of Zeus Atabyrius (the erection of which was attributed to the half mythical Phalaris) and that of Athena.[1] It must be confessed that the available space (about 70×20 yds.) on the eastern summit (where there are some remains of ancient buildings) is so small that there would be only room for a single temple, which must have been occupied by the two deities jointly, if the new theory is correct (see *Notizie degli scavi*, 1902, 387 and reff.). In the modern town, on the other hand, the remains of one temple are to be seen in the church of S. Maria dei Greci, while the other is generally supposed to have occupied the site of the cathedral, though no traces of it are visible. But whichever of these two summits was the acropolis proper,[2] it is certain that both were included in the circuit of the city walls. On the north both summits are defended by cliffs; on the south the ground slopes away somewhat abruptly from the eastern summit towards the plateau on which the town stood, while the western summit is separated from this plateau by a valley traversed by a branch of the Hypsas [mod. *Drago*], the deep ravine of which forms the western boundary and defence of the city. On the east of the city is the valley of the Acragas [Fiume S. Biagio], from which the city took its name and which, though shallower than that of the Hypsas, still affords a sufficient obstacle to attack, and the two unite a little way to the south of the town; at the mouth was the ancient harbour, small and now abandoned.



The most famous remains of the ancient city are the temples, the most important of which form a row along the low cliffs at the south end of the city. All are built in the Doric style, of the local porous stone, which is of a warm red brown colour, full of fossil shells and easily corroded when exposed to the air. It should be noted that their traditional names, with the exception of that of Zeus and that of Asclepius, have no foundation in fact, while the attribution of the temple *in antis*, into the *cella* of which the church of S. Biagio has been built, is uncertain.[3] They are described in R. Koldewey and O. Puchstein, *Die griechischen Tempel in Unteritalien und Sicilien* (Berlin, 1899), 138–184. Of all these temples the oldest is probably that of Heracles, while the best preserved are those of Hera and Concordia, which are very similar in dimensions; the latter, indeed, lacks nothing but its roof, owing its preservation to its conversion into the cathedral in 597 by Gregory II., bishop of Girgenti. Both temples belong to the best period of the Doric style and are among the finest in existence. In front of the former, as in front of those of Heracles and Zeus, stood a huge altar for burnt offerings, as long as the façade of the temple itself. The *cella* of the temple of Heracles underwent considerable modifications in Roman times, and the discovery in it of a statue of Asclepius seems to show that the cult of this deity superseded the original one.

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[1] E. A. Freeman, *History of Sicily* (Oxford, 1891), i. 433, accepts the name "Rock of Athena" and yet puts the acropolis on the site of the modern town, arguing further that the cathedral hill was an acropolis within an acropolis (II. and XVII.).

[2] Some writers place Kamikos, the city of the mythical Sican Kokalos, on the site of Acragas or its acropolis; but it appears to have lain to the north-west, possibly at Caltabellotta, 10m. north-east of Sciacca. We hear of it even in the Punic Wars as a fortified post of Acragas (E. A. Freeman, *Hist. of Sic.* i. 495).

[3] The attribution to Demeter is supported by the discovery of votive terra-cottas, representing Demeter and Kore in the neighbourhood, while the conjecture that it was dedicated to the river-god Acragas rests on its position above the river, in the valley of which, indeed, a statue which may represent the deity has been discovered.

In the colossal temple of Zeus the huge Atlantes (figures of Atlas), 25 ft. in height, are noticeable. They seem to have stood in the intercolumniations half-way up the outside wall and to have supported the epistyle. The collapse both of this temple and of that of Heracles must be attributed to an earthquake; many fallen blocks of the former were removed in 1756 for the construction of the harbour of Porto Empedocle. The four columns erected on the site of the temple of Castor and Pollux are a modern (and incorrect) restoration in which portions of two buildings have been used. Of that of Hephaestus only two columns remain, while of that of Asclepius, a mile to the south of the town, an *anta* and two pillars are preserved. It was in the latter temple that the statue of the god by Myron stood; it had probably been carried off to Carthage, was given to the temple by P. Scipio Africanus from the spoils of that city and aroused the cupidity of Verres.

The other remains within the city walls are of surprisingly small importance; near the picturesque church of S. Nicolo is the so-called Oratory of Phalaris, a shrine of the 2nd century B.C., 27¼ ft. long (including the porch) by 23½ ft. wide; and not far off on the east is a large private house with white tesselated pavements, probably pre-Roman in origin but slightly altered in the Roman period (R. P. Jones and E. A. Gardner in *Journal of Hellenic Studies*, xxvi., 1906, 207). Foundations of other buildings are to be seen in other parts of the site, but of little interest. The huge fishpond, spoken of by Diodorus as being 7 stadia in circumference (xi. 25), is to be seen at the south-west corner of the city; it is an enormous excavation in the rock with drains in its sides, at the bottom of which there is now a flourishing orange garden.

	Demeter (Acragas?).	Hera Lacinia.	Concordia.	Heracles.	Zeus.	Castor and Pollux.	Unnamed near Castor and Pollux.	Hephaestus.	Asclepius.	Athena.
Length excluding steps[1] . .	90?	125	129½	220	361	. .	. .	. .	. .	. .
Breadth . .	40¼	55½	55½	83	173	. .	67¼	51½	30½	45
Length of cella .	. .	93	96¼	156	332	91	. .	. .	. .	. .
Breadth of cella .	. .	32½	31½	45¾	144¼	33	. .	. .	. .	. .
Height of columns with capitals .	. .	21	22	33	62½?	19½	. .	. .	. .	. .
Diameter of columns at bottom . .	. .	4½	4½	6½	14	4	. .	5	3½	4¾
Original number of columns . .	. .	34	34	38	38	34	. .	. .	. .	. .
Class . . .	In antis.	Peripteros hexastylos.	Peripteros hexastylos.	Peripteros hexastylos.	Pseudo peripteros heptastylos.	Peripteros hexastylos.	. .	Peripteros hexastylos.	Prostylos pseudo-peripteros.	Peripteros.
Approximate date	450 B.C.	480–440 B.C.	440–420 B.C.	500 B.C.	450 B.C.	338–210 B.C.	. .	after 338 B.C.	before 210 B.C.	488–472 B.C.

The line of the city walls can be distinctly traced for most of the circuit, but the actual remains of them are inconsiderable. On the east and west the ravines already mentioned afforded, in the main, a sufficient protection, so that a massive wall was unnecessary, while near the south-eastern angle a breastwork was formed by the excavation of the natural rock,[2] which in later times was honeycombed with tombs. E. A. Freeman attributes the southern portion of the walls to Theron (*Hist. of Sic.* ii. 224), but the question depends upon the date of the temple of Heracles; and if Koldewey and Puchstein are right in dating it so early as 500 B.C., it is probable that the wall was in existence by that time. Close to this temple on the west is the site of the gate known in later times as the *Porta Aurea*, through which the modern road passes, so that no traces now remain.

Tombs of the Greek period have mainly been found on the west of the town, outside the probable line of the walls, between the Hypsas and a small tributary, the latter having been spanned by a bridge, now called *Ponte dei Morti*, of which one massive pier, 45 ft. in width, still exists. Just outside the south wall is a Roman necropolis, with massive tombs in masonry, and a Christian catacomb, and a little farther south a tomb in two stories, a mixture of Doric and Ionic architecture, belonging probably to the 2nd century B.C., though groundlessly called the Tomb of Theron. A village of the Byzantine period has been explored at Balatizzo, immediately to the south of the modern town (*Notisie degli Scavi*, 1900, 511-520). The walls of the dwellings are entirely cut out of the natural rock.

See J. Schubring, *Historische Topographie von Akragas* (Leipzig, 1870); R. Koldewey and O. Puchstein, *op. cit.*; C. Hülsen in Pauly-Wissowa, *Encyclopädie*, i. 1187. (T. As.)

AGRIMONY (from the Lat. *agrimonia*, a transformation of ἀργεμώνη, a word of unknown etymology), a slender perennial herb (botanical name, *Agrimonia Eupatoria*, natural order Rosaceae), 1½ to 3 ft. high, growing in hedge-banks, copses and borders of fields. The leafy stem ends in spikes of small yellow flowers. The flower-stalk becomes recurved in the fruiting stage, and the fruit bears a number of hooks which enable it to cling to rough objects, such as the coat of an animal, thus ensuring distribution of the seed. The plant is common in Britain and widely spread through the north temperate region. The underground woody stem is astringent and yields a yellow dye.

The name has been unsystematically given to several other plants; for instance: bastard, Dutch, hemp or water agrimony (*Eupatorium cannabinum*); noble or three-leaved agrimony (*Anemone hepatica*); water agrimony (*Bidens*); and wild agrimony (*Potentilla anserina*).

AGRIONIA, an ancient Greek festival, which was celebrated annually at Orchomenus in Boeotia and elsewhere, in honour of Dionysus Agrionius, by women and priests at night. The women, after playfully pretending for some time to search for the god, desisted, saying that he had hidden himself among the Muses. The tradition is that the daughters of Minyas, king of Orchomenus, having despised the rites of the god, were seized with frenzy and ate the flesh of one of their children. At this festival it was originally the custom for the priest of the god to pursue a woman of the Minyan family with a drawn sword and kill her. (Plutarch, *Quaest. Rom.* 102, *Quaest. Graecae* 38.)

AGRIPPA, a sceptical philosopher, whose date cannot be accurately determined. He must have lived later than Aenesidemus, who is generally said to have been a contemporary of Cicero. To him are ascribed the five tropes (πέντε τρόποι) which, according to Sextus Empiricus, summarize the attitude of the later ancient sceptics. The first trope emphasizes the disagreement of philosophers on all fundamental points; knowledge comes either from the senses or from reason. Some thinkers hold that nothing is known but the things of sense; others that the things of reason alone are known; and so on. It follows that the only wise course is to be content with an attitude of indifference, neither to affirm nor to deny. The second trope deals with the validity of proof; the proof of one so-called fact depends on another fact which itself needs demonstration, and so on *ad infinitum*. The third points out that the data of sense are relative to the sentient being, those of reason to the intelligent mind; that in different conditions things themselves are seen or thought to be different. Where, then, is the absolute criterion? Fourthly, if we examine things fairly, we see that in point of fact all knowledge depends on certain hypotheses, or facts taken for granted. Such knowledge is fundamentally hypothetical, and might well be accepted as such without the labour of a demonstration which is logically invalid. The fifth trope points out the impossibility of proving the sensible by the intelligible inasmuch as it remains to establish the intelligible in its turn by the sensible. Such a process is a vicious circle and has no logical validity. A comparison of these tropes with the ten tropes enumerated in the article AENESIDEMUS shows that scepticism has made an advance into the more abtruse questions of metaphysics. The first and the third include all the ideas expressed in the ten tropes, and the other three systematize the more profound difficulties which new thinkers had developed. Aenesidemus was content to attack the validity of sense-given knowledge; Agrippa goes further and impugns the possibility of all truth whatever. His reasons are those of modern scepticism, the reasons which by their very nature are not susceptible of disproof.

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[1] Dimensions in English feet.

[2] Polybius ix. 27 κεῖται τὸ τεῖχος ἐπὶ πέτρας ἀκροτόμου καὶ περιρρῶγος, ᾗ μὲν αὐτοφυοῦς ᾗ δὲ χειροποιήτου.

See Diogenes Laertius x. 88, and Zeller's *Greek Philosophy*. Also the articles SCEPTICISM; AENESIDEMUS.

AGRIPPA, HEROD, I. (*c.* 10 B.C.–A.D. 44), king of Judea, the son of Aristobulus and Berenice, and grandson of Herod the Great, was born about 10 B.C. His original name was Marcus Julius Agrippa. Josephus informs us that, after the murder of his father, Herod the Great sent him to Rome to the court of Tiberius, who conceived a great affection for him, and placed him near his son Drusus, whose favour he very soon won. On the death of Drusus, Agrippa, who had been recklessly extravagant, was obliged to leave Rome, overwhelmed with debt. After a brief seclusion, Herod the Tetrarch, his uncle, who had married Herodias, his sister, made him *Agoranomos* (Overseer of Markets) of Tiberias, and presented him with a large sum of money; but his uncle being unwilling to continue his support, Agrippa left Judea for Antioch and soon after returned to Rome, where he was welcomed by Tiberius and became the constant campanion of the emperor Gaius (Caligula), then a popular favourite. Agrippa being one day overheard by Eutyches, a slave whom he had made free, to express a wish for Tiberius' death and the advancement of Gaius, was betrayed to the emperor and cast into prison. In A.D. 37 Caligula, having ascended the throne, heaped wealth and favours upon Agrippa, set a royal diadem upon his head and gave him the tetrarchy of Batanaea and Trachonitis, which Philip, the son of Herod the Great, had formerly possessed. To this he added that held by Lysanias; and Agrippa returned very soon into Judea to take possession of his new kingdom. In A.D. 39 he returned to Rome and brought about the banishment of Herod Antipas, to whose tetrarchy he succeeded. On the assassination of Caligula (A.D. 41) Agrippa contributed much by his advice to maintain Claudius in possession of the imperial dignity, while he made a show of being in the interest of the senate. The emperor, in acknowledgment, gave him the government of Judea, while the kingdom of Chalcis in Lebanon was at his request given to his brother Herod. Thus Agrippa became one of the greatest princes of the east, the territory he possessed equalling in extent that held by Herod the Great. He returned to Judea and governed it to the great satisfaction of the Jews. His zeal, private and public, for Judaism is celebrated by Josephus and the rabbis; and the narrative of Acts xii. gives a typical example of it. About the feast of the Passover A.D. 44, James the elder, the son of Zebedee and brother of John the evangelist, was seized by his order and put to death. He proceeded also to lay hands on Peter and imprisoned him. After the Passover he went to Caesarea, where he had games performed in honour of Claudius, and the inhabitants of Tyre and Sidon waited on him to sue for peace. According to the story in Acts xii., Agrippa, gorgeously arrayed, received them in the theatre, and addressed them from a throne, while the audience cried out that his was the voice of a god. But "the angel of the Lord smote him," and shortly afterwards he died "eaten of worms." The story in Acts differs slightly from that in Josephus, who describes how in the midst of his elation he saw an owl perched over his head. During his confinement by Tiberius a like omen had been interpreted as portending his speedy release, with the warning that should he behold the same sight again he would die within five days. He was immediately smitten with violent pains, and after a few days died. Josephus says nothing of his being "eaten of worms," but the discrepancies between the two stories are of slight moment. A third account omits all the apocryphal elements in the story and says that Agrippa was assassinated by the Romans, who objected to his growing power.

See articles in *Ency. Bibl.* (W. J. Woodhouse), *Jewish Ency.* (M. Brann), with further references; N. S. Libowitz, *Herod and Agrippa* (New York, 2nd ed., 1898); Grätz, *Geschichte d. Juden*, iii. 318-361.

AGRIPPA, HEROD, II. (27–100), son of the preceding, and like him originally Marcus Julius Agrippa, was born about A.D. 27, and received the tetrarchy of Chalcis and the oversight of the Temple on the death of his uncle Herod, A.D. 48. In A.D. 53 he was deprived of that kingdom by Claudius, who gave him other provinces instead of it. In the war which Vespasian carried on against the Jews Herod sent him 2000 men, by which it appears that, though a Jew in religion, he was yet entirely devoted to the Romans, whose assistance indeed he required to secure the peace of his own kingdom. He died at Rome in the third year of Trajan, A.D. 100. He was the seventh and last king of the family of Herod the Great. It was before him and his sister Berenice (*q.v.*, B.2) that St Paul pleaded his cause at Caesarea (Acts xxvi.). He supplied Josephus with information for his history.

AGRIPPA, MARCUS VIPSANIUS (63–12 B.C.), Roman statesman and general, son-in-law and minister of the emperor Augustus, was of humble origin. He was of the same age as Octavian (as the emperor was then called), and was studying with him at Apollonia when news of Julius Caesar's assassination (44) arrived. By his advice Octavian at once set out for Rome. Agrippa played a conspicuous part in the war against Lucius, brother of Mark Antony, which ended in the capture of Perusia (40). Two years later he put down a rising of the Aquitanians in Gaul, and crossed the Rhine to punish the aggressions of the Germans. On his return he refused a triumph but accepted the consulship (37). At this time Sextus Pompeius, with whom war was imminent, had command of the sea on the coasts of Italy. Agrippa's first care was to provide a safe harbour for his ships, which he accomplished by cutting through the strips of land which separated the Lacus Lucrinus from the sea, thus forming an outer harbour; an inner one was also made by joining the lake Avernus to the Lucrinus (Dio Cassius xlviii. 49; Pliny, *Nat. Hist.* xxxvi. 24). About this time Agrippa married Pomponia, daughter of Cicero's friend Pomponius Atticus. Having been appointed naval commander-in-chief he put his crews through a course of training, until he felt in a position to meet the fleet of Pompeius. In 36 he was victorious at Mylae and Naulochus, and received the honour of a naval crown for his services. In 33 he was chosen aedile and signalized his tenure of office by effecting great improvements in the city of Rome, restoring and building aqueducts, enlarging and cleansing the sewers, and constructing baths and porticos, and laying out gardens. He also first gave a stimulus to the public exhibition of works of art. The emperor's boast that he had found the city of brick but left it of marble ("marmoream se relinquere, quam latericiam accepisset," Suet. *Aug.* 29) might with greater propriety have been uttered by Agrippa. He was again called away to take command of the fleet when the war with Antony broke out. The victory at Actium (31), which gave the mastery of Rome and the empire of the world to Octavian, was mainly due to Agrippa. As a token of signal regard Octavian bestowed upon him the hand of his niece Marcella (28). We must suppose that his wife Pomponia was either dead or divorced. In 27 Agrippa was consul for the third time, and in the following year the senate bestowed upon Octavian the emperial title of Augustus. Probably in commemoration of the battle of Actium, Agrippa built and dedicated the Pantheum still in existence as *La Rotonda*. The inscription on the portico states that it was erected by him during his third consulship. His friendship with Augustus seems to have been clouded by the jealousy of his father-in-law Marcellus, which was probably fomented by the intrigues of Livia, the second wife of Augustus, who feared his influence with her husband. The result was that Agrippa left Rome, ostensibly to take over the governorship of Syria—a sort of honourable exile; but as a matter of fact he only sent his legate to the East, while he himself remained at Lesbos. On the death of Marcellus, which took place within a year, he was recalled to Rome by Augustus, who found he could not dispense with his services. It is said that by the advice of Maecenas he resolved to attach Agrippa still more closely to him by making him his son-in-law. He accordingly induced him to divorce Marcella and marry his daughter Julia (21), the widow of Marcellus, equally celebrated for her beauty and abilities and her shameless profligacy. In 19 Agrippa was employed in putting down a rising of the Cantabrians in Spain. He was appointed governor of Syria a second time (17), where his just and prudent administration won him the respect and good-will of the provincials, especially the Hebrew population. His last public service was the bloodless suppression of an insurrection in Pannonia (13). He died at Campania in March of the year following his fifty-first year. Augustus honoured his memory by a magnificent funeral.

Agrippa was also known as a writer, especially on geography. Under his supervision Julius Caesar's design of having a complete survey of the empire made was carried out. From the materials at hand he constructed a circular chart, which was engraved on marble by Augustus and afterwards placed in the colonnade built by his sister Polla. Amongst his writings an autobiography, now lost, is referred to. Agrippa left several children; by Pomponia, a daughter Vipsania, who became the wife of the emperor Tiberius; by Julia three sons, Gaius and Lucius Caesar and Agrippa Postumus, and two daughters, Agrippina the elder, afterwards the wife of Germanicus, and Julia, who married Lucius Aemilius Paullus.

See Dio Cassius xlix.-liv.; Suetonius, *Augustus*; Velleius Paterculus ii.; Josephus, *Antiq. Jud.* xv. 10, xvi. 2; Turnbull, *Three Dissertations*, one of the characters of Horace, Augustus and Agrippa (1740); Frandsen, *Marcus Vipsanius Agrippa* (1836); Motte, *Étude sur Marcus Agrippa* (1872); Nispi-Landi, *Marcus Agrippa e i suoi tempi* (1901); D. Detlefsen, *Ursprung, Einrichtung und Bedeutung der Erdkarte Agrippas* (1906); V. Gardthausen, *Augustus und seine Zeit*, vol. i. 762 foll., ii. 432 foll.

AGRIPPA VON NETTESHEIM, HENRY CORNELIUS (1486–1535), German writer, soldier, physician, and by common reputation a magician, belonged to a family many members of which had been in the service of the house of Habsburg, and was born at Cologne on the 14th of September 1486. The details of his early life are somewhat obscure, but he appears to have obtained a knowledge of eight languages, to have studied at the university of Cologne and to have passed some time in France. When quite young he entered the service of the German king, Maximilian I., and in 1508 was engaged in an adventurous enterprise in Catalonia. He probably served Maximilian both as soldier and as secretary, but his wonderful and varied genius was not satisfied with these occupations, and he soon began to take a lively interest in theosophy and magic. In 1509 he went to the university of Dôle, where he lectured on John Reuchlin's *De Verbo mirifico*, but his teaching soon caused charges of heresy to be brought against him, and he was denounced by a monk named John Catilinet in lectures delivered at Ghent. As a result Agrippa was compelled to leave Dôle; proceeding to the Netherlands he took service again with Maximilian. In 1510 the king sent him on a diplomatic mission to England, where he was the guest of Colet, dean of St Paul's, and where he replied to the accusations brought against him by Catilinet. Returning to Cologne he followed Maximilian to Italy in 1511, and as a theologian attended the council of Pisa, which was called by some cardinals in opposition to a council called by Pope Julius II. He remained in Italy for seven years, partly in the service of William VI., marquis of Monferrato, and partly in that of Charles III., duke of Savoy, probably occupied in teaching theology and practising medicine.

In 1515 he lectured at the university of Pavia on the *Pimander* of Hermes Trismegistus, but these lectures were abruptly terminated owing to the victories of Francis I., king of France. In 1518 the efforts of one or other of his patrons secured for Agrippa the position of town advocate and orator, or syndic, at Metz. Here, as at Dôle, his opinions soon brought him into collision with the monks, and his defence of a woman accused of witchcraft involved him in a dispute with the inquisitor, Nicholas Savin. The consequence of this was that in 1520 he resigned his office and returned to Cologne, where he stayed about two years. He then practised for a short time as a physician at Geneva and Freiburg, but in 1524 went to Lyons on being appointed physician to Louise of Savoy, mother of Francis I. In 1528 he gave up this position, and about this time was invited to take part in the dispute over the legality of the divorce of Catherine of Aragon by Henry VIII.; but he preferred an offer made by Margaret, duchess of Savoy and regent of the Netherlands, and became archivist and historiographer to the emperor Charles V. Margaret's death in 1530 weakened his position, and the publication of some of his writings about the same time aroused anew the hatred of his enemies; but after suffering a short imprisonment for debt at Brussels he lived at Cologne and Bonn, under the protection of Hermann of Wied, archbishop of Cologne. By publishing his works he brought himself into antagonism with the Inquisition, which sought to stop the printing of *De occulta philosophia*. He then went to France, where he was arrested by order of Francis I. for some disparaging words about the queen-mother; but he was soon released, and on the 18th of February 1535 died at Grenoble. He was married three times and had a large family. Agrippa was a man of great ability and undoubted courage, but he lacked perseverance and was himself responsible for many of his misfortunes. In spite of his inquiring nature and his delight in novelty, he remained a Catholic, and had scant sympathy with the teaching of the reformers. His memory was nevertheless long defamed in the writings of the monks, who placed a malignant inscription over his grave. Agrippa's work, *De occulta philosophia*, was written about 1510, partly under the influence of the author's friend, John Trithemius, abbot of Würzburg, but its publication was delayed until 1531, when it appeared at Antwerp. It is a defence of magic, by means of which men may come to a knowledge of nature and of God, and contains Agrippa's idea of the universe with its three worlds or spheres. His other principal work, *De Incertitudine et Vanitate Scientiarum et Artium atque Excellentia Verbi Dei Declamatio*, was written about 1527 and published at Antwerp in 1531. This is a sarcastic attack on the existing sciences and on the pretensions of learned men. In it Agrippa denounces the accretions which had grown up around the simple doctrines of Christianity, and wishes for a return to the primitive belief of the early Christian church. He also wrote *De Nobilitate et Praecellentia Feminei Sexus*, dedicated to Margaret of Burgundy, *De matrimonii sacramento* and other smaller works. An edition of his works was published at Leiden in 1550 and they have been republished several times.

See H. Morley, *Life of H. C. Agrippa* (London, 1856); A. Prost, *Les Sciences et les arts occultes au XVI. siècle: Corneille Agrippa, sa vie et ses œuvres* (Paris, 1881); A. Daguet, *Cornelius Agrippa* (Paris, 1856).

AGRIPPINA, the "elder," daughter of Marcus Vipsanius Agrippa by his third wife Julia, was the grand-daughter of Augustus and the wife of Germanicus. She accompanied her husband to Germany, when the legions on the Rhine revolted after the death of Augustus (A.D. 14). Three years later she was in the East with Germanicus (*q.v.*), who died at Antioch in 19, poisoned, it was said, by order of Cn. Calpurnius Piso, governor of Syria. Eager to avenge his death, she returned to Rome and boldly accused Piso of the murder of Germanicus. To avoid public infamy Piso committed suicide. Tiberius and his favourite Sejanus feared that her ambition might lead her to attempt to secure the throne for her children, and she was banished to the island of Pandataria off the coast of Campania, where she died on the 18th of October 33, starved to death by herself, or, according to some, by order of Tiberius. Two of her sons, Nero and Drusus, had already fallen victims to the machinations of Sejanus. Agrippina had a large family by Germanicus, several of whom died young, while only two are of importance—Agrippina the "younger" and Gaius Caesar, who succeeded Tiberius under the name of Caligula. It is remarkable that, although Tiberius had ordered the execution of his elder brothers, by his will he left Caligula one of the heirs of the Empire. Agrippina was a woman of the highest character and exemplary morality. There is a portrait of her in the Capitoline Museum at Rome, and a bronze medal in the British Museum representing the bringing back of her ashes to Rome by order of Caligula.

See Tac. *Ann.* i.-vi.; Suetonius, *Tiberius*, 53; Dio Cassius lvii. 6, lviii. 22, lix. 3; Elizabeth Hamilton, *Memoirs of the Life of Agrippina* (1804); Burkhard, *Agrippina, des Agrippa Tochter* (1846); Stahr, *Römische Kaiserfrauen* (1880).

AGRIPPINA, the "younger" (A.D. 16–59), daughter of Germanicus and Agrippina the elder, sister of Caligula and mother of Nero, was born at Oppidum Ubiorum on the Rhine, afterwards named in her honour Colonia Agrippinae (mod. Cologne). Her life was notorious for intrigue and perfidy. By her first husband, Gnaeus Domitius Ahenobarbus, she was the mother of the emperor Nero; her second husband was Passienus Crispus, whom she was accused of poisoning. Assisted by the influential freedman Pallas, she induced her uncle the emperor Claudius to marry her after the death of Messalina, and adopt the future Nero as heir to the throne in place of Britannicus. Soon afterwards she poisoned Claudius and secured the throne for her son, with the intention of practically ruling on his behalf. Being alarmed at the influence of the freedwoman Acte over Nero, she threatened to support the claims of the rightful heir Britannicus. Nero thereupon murdered the young prince and decided to get rid of his mother. Pretending a reconciliation, he invited her to Baiae, where an attempt was made to drown her on a vessel especially constructed to founder. As this proved a failure, he had her put to death at her country house. Agrippina wrote memoirs of her times, referred to by Tacitus (*Ann.* iv. 53). Her character is set forth in Racine's *Britannicus*.

See Tac. *Ann.* xii., xiii., xiv.; Dio Cassius lix.-lxi.; Suetonius, *Nero*, 34; Stahr, *Agrippina, die Mutter Neros* (1880); Raffay, *Die Memoiren der Kaiserin Agrippina* (1884); B. W. Henderson, *The Life and Principate of the Emperor Nero* (1903); also article NERO.

AGROTERAS THUSIA, an annual festival held at Agrae near Athens, in honour of Artemis Agrotera, in fulfilment of a vow made by the city, before the battle of Marathon, to offer in sacrifice a number of goats equal to that of the Persians slain in the conflict. The number being so great, it was decided to offer 500 goats yearly.

See Plutarch, *De Malignitate Herodoti*, 26; Xenophon, *Anab.* iii. 2. 12; Aelian, *Var. Hist.* ii. 25; Schol. on Aristophanes, *Equites*, 660.

AGUADILLA, a town and port near the northern extremity of the W. coast of Porto Rico. Pop. (1899) 6425. It has a fairly good and safe anchorage, and is the commercial outlet for a very fertile agricultural district. The town is attractively situated and well built, and is connected by railway with Mayaguez, 20 m. distant, and also with Ponce and San Juan. The neighbouring district produces sugar-cane, tobacco, cattle, cocoanuts, oranges and lemons. The bay is supposed to have been first visited by Columbus (November 1493), though the town was not founded until 1775.

AGUADO, ALEXANDRE MARIE, marquis de Las Marismas del Guadalquivir, viscount de Monte Ricco (1784–1842), Spanish banker, was born of Jewish parentage at Seville, on the 29th of June 1784. He began life as a soldier, fighting with distinction in the Spanish war of independence on the side of Joseph Bonaparte. After the battle of Baylen (1808) he entered the French army, in which he rose to be colonel and aide-de-camp to Marshal Soult. He was exiled in 1815, and immediately started business as a commission-agent in Paris, where, chiefly through his family connexions in Havana and Mexico, he acquired in a few years enough wealth to enable him to undertake banking. The Spanish government gave him full powers to negotiate the loans of 1823, 1828, 1830 and 1831; and Ferdinand VII. rewarded him with the title of marquis, the decorations of several orders and valuable mining concessions in Spain. Aguado also negotiated the Greek loan of 1834. In 1828, having become possessed of large estates in France, including the château Margaux, famous for its wine, he was naturalized as a French citizen. He died at Gijon in Spain on the 14th of April 1842, leaving a fortune computed at 60,000,000 francs, and a splendid collection of pictures which at his death was bought by the French government.

AGUASCALIENTES, an inland state of Mexico, bounded N., E. and W. by the state of Zacatecas, and S. by Jalisco. Pop. (est. 1900) 102,416, a gradual decrease since the census years of 1895 and 1879; area, 2970 sq. m. The state occupies an elevated plateau, extending from two spurs of the Sierra Madre, called the Sierra Fria and Sierra de Laurel, eastward to the rolling fertile plains of its eastern and south-eastern districts. It is well watered by numerous small streams and one larger river, the Aguascalientes or Rio Grande, and has a mild healthy climate with a moderate rainfall. The fertile valleys of the north and west are devoted to agriculture and the plains to stock-raising. Indian corn, flour, cattle, horses, mules and hides are exported to the neighbouring states. Mining industries are still undeveloped, but considerable progress has been made in manufactures, especially of textile fabrics. The state has good railway communications and a prosperous trade. The capital, Aguascalientes, named from the medicinal hot springs near it, is a flourishing commercial and manufacturing city. Pop. (est. 1900) 35,052. It has cotton factories, smelting works, potteries, tanneries, distilleries, and wagon and tobacco factories. It is a station on the Mexican Central railway, 364 m. by rail north-west of the city of Mexico, and is connected by rail with Tampico on the Gulf of Mexico. The city is well built, has many fine churches and good public buildings, street cars and electric lights. The surrounding district is well cultivated and produces an abundance of fruit and vegetables. Other prominent towns of the state are Rincón de Romos (or Victoria de Calpulalpam), Asientos de Ibarra and Calvillo, the first having more and the others less than 5000 inhabitants.

AGUE (from Lat. *acuta*, sharp; sc. *febris*, fever), the common name given to a form or stage of malarial disease; the ague fit is the cold, shivering stage, and hence the word is also loosely used for any such paroxysm. Simple ague is of much the same type whether in temperate or tropical climates, and may take various forms (quotidian, tertian, quartan), passing into "remittent fever." The symptoms are discussed, together with causation, &c., in the article MALARIA. For "brow-ague" see NEURALGIA.

AGUESSEAU, HENRI FRANÇOIS D' (1668–1751), chancellor of France, illustrious for his virtues, learning and talents, was born at Limoges, of a family of the magistrature. His father, Henri d' Aguesseau, a hereditary councillor of the parlement of Metz, was a man of singular ability and breadth of view who, after holding successively the posts of intendant of Limousin, Guyenne and Languedoc, was in 1685 called to Paris as councillor of state, appointed director-general of commerce and manufactures in 1695, president of the council of commerce in 1700 and a member of the council of the regency for finance. By him François d'Aguesseau was early initiated into affairs and brought up in religious principles deeply tinged with Jansenism. He studied law under Jean Domat, whose influence is apparent in both the legal writings and legislative work of the chancellor. When little more than twenty-one years of age he was, through his father's influence with the king, appointed one of the three advocates-general to the parlement of Paris; and the eloquence and learning which he displayed in his first speech gained him a very high reputation. D'Aguesseau was in fact the first great master of forensic eloquence in France.

In 1700 he was appointed procurator-general; and in this office, which he filled for seventeen years, he gained the greatest popularity by his defence of the rights of the Gallican Church in the Quietist troubles and in those connected with the bull *Unigenitus* (see Jansenism). In February 1717 he was made chancellor by the regent Orleans; but was deprived of the seals in January of the following year and exiled to his estate of Fresnes in Brie, on account of his steady opposition to the projects of the famous John Law, which had been adopted by the regent and his ministers. In June 1720 he was recalled to satisfy public opinion; and he contributed not a little by the firmness and sagacity of his counsels to calm the public disturbance and repair the mischief which had been done. Law himself had acted as the messenger of his recall; and it is said that d'Aguesseau's consent to accept the seals from his hand greatly diminished his popularity. The parlement continuing its opposition to the registering of the bull *Unigenitus*, d'Aguesseau, fearing a schism and a religious war in France, assisted Guillaume Dubois, the favourite of the regent, in his endeavour to force the parlement to register the bull, acquiesced in the exile of the magistrates and allowed the Great Council to assume the power of registration, which legally belonged to the parlement alone. The people unjustly attributed his conduct to a base compliance with the favourite. He certainly opposed Dubois in other matters; and when Dubois became chief minister d'Aguesseau was deprived of his office (March 1, 1722).

He retired to his estate, where he passed five years of which he always spoke with delight. The Scriptures, which he read and compared in various languages, and the jurisprudence of his own and other countries, formed the subjects of his more serious studies; the rest of his time was devoted to philosophy, literature and gardening. From these occupations he was recalled to court by the advice of Cardinal Fleury in 1727, and on the 15th of August was named chancellor for the third time, but the seals were not restored to him till ten years later. During these years he endeavoured to mediate in the disputes between the court and the parlement. When he was at last reinstated in office, he completely withdrew from all political affairs, and devoted himself entirely to his duties as chancellor and to the achievement of those reforms which had long occupied his thoughts. He aimed, as others had tried before him, to draw up in a single code all the laws of France, but was unable to accomplish his task. Besides some important enactments regarding donations, testaments and successions, he introduced various regulations for improving the forms of procedure, for ascertaining the limits of jurisdictions and for effecting a greater uniformity in the execution of the laws throughout the several provinces. These reforms constitute an epoch in the history of French jurisprudence, and have placed the name of d'Aguesseau in the same rank with those of L'Hôpital and Lamoignon. As a magistrate also he was so conscientious that the duc de Saint-Simon in his *Memoirs* complained that he spent too much time over the cases that came before him.

In 1750, when upwards of eighty-two years of age, d'Aguesseau retired from the duties without giving up the rank of chancellor. He died on the 9th of February of the following year.

His grandson, Henri Cardin Jean Baptiste, Marquis d'Aguesseau (1746–1826), was advocate-general in the parlement of Paris and deputy in the Estates-General. Under the Consulate he became president of the court of appeal and later minister at Copenhagen. He was elected to the French Academy in 1787.

Of d'Aguesseau's works the most complete edition is that of the eminent lawyer Jean Marie Pardessus, published in 16 vols. (1818-1820); his letters were edited separately by Rives (1823); a selection of his works, *Œuvres choisies*, was issued, with a biographical notice, by E. Falconnet in 2 vols. (Paris, 1865). The far greater part of his works relate to matters connected with his profession, but they also contain an elaborate treatise on money; several theological essays; a life of his father, which is interesting from the account which it gives of his own early education; and *Metaphysical Meditations*, written to prove that, independently of all revelation and all positive law, there is that in the constitution of the human mind which renders man a law to himself.

See Boullée, *Histoire de la vie et des ouvrages du chancelier d'Aguesseau* (Paris, 1835); Fr. Monnier, *Le Chancelier d'Aguesseau* (Paris, 1860; 2nd ed., 1863); Charles Butler, *Mem. of Life of H. F. d'Aguesseau*, &c. (1830).

AGUILAR, GRACE (1816–1847), English writer, the daughter of a Jewish merchant in London, was born in June 1816. Her works consist chiefly of religious fiction, such as *The Vale of Cedars* (1850) and *Home Influence* (1847). She also wrote, in defence of her faith and its professors, *The Spirit of Judaism* (1842) and other works. Her services were acknowledged gratefully by the "women of Israel" in a testimonial which they presented shortly before her death, which took place at Frankfort-on-the-Main on the 16th of September 1847.

AGUILAR, or Aguilar de la Frontera, a town of southern Spain, in the province of Cordova; near the small river Cabra, and on the Cordova–Malaga railway. Pop. (1900) 13,236. Aguilar "of the Frontier" was so named in the middle ages from its position on the border of the Moorish territories, which were defended by the castle of Anzur, now a ruin; but the spacious squares and modern houses of the existing town retain few vestiges of Moorish dominion. The olives and white wine of Aguilar are celebrated in Spain, although the wine, which somewhat resembles sherry, is known as Montilla, from the adjacent town of that name. Salt springs exist in the neighbourhood, and to the south there are two small lakes, Zoñar and Rincon, which abound in fish.

ÁGUILAS, a seaport of south-eastern Spain, in the province of Murcia, on the Mediterranean Sea, at the terminus of a railway from Huércal-Overa. Pop. (1900) 15,868. Aguilas is built on the landward side of a small peninsula, between two bays—the Puerto Ponente, a good harbour, on the south-west, and the Puerto Levanto, which is somewhat dangerous to shipping in rough weather, on the north-east. It is the chief outlet for the Spanish trade in esparto grass, and for the iron ore and other mineral products of the neighbourhood. It has also some trade in fruit and grain. The imports consist chiefly of coal. In 1904, 296 vessels, of 238,274 tons, cleared at this port.

AGUILERA, VENTURA RUIZ (1820–1881), Spanish poet, was born in 1820 at Salamanca, where he graduated in medicine. He removed to Madrid in 1844, engaged in journalism and won considerable popularity with a collection of poems entitled *Ecos nacionales* (1849). His *Elegías y Armonías* (1863) was no less successful, but his *Sátiras* (1874) and *Estaciones del año* (1879) showed that his powers were declining. He wrote under the obvious influence of Lamartine, preaching the gospel of liberalism and Christianity in verses which, though deficient in force, leave the impression of a sincere devotion and a charming personality. He became director of the national archaeological museum at Madrid, where he died on the 1st of July 1881.

AGUILLON (Aguilonius), **FRANÇOIS D'** (1566–1617), Flemish mathematician. Having entered the Society of Jesus in 1586, he was successively professor of philosophy at Douai and rector of the Jesuit College at Antwerp. He wrote a treatise on optics in six books (Antwerp, 1613), notable for containing the principles of stereographic projection.

AHAB (in Heb. *'aḥ'āb*, "father's brother"), king of Israel, the son and successor of Omri, ascended the throne about 875 B.C. (1 Kings xvi. 29-34). He married Jezebel, the daughter of the king of Sidon, and the alliance was doubtless the means of procuring him great riches, which brought pomp and luxury in their train. We read of his building an ivory palace and founding new cities, the effect perhaps of a share in the flourishing commerce of Phoenicia.[1] The material prosperity of his reign, which is comparable with that of Solomon a century before, was overshadowed by the religious changes which his marriage involved. Although he was a worshipper of Yahweh, as the names of his children prove (cp. also xxii. 5 seq.), his wife was firmly attached to the worship of the Tyrian Baal, Melkart, and led by her he gave a great impulse to this cult by building a temple in honour of Baal in Samaria. This roused the indignation of those prophets whose aim it was to purify the worship of Yahweh (see ELIJAH). During Ahab's reign Moab, which had been conquered by his father, remained tributary; Judah, with whose king, Jehoshaphat, he was allied by marriage, was probably his vassal; only with Damascus is he said to have had strained relations. The one event mentioned by external sources is the battle at Ḳarḳar (perhaps Apamea), where Shalmaneser II. of Assyria fought a great confederation of princes from Cilicia, N. Syria, Israel, Ammon and the tribes of the Syrian desert (854 B.C.). Here *Aḥabbu Sir'lai* (Ahab the Israelite) with Baasha, son of Ruḥub (Reḥob) of Ammon and nine others are allied with Bir-'idri (Ben-hadad), Ahab's contribution being reckoned at 2000 chariots and 10,000 men. The numbers are comparatively large and possibly include forces from Tyre, Judah, Edom and Moab. The Assyrian king claimed a victory, but his immediate return and subsequent expeditions in 849 and 846 against a similar but unspecified coalition seem to show that he met with no lasting success. According to the Old Testament narratives, however, Ahab with 7000 troops had previously overthrown Ben-hadad and his thirty-two kings, who had come to lay siege to Samaria, and in the following year obtained a remarkable victory over him at Aphek, probably in the plain of Sharon (1 Kings xx.). A treaty was made whereby Ben-hadad restored the cities which his father had taken from Ahab's father (*i.e.* Omri, but see xv. 20, 2 Kings xiii. 25), and trading facilities between Damascus and Samaria were granted. A late popular story (xx. 35-42, akin in tone to xii. 33-xiii. 34) condemned Ahab for his leniency and foretold the destruction of the king and his land. Three years later, war broke out on the east of Jordan, and Ahab with Jehoshaphat of Judah went to recover Ramoth-Gilead and was mortally wounded (xxii.). He was succeeded by his sons (Ahaziah and Jehoram).

It is very difficult to obtain any clear idea of the order of these events (LXX. places 1 Kings xxi. immediately after xix.). How the hostile kings of Israel and Syria came to fight a common enemy, and how to correlate the Assyrian and Biblical records, are questions which have perplexed all recent writers. The reality of the difficulties will be apparent from the fact that it has been suggested that the Assyrian scribe wrote "Ahab" for his son "Jehoram" (Kamphausen, *Chronol. d. hebr. Kön.*, Kittel), and that the very identification of the name with Ahab of Israel has been questioned (Horner, *Proc. Soc. Bibl. Arch.*, 1898, p. 244).[2] Whilst the above passages in 1 Kings view Ahab not unfavourably, there are others which give a less friendly picture. The tragic murder of Naboth (see JEZEBEL), an act of royal encroachment, stirred up popular resentment just as the new cult aroused the opposition of certain of the prophets. The latter found their champion in Elijah, whose history reflects the prophetic teaching of more than one age. (See KINGS.) His denunciation of the royal dynasty, and his emphatic insistence on the worship of Yahweh and Yahweh alone, form the keynote to a period which culminated in the accession of Jehu, an event in which Elijah's chosen disciple Elisha was the leading figure.

The allusions to the statutes and works of Omri and Ahab in Mic. vi. 16 may point to legislative measures of these kings, and the reference to the incidents at the building of Jericho (1 Kings xvi. 34) may be taken to show that foundation sacrifices, familiar in nearly all parts of the world, were not unknown in Israel at this period.[3] This has in fact been confirmed by excavation in Palestine.

Another Ahab is known only as an impious prophet in the time of the Babylonian exile (Jer. xxix. 21). (S. A. C.)

'AḤAI, of Sabḥa, an 8th-century Talmudist of high renown. He was author of *Quaestiones* (*Sheiltoth*), a collection of homilies (at once learned and popular) on Jewish law and ethics. This is recorded to have been the first work written by a Jewish scholar after the completion of the Talmud.

AHASUERUS (the Latinized form of the Hebrew אחשורוש; in LXX. *'Ασσουήρος*, once in Tobit *'Ασύηρος*), a royal Persian or Median name occurring in three of the books of the Old Testament and in one of the books of the Apocrypha. In every case the identification of the person named is a matter of controversy.

In Dan. ix. 1 Ahasuerus is the father of Darius the Mede, who "was made king over the realm of the Chaldeans" after the conquest of Babylon and death of Belshazzar. Who this Darius was is one of the most difficult questions in ancient history. Nabonidos (Nabunaid, Nabu-nahid) was immediately succeeded by Cyrus, who ruled the whole Persian empire. Darius may possibly have acted under Cyrus as governor of Babylon, but this view is not favoured by Dan. vi. 1, vi. 25, for Darius (v. 31) is said to have been sixty-two years old at the time (638 B.C.). This would make him contemporary with Nebuchadrezzar, which agrees with Tob. xiv. 15, where we read "of the destruction of Nineveh, which Nebuchadnezzar and Ahasuerus took captive." As a matter of fact, however, Cyaxares and Nabopolassar were the conquerors of Nineveh, and the latter was the father of Nebuchadrezzar. Cyrus did, on ascending the throne of Babylon, appoint a governor of the province, but his name was Gobryas, the son of Mardonius. The truth is, no doubt, as Prof. Sayce points out, that the book of Daniel was not meant to be strictly historical. As Prof. Driver says, "tradition, it can hardly be doubted, has here confused persons and events in reality distinct" (*Literature of the Old Test.* (6) p. 500).

In Ezra iv. 6 Ahasuerus is mentioned as a king of Persia, to whom the enemies of the Jews sent representations opposing the rebuilding of the temple at Jerusalem. Here the sequence of the reigns in the Biblical writer and in the profane historians—in the one, Cyrus, Ahasuerus, Artaxerxes, Darius; in the other, Cyrus, Cambyses, Smerdis, Darius—led in the past (Ewald, &c.) to the identification of Ahasuerus with Cambyses (529–522 B.C.), son of Cyrus. The name *Khshayârshâ*, however, has been found in Persian inscriptions, and has been thought to be equivalent to the Xerxes (485–465 B.C.) of the Greeks. On Babylonian tablets both the forms *Khishiarshu* and *Akkashiarshi* occur amongst others. Modern scholars, therefore, identify the Ahasuerus of Ezra with Xerxes.

In the book of Esther the king of Persia is called Ahasuerus (rendered in LXX. "Artaxerxes" throughout). The identification of Ahasuerus with Artaxerxes I. Longimanus, the son and successor of Xerxes, though countenanced by Josephus, deserves little consideration. Most students are agreed that he must be a monarch of the Achaemenian dynasty, earlier than Artaxerxes I.; and opinion is divided between Darius Hystaspes and Xerxes. In support of the former view it is alleged, among other things, that Darius was the first Persian king of whom it could be said, as in Esther i. 1, that he "reigned from India even unto Ethiopia, over an hundred and seven and twenty provinces"; and that it was also the distinction of Darius that (Esther x. 1) he laid "a tribute upon the land and upon the isles of the sea" (cf. Herod. iii. 89). In support of the identification with Xerxes it is alleged (1) that the Hebrew 'Aḥashvērosh is the natural equivalent of the old Persian *Khshayarsha*, the true name of Xerxes; (2) that there is a striking similarity of character between the Xerxes of Herodotus and the Ahasuerus of Esther; (3) that certain coincidences in dates and events corroborate this identity, as, *e.g.*, the feast in the king's third year (cf. Esther i. 3 with Herod. vii. 8), the return of Xerxes to Susa in the seventh year of his reign and the marriage of Ahasuerus at Shushan in the same year of his. To this it may be added that the interval of four years between the divorce of Vashti and the marriage of Esther is well accounted for by the intervention of an important series of events fully occupying the monarch's thoughts, such as the invasion of Greece.

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[1] Ahab's ivory palace found its imitators (1 Kings xxii. 39; Am. iii. 15). The ivory was probably brought by the Phoenicians from Cyprus or from one of the works on the coast of Asia Minor.

[2] See the discussions by Cheyne, *Ency. Bib.* col. 91 seq., and by Whitehouse, *Dict. Bib.* i. 53.

[3] See Trumbull, *Threshold Covenant*, pp. 46 sqq.; Haddon, *Study of Man*, pp. 347 sqq.; P. Sartori, *Zeitschr. für Ethnologie*, 1898, pp. 1 seq.

See articles "Ahasuerus" in the *Encyclopaedia Biblica*, Hastings' *Dictionary*, the *Jewish Encyclopaedia*; S. R. Driver, *Introd. to the Lit. of the Old Test.*; Friedrich Delitzsch in the *Calwer Bibellexikon* (1893).

AHAZ (Heb. for "[Yahweh] holds"), son of Jotham, grandson of Uzziah or Azariah and king of Judah. After the death of Menahem, Pekah, king of Israel, and Rezin (rather Rasun), king of Syria, allied against Assyria, invaded Judah, and laid siege to Jerusalem in the hope of setting up one of their puppets upon the throne. At the same time the Edomites recovered Elath on the Gulf of Akabah (so read in 2 Kings xvi. 6; cp. also 2 Chron. xxviii. 16 sqq.) and Judah was isolated. Notwithstanding the counsel of Isaiah (Is. vii. 1-17), Ahaz lost heart and used the temple funds to call in the aid of Tiglath-pileser IV., who after attacking the Philistines destroyed the power of Syria, taking care to exact heavy tribute from Judah, which led to further despoliation of the temple. It was as a vassal that Ahaz presented himself to the Assyrian king at Damascus, and he brought back religious innovations (2 Kings xvi. 10 sqq.; for the priest Urijah see Is. viii. 2) and new ideas to which he proceeded to give effect. His buildings are referred to in 2 Kings xx. 11, xxiii. 12; cf. perhaps Jer. xxii. 15: "art thou a true king because thou viest with Ahaz" (see the LXX.). Ahaz was succeeded by his son Hezekiah.

On the ritual changes which he introduced see W. R. Smith, *Relig. of Semites* (2), pp. 485 sqq.; and on his reign, idem, *Prophets of Israel* (2), pp. 415 sqq. On 2 Kings xvi. 3 (cf. 2 Chron. xxviii. 3) see Moloch. See further Isaiah and Jews.

AHAZIAH ("he whom Yahweh sustains"), the name of two kings in the Bible, one of Israel, the other of Judah. (1) Ahaziah, 8th king of Israel, was the son and successor of Ahab, and reigned for less than two years. On his accession the Moabites refused any longer to pay tribute. Ahaziah lost his life through a fall from the lattice of an upper room in his palace, and it is stated that in his illness he sent to consult the oracle of Baal-zebub at Ekron; his messengers, however, were met by Elijah, who bade them return and tell the king he must die (2 Kings i. 2-17; cf. Luke ix. 54-56). (2) Ahaziah, 6th king of Judah, was the son of Jehoram and Ahab's daughter Athaliah, and reigned one year. He is described as a wicked and idolatrous king, and was slain by Jehu, son of Nimshi. He is variously called Jehoahaz and Azariah.

AHENOBARBUS ("brazen-bearded"), the name of a plebeian Roman family of the gens Domitia. The name was derived from the red beard and hair by which many of the family were distinguished. Amongst its members the following may be mentioned:—

Gnaeus Domitius Ahenobarbus, tribune of the people 104 B.C., brought forward a law (*lex Domitia de Sacerdotiis*) by which the priests of the superior colleges were to be elected by the people in the *comitia tributa* (seventeen of the tribes voting) instead of by co-optation; the law was repealed by Sulla, revived by Julius Caesar and (perhaps) again repealed by Marcus Antonius, the triumvir (Cicero, *De Lege Agraria*, ii. 7; Suetonius, *Nero*, 2). Ahenobarbus was elected pontifex maximus in 103, consul in 96 and censor in 92 with Lucius Licinius Crassus the orator, with whom he was frequently at variance. They took joint action, however, in suppressing the recently established Latin rhetorical schools, which they regarded as injurious to public morality (Aulus Gellius xv. 11).

Lucius Domitius Ahenobarbus, son of the above, husband of Porcia the sister of Cato Uticensis, friend of Cicero and enemy of Caesar, and a strong supporter of the aristocratical party. At first strongly opposed to Pompey, he afterwards sided with him against Caesar. He was consul in 54 B.C., and in 49 he was appointed by the senate to succeed Caesar as governor of Gaul. After the outbreak of the civil war he commanded the Pompeian troops at Corfinium, but was obliged to surrender. Although treated with great generosity by Caesar, he stirred up Massilia (Marseilles) to an unsuccessful resistance against him. After its surrender, he joined Pompey in Greece and was slain in the flight after the battle of Pharsalus, in which he commanded the right wing against Antony (Caesar, *Bellum Civile*, i., ii., iii.; Dio Cassius xxxix., xli.; Appian, *B.C.* ii. 82).

Gnaeus Domitius Ahenobarbus, son of the above, accompanied his father at Corfinium and Pharsalus, and, having been pardoned by Caesar, returned to Rome in 46. After Caesar's assassination he attached himself to Brutus and Cassius, and in 43 was condemned by the lex Pedia as having been implicated in the plot. He obtained considerable naval successes in the Ionian Sea against the triumvirate, but finally, through the mediation of Asinius Pollio, became reconciled to Antony, who made him governor of Bithynia. He took part in Antony's Parthian campaigns, and was consul in 32. When war broke out between Antony and Octavian, he at first supported Antony, but, disgusted with his intrigue with Cleopatra, went over to Octavian shortly before the battle of Actium (31). He died soon afterwards(Dio Cassius xlviii.-l; Appian, *Bell. Civ.* iv., v.). His son was married to Antonia, daughter of Antony, and became the grandfather of the emperor Nero.

See Drumann, *Geschichte Rom.*, 2nd ed. by Groebe, vol. iii. pp. 14 ff.

AHITHOPHEL (Heb. for "brother of foolishness," *i.e.* foolish!), a man of Judah whose son was a member of David's bodyguard. He was possibly the grandfather of Bathsheba (see 2 Sam. xi. 3, xxiii. 34), a view which has been thought to have some bearing on his policy. He was one of David's most trusted advisers, and his counsel was "as though one inquired of the word of God." He took a leading part in Absalom's revolt, and his defection was a severe blow to the king, who prayed that God would bring his counsel to "foolishness."

The subsequent events are rather obscure. At Ahithophel's advice Absalom first took the precaution of asserting his claim to the throne by seizing his father's concubines (cf. Abner). The immediate pursuit of David was then suggested; the advice was accepted, and the sequence of events shows that the king, being warned of this, fled across the Jordan (2 Sam. xvi. 20-23, xvii. 1-4, 22). Inconsistent with this is the account of the intervention of Hushai, whose counsel of delay (in order to gather all Israel "from Dan to Beersheba"), in spite of popular approbation, was not adopted, and with this episode is connected the tradition that the sagacious counsellor returned to his home and, having disposed of his estate, hanged himself. Instances of suicide are rare in the Old Testament (cf. Saul), and it is noteworthy that in this case, at least, a burial was not refused. (See further Absalom; David; Samuel, Books of.)

AḤMAD IBN ḤANBAL (780–855), the founder, involuntarily and after his death, of the Ḥanbalite school of canon law, was born at Bagdad in A.H. 164 (A.D. 780) of parents from Merv but of Arab stock. He studied the Koran and its traditions (*hadīth*, *sunna*) there and on a student journey through Mesopotamia, Arabia and Syria. After his return to Bagdad he studied under ash-Shāfi‘ī between 195 and 198, and became, for his life, a devoted Shāfi-‘ite. But his position in both theology and law was more narrowly traditional than that of ash-Shāfi‘ī; he rejected all reasoning, whether orthodox or heretical in its conclusions, and stood for acceptance on tradition (*naql*) only from the Fathers. (See further on this, Mahommedan Religion and Mahommedan Law.) In consequence, when al-Ma'mūn and, after him, al-Mo‘tasim and al-Wāthiq tried to force upon the people the rationalistic Mo‘tazilite doctrine that the Koran was created, Ibn Ḥanbal, the most prominent and popular theologian who stood for the old view, suffered with others grievous imprisonment and scourging. In 234, under al-Motawakkil, the Koran was finally decreed uncreated, and Ibn Ḥanbal, who had come through this trial better than any of the other theologians, enjoyed an immense popularity with the mass of the people as a saint, confessor and ascetic. He died at Bagdad in 241 (A.D. 855) and was buried there. There was much popular excitement at his funeral, and his tomb was known and visited until at least the 14th century A.D.

On his great work, the *Musnad*, a collection of some thirty thousand selected traditions, see Goldziher in *ZDMG*, l. 465 ff. For his life and works generally see W. M. Patten, *Ahmed ibn Hanbal and the Mihna*; C. Brockelmann, *Geschichte der Arab. Lit.* i. 181 ff.; F. Wüstenfeld, *Schāfi'iten*, 55 ff.; M'G. de Slane's transl. of *Ibn Khallikan*, i. 44 ff.; Macdonald, *Development of Muslim Theology*, 110, 157, index. (D. B. Ma.)

AHMAD SHAH (1724–1773), founder of the Durani dynasty in Afghanistan, was the son of Sammaun-Khan, hereditary chief of the Abdali tribe. While still a boy Ahmad fell into the hands of the hostile tribe of Ghilzais, by whom he was kept prisoner at Kandahar. In March 1738 he was rescued by Nadir Shah, who soon afterwards gave him the command of a body of cavalry composed chiefly of Abdalis. On the assassination of Nadir in 1747, Ahmad, having failed in an attempt to seize the Persian treasures, retreated to Afghanistan, where he easily persuaded the native tribes to assert their independence and accept him as their sovereign. He was crowned at Kandahar in October 1747, and about the same time he changed the name of his tribe to Durani. Two things may be said to have contributed greatly to the consolidation of his power. He interfered as little as possible with the independence of the different tribes, demanding from each only its due proportion of tribute and military service; and he kept his army constantly engaged in brilliant schemes of foreign conquest. Being possessed of the Koh-i-noor diamond, and being fortunate enough to intercept a consignment of treasure on its way to the shah of Persia, he had all the advantages which great wealth can give. He first crossed the Indus in 1748, when he took Lahore; and in 1751, after a feeble resistance on the part of the Mahommedan viceroy, he became master of the entire Punjab. In 1750 he took Nishapur, and in 1752 subdued Kashmir. His great expedition to Delhi was undertaken in 1756 in order to avenge himself on the Great Mogul for the recapture of Lahore. Ahmad entered Delhi with his army in triumph, and for more than a month the city was given over to pillage. The shah himself added to his wives a princess of the imperial family, and bestowed another upon his son Timur Shah, whom he made governor of the Punjab and Sirhind. As his viceroy in Delhi he left a Rohilla chief in whom he had all confidence, but scarcely had he crossed the Indus when the Mahommedan wazir drove the chief from the city, killed the Great Mogul and set another prince of the family, a tool of his own, upon the throne. The Mahratta chiefs availed themselves of these circumstances to endeavour to possess themselves of the whole country, and Ahmad was compelled more than once to cross the Indus in order to protect his territory from them and the Sikhs, who were constantly attacking his garrisons. In 1758 the Mahrattas obtained possession of the Punjab, but on the 6th of January 1761 they were totally routed by Ahmad in the great battle of Panipat. In a later expedition he inflicted a severe defeat upon the Sikhs, but had to hasten westwards immediately afterwards in order to quell an insurrection in Afghanistan. Meanwhile the Sikhs again rose, and Ahmad was now forced to abandon all hope of retaining the command of the Punjab. After lengthened suffering from a terrible disease, said to have been cancer in the face, he died in 1773, leaving to his son Timur the kingdom he had founded.

AHMED I. (1589–1617), sultan of Turkey, was the son of Mahommed III., whom he succeeded in 1603, being the first Ottoman sultan who reached the throne before attaining his majority. He was of kindly and humane disposition, as he showed by refusing to put to death his brother Mustafa, who eventually succeeded him. In the earlier part of his reign he gave proofs of decision and vigour, which were belied by his subsequent conduct. The wars which attended his accession both in Hungary and in Persia terminated unfavourably for Turkey, and her prestige received its first check in the peace of Sitvatörök, signed in 1606, whereby the annual tribute paid by Austria was abolished. Ahmed gave himself up to pleasure during the remainder of his reign, which ended in 1617, and demoralization and corruption became as general throughout the public service as indiscipline in the ranks of the army. The use of tobacco is said to have been introduced into Turkey during Ahmed I.'s reign.

AHMED II. (1643–1695), sultan of Turkey, son of Sultan Ibrahim, succeeded his brother Suleiman II. in 1691. His chief merit was to confirm Mustafa Kuprili as grand vizier. But a few weeks after his accession Turkey sustained a crushing defeat at Slankamen from the Austrians under Prince Louis of Baden and was driven from Hungary; during the four years of his reign disaster followed on disaster, and in 1695 Ahmed died, worn out by disease and sorrow.

AHMED III. (1637–1736), sultan of Turkey, son of Mahommed IV., succeeded to the throne in 1703 on the abdication of his brother Mustafa II. He cultivated good relations with England, in view doubtless of Russia's menacing attitude. He afforded a refuge in Turkey to Charles XII. of Sweden, after his defeat at Poltava (1709). Forced against his will into war with Russia, he came nearer than any Turkish sovereign before or since to breaking the power of his northern rival, whom his Grand Vizier Baltaji Mahommed Pasha succeeded in completely surrounding near the Pruth (1711). In the treaty which Russia was compelled to sign Turkey obtained the restitution of Azov, the destruction of the forts built by Russia and the undertaking that the tsar should abstain from future interference in the affairs of the Poles or the Cossacks. Discontent at the leniency of these terms was so strong at Constantinople that it nearly brought on a renewal of the war. In 1715 the Morea was taken from the Venetians. This led to hostilities with Austria, in which Turkey was unsuccessful, and Belgrade fell into the hands of Austria (1717). Through the mediation of England and Holland the peace of Passarowitz was concluded (1718), by which Turkey retained her conquests from the Venetians, but lost Hungary. A war with Persia terminated in disaster, leading to a revolt of the janissaries, who deposed Ahmed in September 1730. He died in captivity some years later.

AHMEDABAD, or AHMADABAD, a city and district of British India in the northern division of Bombay. The city was once the handsomest and most flourishing in western India, and it still ranks next to Agra and Delhi for the beauty and extent of its architectural remains. It was founded by Ahmad Shah in A.D. 1411 on the site of several Hindu towns, which had preceded it, and was embellished by him with fine buildings of marble, brought from a distance. The Portuguese traveller Barbosa, who visited Gujarat in A.D. 1511 and 1514, described Ahmedabad as "very rich and well embellished with good streets and squares supplied with houses of stone and cement." In Sir Thomas Roe's time, A.D. 1615, "it was a goodly city as large as London." During the course of its history it has passed through two periods of greatness, two of decay and one of revival. From 1411 to 1511 it grew in size and wealth; from 1512 to 1572 it declined with the decay of the dynasty of Gujarat; from 1572 to 1709 it renewed its greatness under the Mogul emperors; from 1709 to 1809 it dwindled with their decline; and from 1818 onwards it has again increased under British rule.

The consequence of all these changes of dynasty was that Ahmedabad became the meeting-place of Hindu, Mahommedan and Jain architecture. Ahmad Shah pulled down Hindu temples in order to build his mosques with the material. The Jama Masjid itself, which he built in A.D. 1424, with its three hundred pillars fantastically carved, is a Hindu temple converted into a mosque (see INDIAN ARCHITECTURE, Plate III., fig. 15). One of the finest buildings is the modern Jain temple of Hathi Singh outside the Delhi gate, which was built only in 1848, and is a standing monument to the endurance of Jain architectural art The external porch, between two circular towers, is of great magnificence, most elaborately ornamented, and leads to an outer court, with sixteen cells on either side. In the centre of this court is a domed porch of the usual form with twenty pillars. The court leads to an inner porch of twenty-two pillars, two stories in height. This inner porch conducts to a triple sanctuary. James Fergusson wrote of this temple that "each part increases in dignity to the sanctuary; and whether looked at from its courts or from outside, it possesses variety without confusion, and an appropriateness of every part to the purpose for which it was intended." But perhaps the most unique sight in Ahmedabad is the two windows in Sidi Said's mosque of filigree marble work. The design is an imitation of twining and interlaced branches, a marvel of delicacy and grace, and finer than anything of the kind to be found in Agra or Delhi.

The modern city of Ahmedabad is situated on the left bank of the river Sabarmati, and is still surrounded by walls enclosing an area of about 2 sq. m. Its population in 1901 was 185,889. It has a station on the Bombay and Baroda railway, 309 m. from Bombay, whence branch lines diverge into Kathiawar and Mahi Kantha, and is a great centre for both trade and manufacture. Its native bankers, shopkeepers and workers are all strongly organized in gilds. It has cotton mills for spinning and weaving, besides many handlooms, and factories for ginning and pressing cotton. Other industries include the manufacture of gold and silver thread, silk brocades, pottery, paper and shoes. The prosperity of Ahmedabad, says a native proverb, hangs on three threads—silk, gold and cotton; and though its manufactures are on a smaller scale than formerly, they are still moderately flourishing. The military cantonment, 3 m. north of the native town, is the headquarters of the northern division of the Bombay command, with an arsenal.

The DISTRICT OF AHMEDABAD lies at the head of the Gulf of Cambay, between Baroda and Kathiawar. Area 3816 sq. m. The river Sabarmati and its tributaries, flowing from north-east to south-west into the Gulf of Cambay, are the principal streams that water the district. The north-eastern portion is slightly elevated, and dotted with low hills, which gradually sink into a vast plain, subject to inundation on its western extremity. With the exception of this latter portion, the soil is very fertile, and some parts of the district are beautifully wooded. The population in 1901 was 795,967, showing a decrease of 14 % in the decade, due to the effects of famine. The principal crops are millets, cotton, wheat and pulse. The district is traversed by the Bombay and Baroda railway, and has two seaports, Dholera and Gogo, the former of which has given its name to a mark of raw cotton in the Liverpool market. It suffered severely in the famine of 1899–1900.

AHMEDNAGAR, or AHMADNAGAR, a city and district of British India in the Central division of Bombay on the left bank of the river Sina. The town is of considerable antiquity, having been founded in 1494 by Ahmad Nizam Shah, on the site of a more ancient city, Bhingar. This Ahmad established a new monarchy, which lasted till its overthrow by Shah Jahan in 1636. In 1759 the Peshwa obtained possession of the place by bribing the Mahommedan commander, and in 1797 it was ceded by the Peshwa to the Mahratta chief Daulat Rao Sindhia. During the war with the Mahrattas in 1803 Ahmednagar was invested by a British force under General Wellesley and captured. It was afterwards restored to the Mahrattas, but again came into the possession of the British in 1817, according to the terms of the treaty of Poona. The town has rapidly advanced in prosperity under British rule. Several mosques and tombs have been converted to the use of British administration. The old industries of carpet-weaving and paper-making have died out; but there is a large trade in cotton and silk goods, and in copper and brass pots, and there are factories for ginning and pressing cotton. Ahmednagar is a station on the loop line of the Great Indian Peninsula railway, 218 m. from Bombay, and a military cantonment, being the headquarters of a brigade in the 6th division of the western army corps. The population in 1901 was 43,032.

The DISTRICT OF AHMEDNAGAR is a comparatively barren tract with a small rainfall. The area is 6586 sq. m. The population in 1901 was 837,695, showing a decrease of 6 % in the decade, due to the results of famine. The bulk of the population consists of Mahrattas and Kunbis, the latter being the agriculturists. On the north the district is watered by the Godavari and its tributaries the Prawara and the Mula; on the north-east by the Dor, another tributary of the Godavari; on the east by the Sephani, which flows through the valley below the Balaghat range; and in the extreme south by the Bhima and its tributary the Gor. The Sina river, another tributary of the Bhima, flows through the Nagar and Karjat talukas. The principal crops are millet, pulse, oil-seeds and wheat. The district suffered from drought in 1896–1897, and again in 1899–1900.

AHMED TEWFIK, PASHA (1845–), Turkish diplomatist, was the son of Ismail Hakki Pasha. He was at first in the army, but left the service in 1862; four years later he entered the diplomatic service, being employed at various European capitals. He became minister at Athens in 1883 and ambassador in Berlin in 1884. He was appointed minister for foreign affairs (*Khorijie Nasiri*) in 1896.

AHMED VEFIK, PASHA (1819–1891), Turkish statesman and man of letters, was born in Stambul in 1819. He was the son of Rouheddin Effendi, at one time chargé d'affaires in Paris, an accomplished French scholar, who was, therefore, attached, in the capacity of secretary-interpreter, to Reshid Pasha's diplomatic mission to Paris in 1834. Reshid took Ahmed with him and placed him at school, where he remained about five years and completed his studies. He then returned to Constantinople, and was appointed to a post in the *bureau de traduction* of the ministry for foreign affairs. While thus employed he devoted his leisure to the translation of Molière's plays into Turkish and to the compilation of educational books—dictionaries, historical and geographical manuals, &c.—for use in Turkish schools, with the object of promoting cultivation of the French language among the rising generation. In 1847 he brought out the first edition of the *Salnameh*, the official annual of the Ottoman empire. Two years later he was appointed imperial commissioner in the Danubian principalities, and held that office till early in 1851 when he was sent to Persia as ambassador—a post which suited his temperament, and in which he rendered good service to his government for more than four years. Recalled in 1855, he was sent on a mission to inspect the eastern frontiers, and on his return was appointed member of the Grand Council of Justice, and was entrusted with the revision of the penal code and the code of procedure. This work occupied him until the beginning of 1860, when he was sent as ambassador to Paris, for the special purpose of averting the much-dreaded intervention of France in the affairs of Syria. But Ahmed Vefik's abrupt frankness, irascibility and abhorrence of compromise unfitted him for European diplomacy. He offended the French government; his mission failed, and he was recalled in January 1861. None the less his integrity of purpose was fully understood and appreciated in Paris. On his return he was appointed minister of the *Evkaf*, but he only retained his seat in the cabinet for a few months. He was then for a brief period president of the Board of Audit, and subsequently inspector of the Anatolian provinces, where he was engaged for more than three years. His next appointment was that of director-general of customs, whence he was removed to the office of *musteshar* of the grand vizierate, and in the following year entered the cabinet of Midhat Pasha as minister of public instruction, but very soon retired to his seat in the Council of State and remained out of office until 1875, when he represented Turkey at the International Telegraphic Conference in St Petersburg. He was president of the short-lived Turkish parliament during its first session—March 19 to June 28, 1877—and at its close was appointed vali of Adrianople, where he rendered invaluable aid to the Red Cross Society. On his recall, at the beginning of 1878, he accepted the ministry of public instruction in the cabinet of Ahmed Hamdi Pasha, and on the abolition of the grand vizierate (February 5, 1878) he became prime minister and held office till about the middle of April, when he resigned. Early in the following year he was appointed vali of Brusa, where he remained nearly four years, and rendered admirable services to the province. The drainage of the pestilent marshes, the water-supply from the mountains, the numerous roads, the suppression of brigandage, the multiplication of schools, the vast development of the silk industry through the substitution of mulberry plantations for rice-fields, the opening out of the mineral springs of Chitli, the introduction of rose-trees and the production of otto of roses—all these were Ahmed Vefik's work; and he became so popular that when in 1882 he was recalled, it was thought advisable that he should be taken away secretly by night from the *konak* in Brusa and brought to his private residence on the Bosporus. A few days after his return he was again appointed prime minister (December 1, 1882), but Ahmed Vefik demanded, as the condition of his acceptance of office, that he should choose the other members of the cabinet, and that a number of persons in the sultan's *entourage* should be dismissed. Upon this, the sultan, on the 3rd of December, revoked the iradé of the 1st of December, and appointed Said Pasha prime minister. For the rest of his life Ahmed Vefik, by the sultan's orders, was practically a prisoner in his own house; and eventually he died, on the 1st of April 1891, of a renal complaint from which he had long been a sufferer. Ahmed Vefik was a great linguist. He spoke and wrote French perfectly, and thoroughly understood English, German, Italian, Greek, Arabic and Persian. From all these languages he translated many books into Turkish, but wrote no original work. His splendid library of 15,000 volumes contained priceless manuscripts in many languages. In his lifetime he appreciably aided the progress of education; but, as he had no following, the effects of his labour and influence in a great measure faded away after his death. In all his social and family relations Ahmed Vefik was most exemplary. His charity knew no bounds. He was devoted to his aged mother and to his one wife and children. To his friends and acquaintances he was hospitable, courteous and obliging; his conversation was intellectual and refined, and in every act of his private life he manifested the spirit of a true gentleman. At home his habits, attire and mode of life were quite Turkish, but he was perfectly at his ease in European society; he had strong English proclivities, and numbered many English men and women amongst his intimate friends. In public life his gifts were almost sterilized by peculiarities of temperament and incompatibility with official surroundings; and his mission as ambassador to Persia and his administration of Brusa were his only thorough successes. But his intellectual powers, literary erudition and noble character made him for the last forty years of his life a conspicuous figure in eastern Europe. (E. W.*)

AHOM, or Aham, a tribe of Shan descent inhabiting the Assam valley, and, prior to the invasion of the Burmese at the commencement of the 19th century, the dominant race in that country. The Ahoms, together with the Shans of Burma and Eastern China and the Siamese, were members of the Tai race. The name is believed to be a corruption of the word "Ā-sām," the latter part of which is identical with "Shan" (properly "Shām") and with "Siam." Under their king Su-ka-pha they invaded Assam (*q.v.*) from the East in the year A.D. 1228, giving their name to the country. For a century and a half from 1228 the successors of Su-ka-pha appear to have ruled undisturbed over a small territory in Lakkimpur and Sibsagar districts. The extension of their power westward down the valley of the Brahmaputra was very gradual, and its success was by no means uniform. In the time of Aurangzeb the Ahom kings held sway over the entire Brahmaputra valley from Sadiya to near Goalpara, and from the skirts of the southern hills to the Bhutia frontier on the north. The dynasty attained the height of its power under Rudra Singh, who is said to have ascended the throne in 1695. In the following century the power of the Ahoms began to decay, alike from internal dissensions and the pressure of outside invaders. The Burmese were called in to the assistance of one of the contending factions in 1810. Having once obtained a foothold in the country, they established their power over the entire valley and ruled with merciless barbarity, until they were expelled by the British in 1824–1825. In the census of 1901 the total Ahom population in Assam was returned at 178,049.

The Ahoms retained the form of government in Assam peculiar to the Shan tribes, which may be briefly described as an organized system of personal service in lieu of taxation. Their religion was pagan, being quite distinct from Buddhism; but in Assam they gradually became Hinduized, and their kings finally adopted Hindu names and titles. They believed that there were in the beginning no heavenly bodies, air or earth, only water everywhere, over which at first hovered a formless Supreme Being called Pha. He took corporeal shape as a huge crab that lay floating, face upwards, upon the waters. In turn other animals took shape, the last being two golden spiders from whose excrement the earth gradually rose above the surrounding ocean. Pha then formed a female counterpart of himself, who laid four eggs, from which were hatched four sons. One of these was appointed to rule the earth, but died and became a spirit. His son also died and became the national household deity of the Ahoms. The origin of mankind is connected with a flood-legend. The only survivors of the flood, and of the conflagration that followed it, were an old man and a pumpkin-seed. From the latter there grew a gigantic gourd. This was split open by a thunderbolt, the old man sacrificing himself to save the lives of those who were inside, and from it there issued the progenitors of the present races of men, beasts, birds, fishes and plants. The kings claimed independent divine origin.

The religion and language have both died out, being only preserved by a few priests of the old cult; but even among them the tradition of the pronunciation of the language has been lost. The Ahoms had a considerable literature, much of which is still in existence. Their historic sense was very fully developed, and many priests and nobles maintained *bū-ran-jis* (*i.e.* "stores of instruction for the ignorant"), or chronicles, which were carefully written up from time to time. A few of these have been translated, but as yet no European scholar possesses knowledge sufficient to enable him to study these valuable documents at first hand.

The Ahom language is the oldest member of the Tai branch of the Siamese-Chinese linguistic family of which we have any record. It bears much the same relationship to Siamese and Shan that Latin does to Italian. It is more nearly related to modern Siamese than to modern Shan, but possesses many groups of consonants which have become simplified in both. It is a language of the isolating class, in which every word is a monosyllable, and may be employed either as a noun or as a verb according to its context and its position in a sentence. In the order of words, the genitive follows the noun it governs, and, as usual in such cases, the relations of time and place are indicated by prefixes, not by suffixes. The meanings of the monosyllables were differentiated, as in the other Tai languages and in Chinese, by a system of tones, but these were rarely indicated in writing, and the tradition regarding them is lost. The language had an alphabet of its own, which was clearly related to that of Burmese.

See E. A. Gait, *A History of Assam* (Calcutta, 1906). For the language see *The Linguistic Survey of India*, vol. ii. (Calcutta, 1906) (contains grammar and vocabulary); G. A. Grierson, "Notes on Ahom," in the *Zeitschrift der deutschen morgenländischen Gesellschaft*, vol. lvi., 1902, pp. 1 ff. (contains grammar and vocabulary, with specimens), and "An Ahom Cosmogony, with a translation and a vocabulary of the Ahom language," in the *Journal of the Royal Asiatic Society for 1904*, pp. 181 ff. (G. A. Gr.)

AHR, a river of Germany. It is a left-bank tributary of the Rhine, into which it falls at Sinzig, rising in the Eifel mountains, and having a total length of 55 m. It flows at first through rather monotonous country, but the latter portion of its course, from the village of Altenahr, over which tower the ruins of the castle of Ahr, or Are (10th century), is full of romantic beauty. It is well stocked with trout, and the steep declivities of the lower valley furnish red wines of excellent quality.

AHRENS, FRANZ HEINRICH LUDOLF (1809–1881), German philologist, was born at Helmstedt on the 6th of June 1809. After studying at Göttingen (1826–1829) under K. O. Müller and Ludolf Dissen, and holding several educational appointments, in 1849 he succeeded G. F. Grotefend as director of the Lyceum at Hanover, a post which he filled with great success for thirty years. He died on the 25th of September 1881. His most important work is *De Graecae Linguae Dialectis* (1839–1843, new ed. by Meister, 1882–1889), which, although unfortunately incomplete, dealing only with Aeolic and Doric, and in some respects superseded by modern research, will always remain a standard treatise on the subject. He also published *Bucolicorum Graecorum Reliquiae* (1855–1859); studies on the dialects of Homer and the Greek lyrists; on Aeschylus; and some excellent school-books. A volume of his minor works (ed. Häberlin) was published in 1891, which also contains a complete list of his writings.

AHRIMAN (Gr. *'Αρειμάνιος* in Aristotle, or *'Αρειμάνης* in Agathias; in the *Avesta*, *Añgrô Mainyush*)—"the Destructive Spirit"), the name of the principle of evil in the dualistic doctrine of Zoroaster. The name does not occur in the Old Persian inscriptions. In the *Avesta* he is called the twin-brother of the Holy Spirits, and contrasted either with the Holy Spirit of Ormazd or with Ormazd himself. He is the all-destroying Satan, the source of all evil in the world and, like Ormazd, exists since the beginning of the world. Eventually, in the great world catastrophe, he will be defeated by Ormazd and disappear. The later sect of the Zervanites held that both were visible manifestations of the primeval principle *Zrwan akarana* (Infinite Time). (See ZOROASTER.)

AHRWEILER, a town of Germany, in the Prussian Rhine province, on the river Ahr and the Remagen-Adenau line of railway. Pop. 5000. It is a town of medieval aspect and is surrounded by ancient walls, with battlements and four gates in good repair. There is a Gothic church (dating from 1245). A convent school of the Ursuline nuns is a prominent feature on a hill to the south. The trade is almost exclusively confined to the manufacture and export of the wines of the district.

AHT, a confederacy of twenty-two tribes of North American Indians of the Wakashan stock. They are settled on the west coast of Vancouver, British Columbia. The chief tribes included are the Nitinaht, Tlaasaht or Makah, Tlaokiwaht or Clahoquaht, Ahansaht and Ehatishaht. The confederacy numbers some 3500.

AHTENA ("ice people"), the name of an Athapascan tribe of North American Indians, in the basin of Copper River, Alaska.

See *Handbook of American Indians*, ed. F. W. Hodge (Washington, 1907).

AHVAZ, a town of Persia, in the province of Arabistan, on the left bank of the river Karun, 48 m. S. of Shushter, in 31° 18′ N., 49° E. It has been identified with the Aginis of Nearchus, 500 stadia from Susa, and occupies the site of what was once an extensive and important city. Of this ancient city vast remains are left, extending several miles along the bank of the river. Among the most remarkable are the ruins of a bridge and a citadel, or palace, besides vestiges of canals and water-mills, which tell of former commercial activity. There are also the ruins of a band, or stone dam of great strength, which was thrown across the river for the purposes of irrigation. The band was 1150 yds. in length and had a diameter of 24 ft. at its base. Remains of massive structure are still visible, and many single blocks in it measure from 8 to 10 ft. in thickness. Ahvaz reached the height of its prosperity in the 12th and 13th centuries and is now a collection of wretched hovels, with a small rectangular fort in a state of ruin, and an Arab population of about 400. Since the opening of the Karun to foreign commerce in October 1888, another settlement called Benderi Nâssiri, in compliment to the Shah Nâssir ed din (d. 1896), has been established on a slight elevation overlooking the river at the point below the rapids where steamers come to anchor, about one mile below Ahvaz. It has post and telegraph offices; and agencies of some mercantile firms, a British vice-consul (since 1904) and a Russian consular agent (since 1902) are established there. The new caravan road to Isfahan, opened for traffic in 1900, promised, if successful, to give Ahvaz greater commercial importance.

AI [Sept. 'Αγγαί, 'Αγγαῖ and Γαΐ; Vulg. *Hai*], a small royal city of the Canaanites, E. of Bethel. The meaning of the name may be "the stone heap"; but it is not necessarily a Hebrew word. Abraham pitched his tent between Ai and Bethel (Gen. xii. 8, xiii. 3); but it is chiefly noted for its capture and destruction by Joshua (vii. 2-5, viii. 1-29), who made it "a heap for ever, even a desolation." It is mentioned by Isaiah (x. 28), and also after the captivity (Ezra ii. 28; Neh. vii. 32), but then probably was not more than a village. In the later Hebrew writings the name sometimes has a feminine form, Aiath (Is. x. 28), Aija (Neh. xi. 31). The definite article is usually prefixed to the name in Hebrew. The site was known, and some scanty ruins still existed, in the time of Eusebius and Jerome (*Onomast.*, *s.v.* 'Αγγαί). Dr E. Robinson was unable to discover any certain traces of either name or ruins. He remarks, however (*Bib. Researches*, ed. 1856, i. p. 443), that it must have been close to Bethel on account of Biblical narrative (Josh. viii. 17). A little to the south of a village called Deir Diwân, and one hour's journey south-east from Bethel, is the site of an ancient place called *Khirbet Haiyân*, indicated by reservoirs hewn in the rock, excavated tombs and foundations of hewn stone. This may possibly be the site of Ai; it agrees with all the intimations as to its position. It has also been identified with a mound now called *et-Tell* ("the heap"), but though the name of a neighbouring village, *Turmus Aya*, is suggestive, it is in the wrong direction from Bethel. In this view recent authorities, such as G. A. Smith, generally coincide.

See *Palestine Exploration Fund Quarterly Statement*, 1869, p. 123; 1874, p. 62; 1878, pp. 10, 132, 194; 1881, p. 254. (R. A. S. M.)

AIBONITO, an inland town of the electoral district of Guayama, Porto Rico, on the highway between San Juan and Ponce, 25 m. E.N.E. of the latter. It is the capital of a municipal district of the same name. Pop. (1899) of the town, 2085; of the district, 8596. The town is about 2200 ft. above sea level, and owing to its cool climate and freedom from malaria it has been chosen as an acclimatizing station and sanatorium for foreigners. It is surrounded by coffee plantations, and tobacco of excellent quality is raised in the vicinity. The town was considerably damaged by the great hurricane of the 8th of August 1899.

AICARD, JEAN FRANÇOIS VICTOR (1848–), French poet and dramatist, was born at Toulon on the 4th of February 1848. His father, Jean Aicard, was a journalist of some distinction, and the son early began his career in 1867 with *Les Jeunes Croyances*, followed in 1870 by a one-act play produced at the Marseilles theatre. His poems include: *Les Rébellions et les apaisements* (1871); *Poèmes de Provence* (1874), and *La Chanson de l'enfant* (1876), both of which were crowned by the Academy; *Miette et Noré* (1880), a Provençal idyll; *Le Livre d'heures de l'amour* (1887); *Jésus* (1896), &c. Of his plays the most successful was *Le Père Lebonnard* (1890), which was originally produced at the Théâtre Libre. Among his other works are the novels, *Le Roi de Camargue* (1890), *L'Âme d'un enfant* (1898) and *Tatas* (1901), *Benjamine* (1906) and *La Vénus de Milo* (1874), an account of the discovery of the statue from unpublished documents.

AICHINGER, GREGOR (*c.* 1565–1628), one of the greatest German composers of the Golden Age. He was organist to the Fugger family of Augsburg in 1584. In 1599 he went for a two years' visit to Rome. This was for musical and not for ecclesiastical reasons, though he had taken orders before his appointment under Fugger. Proske, in the preface to vol. ii. of his *Musica Divina*, calls him a priest of Regensburg, and is inclined to give him the palm for the devout and ingenuous mastery of his style. Certainly this impression is fully borne out by the beautiful and somewhat quaint works included in that great anthology.

AICKIN, FRANCIS (d. 1805), Irish actor, first appeared in London in 1765 as Dick Amlet in Vanbrugh's *The Confederacy* at Drury Lane. He acted there, and at Covent Garden, until 1792. His repertory consisted of over eighty characters, and among his best parts were the Ghost in *Hamlet* and Jaques in *As You Like It*. His success in impassioned declamatory rôles obtained for him the nickname of "Tyrant."

His younger brother JAMES AICKIN (d. 1803) was playing leading parts in both comedy and tragedy at the Edinburgh theatre, when he gave offence to his public by his protest against the discharge of a fellow-actor. He therefore went to London, and from 1767 to 1800 was a member of the Drury Lane Company and for some years a deputy manager. He quarrelled with John Philip Kemble, with whom, in 1792, he fought a bloodless duel.

AIDAN (d. 606), king of the Scottish kingdom of Dalriada, was the son of Gabran, king of Dalriada, and became king after the death of his kinsman King Conall, when he was crowned at Iona by St Columba. He refused to allow his kingdom to remain in dependence on the Irish Dalriada, but coming into collision with his southern neighbours he led a large force against Æthelfrith, king of the Northumbrians, and was defeated at a place called Daegsanstane, probably in Liddesdale.

See Bede, *Historiae Ecclesiasticae gentis Anglorum*, edited by C. Plummer (Oxford, 1896); Adamnan, *Vita S. Columbae*, edited by J. T. Fowler (Oxford, 1894).

AIDAN, or *Ædan*, first bishop of Lindisfarne, a monk of Hii (Iona), was sent by the abbot Senegi to Northumbria, at the request of King Oswald, A.D. 634–635. He restored Christianity, and in accordance with the traditions of Irish episcopacy chose the island of Lindisfarne, close to the royal city of Bamborough, as his see. Although he retained the Irish Easter, his character and energy in missionary work won him the respect of Honorius and Felix. He survived Oswald, and died shortly after the murder of his friend Oswine of Deira, on the 31st of August 651, in the 17th year of his episcopate.

See Bede, *Hist. Eccl.* (ed. Plummer), iii. 3, 5, 17, 25.

AIDE-DE-CAMP (Fr. for camp-assistant or, perhaps, field-assistant), an officer of the personal staff of a general, who acts as his confidential secretary in routine matters. In Great Britain the office of aide-de-camp to the king is given as a reward or an honorary distinction. In many foreign armies the word *adjutant* is used for an aide-de-camp, and *adjutant general* for a royal aide-de-camp. The common abbreviation for aide-de-camp in the British service is "A.D.C.," and in the United States "aid." Civil governors, such as the lord lieutenant of Ireland, have also, as a rule, officers on their staffs with the title and functions of aides-de-camp.

AIDIN. (1) A vilayet in the S.W. of Asia Minor including the ancient Lydia, Ionia, Caria and western Lycia. It derives its name from the Seljuk emir who took Tralles, and is the richest and most productive province of Asiatic Turkey. The seat of government is Smyrna. (2) The principal town of the valley of the Menderes or Maeander, about 70 m. E.S.E. of Smyrna. It is called also Güzel Hissar from the beauty of its situation on the lower slopes of Mons Messogis and along the course of the ancient Eudon. It is the capital of a sanjak. It was taken by the Seljuks, Aidin and Mentesh, late in the 13th century, and about 1390, when ruled by Isa Bey, a descendant of the first-named, acknowledged Ottoman suzerainty. In the Seljuk period it was a secondary city under the provincial capital, Tireh (*q.v.*). In the 17th century it came under the power of the Karasmans of Manisa and remained so till about 1820. Aidin is on the Smyrna-Dineir railway, has large tanneries and sweetmeat manufactories, and exports figs, cotton and raisins. It was greatly damaged by an earthquake in 1899. On a neighbouring height are to be seen the ruins of the ancient *Tralles* (*q.v.*), the site to which the name Güzel Hissar was particularly given by the Seljuks. Aidin is the seat of a British consular agent. As there are considerable numbers of Greeks, Armenians and Jews among the inhabitants, there are a Greek cathedral, several churches and synagogues in addition to the fine Turkish mosques. (D. G. H.)

AIDONE, a town of Sicily, in the province of Caltanisetta. From the town of Caltanisetta it is 22 m. E.S.E. direct (18 m. S.S.W. of the railway station of Raddusa, which is 41 m. W. of Catania). Pop. (1901) 8548. There are some interesting churches of the 14th century (see E. Mauceri in *L'Arte*, 1906, 17). On the Serra Orlando, a mountain not far off, are the extensive remains of an unknown city, the finest in eastern Sicily, but rapidly suffering destruction from the spread of cultivation and unauthorized excavations.

See P. Orsi in *Atti del Congresso di Scienze Storiche*, vol. v. 178 (Rome, 1904).

AIDS, a term of medieval finance, were part of the service due to a lord from his men, and appear to have been based upon the principle that they ought to assist him in special emergency or need. The occasions for demanding them and the amount to be demanded would thus be matters of dispute, while the loose use of the term to denote many different payments increases the difficulty of the subject.

Both in Normandy and in England, in the 12th century, the two recognized occasions on which, by custom, the lord could demand "aid," were (1) the knighting of his eldest son, (2) the marriage of his eldest daughter; but while in England the third occasion was, according to Glanvill, as in Normandy, his payment of "relief" on his succession, it was, according to the Great Charter (1215), the lord's ransom from captivity. By its provisions, the king covenanted to exact an "aid" from his barons on these three occasions alone—and then only a "reasonable" one—except by "the common counsel" of his realm. Enormous importance has been attached to this provision, as establishing the principle of taxation by consent, but its scope was limited to the barons (and the city of London), and the word "aids" was omitted from subsequent issues of the charter. The barons, on their part, covenanted to claim from their feudal tenants only the above three customary aids. The last levy by the crown was that of James I. on the knighting of his eldest son (1609) and the marriage of his daughter (1613).

From at least the days of Henry I. the term "aid" was also applied (1) to the special contributions of boroughs to the king's revenue, (2) to a payment in lieu of the military service due from the crown's knights. Both these occur on the pipe roll of 1130, the latter as *auxilium militum* (and possibly as *auxilium comitatus*). The borough "aids" were alternatively known as "gifts" (*dona*), resembling in this the "benevolences" of later days. When first met with, under Henry I., they are fixed round sums, but under Henry II. (as the *Dialogue on the Exchequer* explains) they were either assessed on a population basis by crown officers or were sums offered by the towns and accepted by them as sufficient. In the latter case the townsfolk were collectively responsible for the amount. The Great Charter, as stated above, extended specially to London the limitation on baronial "aids," but left untouched its liability to tallage, a lower and more arbitrary form of taxation, which the towns shared with the crown's demesne manors, and which London resisted in vain. The two exactions, although distinct, have to be studied together, and when in 1296–1297 Edward I. was forced to his great surrender, he was formerly supposed by historians to have pledged himself, under *De tallagio non concedendo*, to levy no tallage or aid except by common consent of his people. It is now held, however, that he limited this concession to "*aides, mises*," and "*prises*," retaining the right to tallage. Eventually, by a statute of 1340, it was provided that the nation should not be called upon "to make any common aid or sustain charge" except by consent of parliament. The aids spoken of at this period are of yet another character, namely, the grant of a certain proportion of all "movables" (*i.e.* personal property), a form of taxation introduced about 1188 and now rapidly increasing in importance. These subsidies were conveniently classed under the vague term "aids," as were also the grants made by the clergy in convocation, the term covering both feudal and non-feudal levies from the higher clergy and proportions not only of "movables" but of ecclesiastical revenues as well.

The "knight's aid" of 1130 spoken of above is probably identical with *auxilium exercitus* spoken of in the oldest custumals of Normandy, where the phrase appears to represent what was known in England as "scutage." Even in England the phrase "*quando Rex accipit auxilium de militibus*" occurs in 1166 and appears to be loosely used for scutage.

The same loose use enabled the early barons to demand "aid" from their tenants on various grounds, such as their indebtedness to the Jews, as is well seen in the Norfolk fragments of returns to the Inquest of Sheriffs (1170).

Sheriff's aid was a local payment of a fixed nature paid in early days to the sheriff for his service. It was the subject of a hot dispute between Henry II. and Becket in 1163.

AUTHORITIES.—Stubbs' *Constitutional History* and *Select Charters*; M'Kechnie's *Magna Carta*; Pollock and Maitland's *History of English Law*; Maitland's *Domesday Book and Beyond*; *Dialogus de Scaccario* (Oxford, 1892); Madox's *History of the Exchequer*; Round's *Feudal England* and *The Commune of London*; *The Pipe Rolls* (Record Commission and Pipe Roll Society). (J. H. R.)

AIGRETTE (from the Fr. for egret, or lesser white heron), the tufted crest, or head-plumes of the egret, used for adorning a woman's head-dress, the term being also given to any similar ornament, in gems, &c. An aigrette is also worn by certain ranks of officers in the French army. By analogy the word is used in various sciences for feathery excrescences of like appearance, as for the tufts on the heads of insects, the feathery down of the dandelion, the luminous rays at the end of electrified bodies, or the luminous rays seen in solar eclipses, diverging from the moon's edge.

AIGUES-MORTES, a town of south-eastern France, in the department of Gard 25 m. S.S.W. of Nîmes, on a branch line of the Paris-Lyon-Méditerranée railway. Pop. (1906) 3577. Aigues-Mortes occupies an isolated position in the marshy plain at the western extremity of the Rhone delta, 2½ m. from the Golfe du Lion. It owes its celebrity to the medieval fortifications of remarkable completeness with which it is surrounded. They form a parallelogram 596 yds. long by 149 yds. broad, and consist of crenellated walls from 25 to 36 ft. in height, dominated at intervals by towers. Of these, the Tour de Constance, built by Louis IX., is the most interesting; it commands the north-western angle of the ramparts, and contains two circular, vaulted chambers, used as prisons for Protestants after the revocation of the edict of Nantes. The remainder of the fortifications were built in the reign of Philip III. Aigues-Mortes is the meeting-place of several canals connecting it with Beaucaire, with Cette, with the Lesser Rhone and with the Mediterranean, on which it has a small port. Fishing and the manufacture of soda are the chief industries with which the town is connected. It has trade in coal, oranges and other fruits, and in wine. In the surrounding country there are important vineyards, which are preserved from disease by periodical submersion. There is a statue in the town in memory of Louis IX. who embarked from Aigues-Mortes in 1248 and 1270 for the seventh and eighth crusades. To further the prosperity of the town a most liberal charter was granted to it, and in addition the trade of the port was artificially fostered by a decree requiring that every vessel navigating within sight of its lights should put in there. This ordinance remained in force till the reign of Louis XIV.

AIGUILLE (Fr. for needle), the sharp jagged points above the snow-line, standing upon the massif of a mountain split by frost action along joints or planes of cleavage with sides too steep for snow to rest upon them. Aiguilles are thus the forms remaining from the splitting up of the high ridges with house-roof structure into detached pinnacles.

AIGUILLETTE (Fr. diminutive of *aiguille*, a needle; the obsolete English form is "aglet"), originally a tag of metal, often made of precious metals and richly chased, attached to the end of a lace or ribbon, and pointed, so as to pass more easily through eyelet holes. The term was, in time, applied to any bright ornament or pendant for the dress made of metal, and is now specially used of ornamental cords and tags of gold and silver lace, worn on naval and military uniforms. The aiguillette is fastened to the shoulder, the various cords hanging down therefrom being fastened at their other end on the front of the coat.

AIGUILLON, EMMANUEL ARMAND DE WIGNEROD DU PLESSIS DE RICHELIEU, DUC D' (1720–1782), French statesman, nephew of the maréchal de Richelieu, was born on the 31st of July 1720. He entered the army at the age of seventeen, and at the age of nineteen was made colonel of the regiment of Brie. He served in the campaigns in Italy during the War of the Austrian Succession, was seriously wounded at the siege of Château-Dauphin (1744), was taken prisoner (1746) and was made *maréchal de camp* in 1748. His marriage in 1740 with Louise Félicité de Bréhan, daughter of the comte de Plélo, coupled with his connexion with the Richelieu family, gave him an important place at court. He was a member of the so-called *parti dévot*, the faction opposed to Madame de Pompadour, to the Jansenists and to the parlement, and his hostility to the new ideas drew upon him the anger of the pamphleteers. In 1753 he was appointed commandant (governor) of Brittany and soon became unpopular in that province, which had retained a large number of privileges called "liberties." He first came into collision with the provincial estates on the question of the royal imposts (1758), but was then blamed for his inertia in the preparation of a squadron against England (1759), and finally alienated the parlement of Brittany by violating the privileges of the province (1762). In June 1764 the king, at the instance of d'Aiguillon, quashed a decree of the parlement forbidding the levying of new imposts without the consent of the estates, and refused to receive the remonstrances of the parlement against the duke. On the 11th of November 1765 La Chalotais, the *procureur* of the parlement, was arrested, but whether at the instigation of d'Aiguillon is not certain. The conflict between d'Aiguillon and the Bretons lasted two years. In the place of the parlement, which had resigned, d'Aiguillon organized a tribunal of more or less competent judges, who were ridiculed by the pamphleteers and ironically termed the *bailliage d'Aiguillon*. In 1768 the duke was forced to suppress this tribunal, and returned to court, where he resumed his intrigue with the *parti dévot* and finally obtained the dismissal of the minister Choiseul (December 24, 1770). When Louis XV., acting on the advice of Madame Dubarry, reorganized the government with a view to suppressing the resistance of the parlements, d'Aiguillon was made minister of foreign affairs, Maupeou and the Abbé Terray (1715–1778) also obtaining places in the ministry. The new ministry, albeit one of reform, was very unpopular, and was styled the "triumvirate." All the failures of the government were attributed to the mistakes of the ministers. Thus d'Aiguillon was blamed for having provoked the *coup d'état* of Gustavus III., king of Sweden, in 1772, although the instructions of the comte de Vergennes, the French ambassador in Sweden, had been written by the minister, the duc de la Vrillière. D'Aiguillon, however, could do nothing to rehabilitate French diplomacy; he acquiesced in the first division of Poland, renewed the Family Compact, and, although a supporter of the Jesuits, sanctioned the suppression of the society. After the death of Louis XV. he quarrelled with Maupeou and with the young queen, Marie Antoinette, who demanded his dismissal from the ministry (1774). He died, forgotten, in 1782. In no circumstances had he shown any special ability. He was more fitted for intrigue than for government, and his attempts to restore the status of French diplomacy met with scant success.

See *Mémoires du ministère du duc d'Aiguillon* (3rd ed., Paris and Lyons, 1792), probably written by J. L. Soulavie. On d'Aiguillon's governorship of Brittany see Carré, *La Chalotais et le duc d'Aiguillon* (Paris, 1893); Marion, *La Bretagne et le duc d'Aiguillon* (Paris, 1898); and Barthélemy Pocquet, *Le Duc d'Aiguillon et La Chalotais* (Paris, 1901–1902). The three last have full bibliographies. See also Flammermont, *Le Chancelier Maupeou et les parlements* (Paris, 1883); Frédéric Masson, *Le Cardinal de Bernis* (Paris, 1884).

AIGUILLON, MARIE MADELEINE DE WIGNEROD DU PONT DE COURLAY, DUCHESSE D' (1604–1675), daughter of Cardinal Richelieu's sister. In 1620 she married a nephew of the constable de Luynes, Antoine de Beauvoir du Roure, sieur de Combalet, who died in 1622. In 1625, through her uncle's influence, she was made a lady-in-waiting (*dame d'atour*) to the queen-mother, and in 1638 was created duchess of Aiguillon. She did not marry a second time, although Richelieu wished to marry her to a prince—either to the comte de Soissons or to the king's brother. After the death of the cardinal (1642) she retained her honours and titles, but withdrew from the court, and devoted herself entirely to works of charity. She entered into relations with Saint Vincent de Paul and helped him to establish the hospital for foundlings. She also took part in organizing the General Hospital and several others in the provinces. She died on the 17th of April 1675. She was the patroness of Corneille, who in 1636 dedicated to her his tragedy of *The Cid*.

See E. Fléchier, *Oraison funèbre de Mme. Marie de Wignerod, duchesse d'Aiguillon*; Bonneau-Avenant, *La duchesse d'Aiguillon* (1879); *Mémoires de Saint-Simon*, ed. by A. de Boislisle (1879 *et seq.*).

AIGUN, or Aihun (also *Sakhalyan-ula-khoto*), a town of China, province Hei-lung-kiang, in northern Manchuria, situated on the right bank of the Amur, in a fertile and populous region, 20 m. below Blagovyeshchensk, where it occupies nearly 2 m. on the bank of the river. There is a palisaded fort in the middle of the town, inside of which is the house of the *fu-tu* (governor). Its merchants carry on an active local trade in grain, mustard, oil and tobacco, and some of its firms supply the Russian administration with grain and flour. During the "Boxer" rising of 1900 it was, for a few weeks, the centre of military action directed against the Russians. The population, of some 20,000, includes a few hundred Mussulmans. The town was founded first on the left bank of the Amur, below the mouth of the Zeya, but was abandoned, and the present town was founded in 1684. It was here that Count Muraviev concluded, in May 1857, the Aihun treaty, according to which the left bank of the Amur was conceded to Russia.

AIKEN, a city and the county-seat of Aiken county, South Carolina, U.S.A., 17 m. E.N.E. of Augusta, Georgia. Pop. (1890) 2362; (1900) 3414, of whom 2131 were of negro descent. It is served by the Southern railway, and by an electric line connecting with Augusta. Aiken is a fashionable winter resort, chiefly frequented by Northerners, and is pleasantly situated about 500 ft. above sea level in the heart of the famous sand-hill and pine-forest region of the state. The dry and unusually equable temperature (mean for winter 50° F., for spring 57° F., and for autumn 64° F.) and the balmy air laden with the fragrance of the pine forests have combined to make Aiken a health and pleasure resort; its climate is said to be especially beneficial for those afflicted with pulmonary diseases. There are fine hotels, club houses and cottages, and the Palmetto Golf Links near the city are probably the finest in the southern states; fox-hunting, polo, tennis and shooting are among the popular sports. There are some excellent drives in the vicinity. The city is the seat of the Aiken Institute (for whites) and the Schofield Normal and Industrial School (for negroes). There are lumber mills, cotton mills and cotton-gins; and cotton, farm products and artificial stone are exported. Considerable quantities of aluminium are obtained from the kaolin deposits in the vicinity. The city's water supply is obtained from artesian wells. Aiken was settled in the early part of the 19th century, but was not incorporated until 1835, when it was named in honour of William Aiken (1806–1887), governor of the state in 1844–1847, and a representative in Congress in 1851–1857.

AIKIN, ARTHUR (1773–1854), English chemist and mineralogist, was born on the 19th of May 1773, at Warrington in Lancashire. He studied chemistry under Priestley and gave attention to the practical applications of the science. To mineralogy he was likewise attracted, and he was one of the founders of the Geological Society of London, 1807, and honorary secretary, 1812–1817. To the transactions of that society he contributed papers on the Wrekin and the Shropshire coalfield, &c. Later he became secretary of the Society of Arts, and in 1841 treasurer of the Chemical Society. In early life he had been for a short time a Unitarian minister. He was highly esteemed as a man of sound judgment and wide knowledge. He died in London on the 15th of April 1854.

Publications.—*Journal of a Tour through North Wales and part of Shropshire; with observations in Mineralogy and other branches of Natural History* (London, 1797); *A Manual of Mineralogy* (1814; ed. 2, 1815); *A Dictionary of Chemistry and Mineralogy* (with his brother C. R. Aikin), 2 vols. (London, 1807, 1814).

AIKIN, JOHN (1747–1822), English doctor and writer, was born at Kibworth-Harcourt, and received his elementary education at the Noncomformist academy at Warrington, where his father was tutor. He studied medicine in the university of Edinburgh, and in London under Dr William Hunter. He practised as a surgeon at Chester and Warrington. Finally, he went to Leyden, took the degree of M.D. (1780), and in 1784 established himself as a doctor in Yarmouth. In 1792 he removed to London, where he practised as a consulting physician. But he concerned himself more with the advocacy of liberty of conscience than with his professional duties, and he began at an early period to devote himself to literary pursuits. In conjunction with his sister, Mrs Barbauld (*q.v.*), he published a popular series of volumes entitled *Evenings at Home* (6 vols., 1792–1795), excellently adapted for elementary family reading, which were translated into almost every European language. In 1798 Dr Aikin retired from professional life and devoted himself with great industry to various literary undertakings, among which his *General Biography* (10 vols., 1799–1815) holds a conspicuous place. Besides these, he published *Biog. Memoirs of Medicine* (1780); *Lives of John Selden and Archbishop Usher* (1812) and other works. He edited the *Monthly Magazine* from 1796 to 1807, and conducted a paper called the *Athenaeum* from 1807 to 1809, when it was discontinued. Aikin died in 1822.

His daughter, Lucy Aikin (1781–1864), born at Warrington on the 6th of November 1781, had some repute as a historical writer. After producing various books for the young, and a novel, *Lorimer* (1814), she published in 1818 her *Memoirs of the Court of Queen Elizabeth*, which passed through several editions. This was followed by *Memoirs of the Court of James I.* (1822), *Memoirs of the Court of Charles I.* (1833) and a *Life of Addison* (1843). Miss Aikin died at Hampstead, where she had lived for forty years, on the 29th of January 1864.

See a *Memoir of John Aikin, with selections of his miscellaneous pieces* (1823), by his daughter; and the *Memoirs, Miscellanies and Letters of Lucy Aikin* (1864), including her correspondence (1826–1842) with William Ellery Channing, edited by P. H. Le Breton.

AIKMAN, WILLIAM (1682–1731), British portrait-painter, was born at Cairney, Forfarshire. He was intended by his father for the bar, but followed his natural bent by becoming a pupil under Sir John Medina, the leading painter of the day in Scotland. In 1707 he went to Italy, resided in Rome for three years, afterwards travelled to Constantinople and Smyrna, and in 1712 returned home. In Edinburgh, where he practised as a portrait-painter for some years, he enjoyed the patronage of the duke of Argyll; and on his removal to London in 1723 he soon obtained many important commissions. Perhaps his most successful work was the portrait of the poet Gay. He also painted portraits of himself, Fletcher of Saltoun, William Carstares and Thomson the poet. The likenesses were generally truthful and the style was modelled very closely upon that of Sir Godfrey Kneller. Aikman held a good position in literary society and counted among his personal friends Swift, Pope, Thomson, Allan Ramsay, Somervile and Mallet.

AILANTHUS (more correctly *ailantus*, from *ailanto*, an Amboyna word probably meaning "Tree of the Gods," or "Tree of Heaven"), a genus of trees belonging to the natural order Simarubaceae. The best known species, *A. glandulosa*, Chinese sumach or tree of heaven, is a handsome, quick-growing tree with spreading branches and large compound leaves, resembling those of the ash, and bearing numerous pairs of long pointed leaflets. The small greenish flowers are borne on branched panicles; and the male ones are characterized by having a disgusting odour. The fruits are free in clusters, and each is drawn out into a long wing with the seed in the middle. The wood is fine grained and satiny. The tree, which is a native of China and Japan, was introduced into England in 1751 and is a favourite in parks and gardens. A silk spinning moth, the ailanthus moth (*Bombyx* or *Philosamia cynthia*), lives on its leaves, and yields a silk more durable and cheaper than mulberry silk, but inferior to it in fineness and gloss. This moth is common near many towns in the eastern United States; it is about 5 in. across, with angulated wings, and in colour olive brown, with white markings. Other species of ailanthus are: *A. imberbiflora* and *A. punctata*, important Australian timber-trees; and *A. excelsa*, common in India.

AILLY, PIERRE D' (1350–1420), French theologian, was born at Compiègne in 1350 of a bourgeois family, and studied in Paris at the celebrated college of Navarre. He became a licentiate of arts in 1367, procurator of the French "nation" in 1372, bachelor of theology in 1372, and licentiate and doctor in that faculty in 1381.

Since 1378 Western Christendom, in consequence of the election of the two popes Urban VI. and Clement VII., had been divided into two obediences. In the spring of 1379 Pierre d'Ailly, in anticipation even of the decision of the university of Paris, had carried to the pope of Avignon the "rôle" of the French nation, but notwithstanding this prompt adhesion he was firm in his desire to put an end to the schism, and when, on the 20th of May 1381, the university decreed that the best means to this end was to try to gather together a general council, Pierre d'Ailly supported this motion before the king's council in the presence of the duke of Anjou. The dissatisfaction displayed shortly after by the government obliged the university to give up this scheme, and was probably the cause of Pierre d'Ailly's temporary retirement to Noyon, where he held a canonry. There he continued the struggle for his side in a humorous work, in which the partisans of the council are amusingly taken to task by the demon Leviathan.

After his return to Paris, where from 1384 onwards he filled the position of master of the college of Navarre, and took part in a violent campaign against the chancellor of Notre-Dame, he was twice entrusted with a mission to Clement VII. in 1388 to defend the doctrines of the university, and especially those concerning the Immaculate Conception of the Virgin, against the preaching friar Jean de Montson, and in 1389 to petition in the name of the king for the canonization of the young cardinal Peter of Luxemburg. The success which attended his efforts on these two occasions, and the eloquence which he displayed, perhaps contributed to his choice as the king's almoner and confessor. At the same time, by means of an exchange, he obtained to the highest dignity in the university, becoming chancellor of Notre-Dame de Paris.

When in 1394 Benedict XIII. succeeded Clement VII. at Avignon, Pierre d'Ailly was entrusted by the king with a mission of congratulation to the new pontiff. His obsequious language on this occasion, and the favours with which it was rewarded, formed a too violent contrast to the determined attitude of the university of Paris, which, tired of the schism, was even then demanding the resignation of the two pontiffs. Pierre d'Ailly himself had not long before taken part in the drawing up of a letter to the king in which the advantages of this double abdication were set forth, but since then his zeal had seemed to cool a little. None the less, on his return from Avignon, he again in the presence of the king enlarged upon the advantages offered by the way which the university commended. But the suspicions aroused by his conduct found further confirmation when he caused himself—or allowed himself—to be nominated bishop of Le Puy by Benedict XIII. (April 2, 1395). The great number of benefices which he held left room for some doubt as to his disinterestedness. Henceforward he was under suspicion at the university, and was excluded from the assemblies where the union was discussed.

Some time afterwards Pierre d'Ailly became bishop of Cambrai (March 19, 1397) by the favour of the pope, who had yielded no whit, and, by virtue of this position, became also a prince of the empire. In order to take possession of his new see, he had to brave the wrath of the duke of Burgundy, override the resistance of the clergy and bourgeoisie, and even withstand an armed attack on the part of several lords; but his protector, the duke of Orleans, had his investiture performed by Wenceslaus, king of the Romans. The latter, though a partisan of the pope of Rome, took the opportunity of enjoining on Pierre d'Ailly to go in his name and argue with the pope of Avignon, a move which had as its object to persuade Benedict XIII. to an abdication, the necessity of which was becoming more and more evident. However, the language of the bishop of Cambrai seems on this occasion to have been lacking in decision; however that may be, it led to no felicitous result.

France next tried to bring violent pressure to bear to conquer the obstinacy of Benedict XIII. by threatening a formal withdrawal from his obedience. Pierre d'Ailly, who, in spite of his attachment to the pope, had been carried away by the example of the kingdom, was among the first who, in 1403, after experience of what had happened, counselled and celebrated the restoration of obedience. He was sent by Charles VI. on an embassy to Benedict XIII. and seized this opportunity of lavishing on the pontiff friendly congratulations mingled with useful advice. Two years later, before the same pontiff, he preached in the city of Genoa a sermon which led to the general institution, in the countries of the obedience of Avignon, of the festival of the Holy Trinity.

At the ecclesiastical council which took place at Paris in 1406 Pierre d'Ailly made every effort to avert a new withdrawal from the obedience and, by order of the king, took the part of defender of Benedict XIII., a course which yet again exposed him to attacks from the university party. The following year he and his disciple Gerson formed part of the great embassy sent by the princes to the two pontiffs, and while in Italy he was occupied in praiseworthy but vain efforts to induce the pope of Rome to remove himself to a town on the Italian coast, in the neighbourhood of his rival, where it was hoped that the double abdication would take place. Discouraged by his failure to effect this, he returned to his diocese of Cambrai at the beginning of 1408. At this time he was still faithful to Benedict XIII., and the disinclination he felt to joining the members of the French clergy who were on the point of ratifying the royal declaration of neutrality excited the anger of Charles VI.'s government, and a mandate, which was however not executed, ordered the arrest of the bishop of Cambrai.

It was not till after the cardinals of the two colleges had led to the convocation of the general council of Pisa that Pierre d'Ailly renounced the support of Benedict XIII., and, for want of a better policy, again allied himself with the cause which he had championed in his youth. In the council lay now, to judge from his words, the only chance of salvation; and, in view of the requirements of the case, he began to argue that, in case of schism, a council could be convoked by any one of the faithful, and would have the right to judge and even to depose the rival pontiffs. This was, in fact, the procedure of the council of Pisa, in which Pierre d'Ailly took part. After the declaration of the deposition of Gregory XII. and Benedict XIII. it went on to the election of Alexander V. (June 26th, 1409). This pope reigned only ten months; his successor, John XXIII., raised Pierre d'Ailly to the rank of cardinal (June 6, 1411), and further, to indemnify him for the loss of the bishopric of Cambrai, conferred upon him the administration of that of Limoges (November 3, 1412), which was shortly after exchanged for the bishopric of Orange. He also nominated Pierre d'Ailly as his legate in Germany (March 18, 1413).

Forgetting these benefits, the cardinal of Cambrai was one of the most formidable adversaries of John XXIII. at the council of Constance. Convinced as he was of the necessity for union and reform, he contributed more than any one to the adoption of the principle that, since the schism had survived the council of Pisa, it was necessary again to take up the work for a fundamental union, without considering the rights of John XXIII. any more than they had those of Gregory XII. and Benedict XIII. From this point of view Pierre d'Ailly, together with his compatriot Cardinal Fillastre, took the preponderating part during the first few months. Afterwards, seeing the trend of events, he showed some uneasiness and hesitation. He refused, however, to undertake the defence of John XXIII., and only appeared in the trial of this pope to make depositions against him, which were sometimes of an overwhelming character.

Among the important matters which claimed his attention at Constance may be mentioned also the condemnation of the errors of Wycliffe and the trial of John Huss. The reading in public of his two treatises *De Potestate ecclesiastica* and *De Reformatione Ecclesiae* revealed, besides ideas very peculiar to himself on the reform and constitution of the church, his design of reducing the power of the English in the council by denying them the right of forming a separate nation (October 1–November 1, 1416). By this campaign, which exposed him to the worst retaliation of the English, he inaugurated his rôle of "procurator and defender of the king of France."

When at last the question arose of giving the Christian world a new pope, this time sole and uncontested, Pierre d'Ailly defended the right of the cardinals, if not to keep the election entirely in their own hands, at any rate to share in the election, and he brought forward an ingenious system for reconciling the pretensions of the council with the rights of the Sacred College. In this way was elected Pope Martin V. (November 11, 1417), and the task of Pierre d'Ailly was at last finished.

The predominance of the Anglo-Burgundians in France having made it impossible for him to stay there, he went to Avignon to end his days in melancholy calculations arising from the calamities of which he had been the witness, and the astrological reckonings, in which he found pleasure, of the chances for and against the world coming to an end in the near future. He died on the 9th of August 1420.

Pierre d'Ailly's written works are numerous. A great part of them was published with the works of Gerson (by Ellies du Pin, Antwerp, 1706); another part appeared in the 15th century, probably at Brussels, and there are many treatises and sermons still unpublished. In philosophy he was a nominalist. Many questions in science and astrology, such as the reform of the calendar, attracted his attention. His other works consisted of theological essays, ascetic or exegetic, questions of ecclesiastical discipline and reform, and of various polemical writings called forth for the most part by the schism.

Whatever reservations may be made as to a certain interested or ambitious side of his character, Pierre d'Ailly, whose devotion to the cause of union and reform is incontestable, remains one of the leading spirits of the end of the 14th and beginning of the 15th centuries.

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AILSA CRAIG, an island rock at the mouth of the Firth of Clyde, 10 m. W. of Girvan, Ayrshire, Scotland. It is of conoidal form, with an irregular elliptic base, and rises abruptly to a height of 1114 ft. The only side from which the rock can be ascended is the east; the other sides being for the most part perpendicular, and generally presenting lofty columnar forms, though not so regular as those of Staffa. This island is composed of micro-granite with riebeckite, of great interest on account of the rare occurrence of this type in Britain. It is comparatively fine-grained and of a greyish colour. Its essential constituents are felspar, quartz and riebeckite—a soda amphibole. The last of these minerals occurs in small irregular patches between the idiomorphic felspars which Dr J. J. H. Teall has found to be a soda orthoclase. The rock is allied to paisanite described by C. A. Osann and has been termed ailsite by Professor M. F. Heddle. It forms part of an intrusive mass which, on the south and west cliffs of the island, has a columnar arrangement and is traversed by dykes of dolerite, most of which run in a north-west direction. The age of this mass is uncertain, as its relations to other rocks are not visible in the island. As riebeckite-granophyre has been found in Skye it may be of Tertiary age. The rock is a favourite material for curling-stones, about three-fourths (according to estimate) of those in use in the countries where the game obtains being made of it. On this account curling-stones are popularly known as "Ailsas" or "Ailsa Craigs." A columnar cave exists towards the northern side of the island, and on the eastern are the remains of a tower, with several vaulted rooms. Two springs occur and some scanty grass affords subsistence to rabbits, and, on the higher levels, to goats. The precipitous parts are frequented by large flocks of solan geese and other sea birds. The lighthouse on the southern side shows a flashing light visible for 13 m. In 1831 the twelfth earl of Cassillis became first marquis of Ailsa, taking the title from the Craig, which was his property. When John Keats was in Girvan during his Scottish tour in 1818 he apostrophized the rock in a fine sonnet.

AIMAK, or EIMAK (Mongolian for "clan," or section of a tribe), the name given to certain nomadic or semi-nomadic tribes of Mongolian stock inhabiting the north and north-west Afghan highlands immediately to the north of Herat. They were originally known as "chahar (the four) Eimaks," because there were four principal tribes: the Taimani (the predominating element in the population of Ghur), the Ferozkhoi, the Jamshidi and, according to some authorities, the Hazara. The Aimak peoples number upwards of a quarter of a million, and speak a dialect said to be closely related to the Kalmuck. They are Sunnite Mahommedans in distinction from the Hazara who are Shiites. They are predominantly of Iranian or quasi-Iranian blood, while the Hazara are Turanian. They are a bold, wild people and renowned fighters.

AIMARD, GUSTAVE, the pen-name of OLIVIER GLOUX (1818–1883), French novelist, who was born in Paris on the 13th of September 1818. He made use of the materials collected in a roving and adventurous youth and early manhood in numerous romances in the style of J. Fenimore Cooper. Among the best of them are: *Les Trappeurs de l'Arkansas* (1858); *La Grande flibuste* (1860); *Nuits mexicaines* (1863); *La Forêt vierge* (1870). He died in Paris on the 20th of June 1883. Many of his novels have been translated into English.

AIMOIN (*c.* 960–*c.* 1010), French chronicler, was born at Villefranche de Longchapt about 960, and in early life entered the monastery of Fleury, where he became a monk and passed the greater part of his life. His chief work is a *Historia Francorum*, or *Libri V. de gestis Francorum*, which deals with the history of the Franks from the earliest times to 653, and was continued by other writers until the middle of the 12th century. It was much in vogue during the middle ages, but its historical value is now regarded as slight. It has been edited by G. Waitz and published in the *Monumenta Germaniae historica: Scriptores*, Band xxvi. (Hanover and Berlin, 1826–1892). He also wrote a *Vita Abbonis, abbatis Floriacensis*, the last of a series of lives of the abbots of Fleury, all of which, except the life of Abbo, have been lost. This has been published by J. Mabillon in the *Acta sanctorum ordinis sancti Benedicti* (Paris, 1668–1701). Aimoin's third work was the composition of books ii. and iii. of the *Miracula Sancti Benedicti*, the first book of which was written by another monk of Fleury named Adrevald. This also appears in the *Acta sanctorum ordinis sancti Benedicti*.

Aimoin, who died about 1010, must be distinguished from Aimoin, a monk of St Germain-des-Prés, who wrote *De miraculis sancti Germani*, and a fragment *De Normanorum gestis circa Parisiacam urbem et de divina in eos ultione tempore Caroli calvi*. Both of these are published in the *Historiae Francorum Scriptores*, Tome ii. (Paris, 1639–1649).

See *Histoire littéraire de la France*, tome vii. (Paris, 1865–1869).

AIN, a department on the eastern frontier of France, formed in 1790 from Bresse, the Pays de Gex, Bugey, Dombes and Valromey, districts of Burgundy. It is bounded N. by the departments of Jura and Saône-et-Loire, W. by Saône-et-Loire and Rhône, S. by Isère, and E. by the departments of Savoie and Haute-Savoie and the Swiss cantons Geneva and Vaud. Pop. (1906) 345,856. Area 2248 sq. m. The department takes its name from the river Ain, which traverses its centre in a southerly direction and separates it roughly into two well-marked physical divisions—a region of mountains to the east, and of plains to the west. The mountainous region is occupied by the southern portion of the Jura, which is divided into parallel chains running north and south and decreasing in height from east to west. The most easterly of these chains, that forming the Pays de Gex in the extreme north-east of the department, contains the Crêt de la Neige (6653 ft.) and other of the highest summits in the whole range. The district of Bugey occupies the triangle formed by the Rhone in the south-east of the department. West of the Ain, with the exception of the district covered by the Revermont, the westernmost chain of the Jura, the country is flat, consisting in the north of the south portion of the Bresse, in the south of the marshy Dombes. The chief rivers of the eastern region are the Valserine and the Seran, right-hand tributaries of the Rhone, which forms the eastern and southern boundary of the department; and the Albarine and Oignin, left-hand affluents of the Ain. The Bresse is watered by the Veyle and the Reyssouze, both flowing into the Saône, which washes the western limit of the department. The climate is cold in the eastern and central districts of Ain, but it is on the whole healthy, except in the Dombes. The average rainfall is about 38 in. The soil in the valleys and plains of the department, especially in the Bresse, is fertile, producing large quantities of wheat, as well as oats, buckwheat and maize. East of the Ain, forests of fir and oak abound on the mountains, the lower slopes of which give excellent pasture for sheep and cattle, and much cheese is produced. Horse-raising is carried on in the Dombes. The pigs and fowls of the Bresse and the geese and turkeys of the Dombes are largely exported. The vineyards of Bugey and Revermont yield good wines. The chief mineral product is the asphalt of the mines of Seyssel on the eastern frontier, besides which potter's clay, building stone, hydraulic lime and cement are produced in the department. There are many corn and saw mills and the wood-working industry is important. Silk fabrics, coarse woollen cloth, paper and clocks are manufactured. Live-stock and agricultural products are exported; the chief imports are wood and raw silk. The department is within the judicial circumscription of the appeal court of Lyons and the educational circumscription (académie) of Lyons. It forms part of the archiepiscopal province of Besançon. The Rhone and the Saône are navigable for considerable distances in the department; the chief railway is that of the Paris-Lyon-Méditerranée Company, whose line from Mâcon to Culoz traverses the department. Ain is divided into five arrondissements—those of Bourg and Trévoux in the west, and those of Gex, Nantua and Belley in the east; containing in all 36 cantons and 455 communes. Bourg is the capital and Belley is the seat of a bishop. Jujurieux, in the arrondissement of Nantua, has the most important silk factory in the department, occupying over 1000 workpeople. Bellegarde on the eastern frontier is an industrial centre; it has a manufactory of wood-pulp, and saw and flour mills, power for which is obtained from the waters of the Rhone. Oyonnax and its environs, north of Nantua, are noted for the production of articles in wood and horn, especially combs. St Rambert, in the arrondissement of Belley, besides being of industrial importance for its manufactures of silk and paper, possesses the remains of a Benedictine abbey, powerful in the 11th, 12th and 13th centuries. The Gothic church of Ambronay in the arrondissement of Belley, the church of St Paul de Varax (about 9 m. S.W. of Bourg), a building in the Romanesque style of Burgundy, and that of Nantua (12th century), are of architectural interest. Ferney, 4 m. S.W. of Gex, is famous as the residence of Voltaire from 1758–1778.

AINGER, ALFRED (1837–1904), English divine and man of letters, was born in London on the 9th of February 1837, the son of an architect. He was educated at King's College, London, and at Trinity College, Cambridge, and was ordained in 1860 to a curacy at Alrewas, near Rugeley. There he remained until 1864, when he became an assistant master at the Sheffield Collegiate School. His connexion with the Temple church, in London, began in 1866, when he was appointed reader; and in 1894 he succeeded Dr Vaughan as master. In 1887 he was presented to a canonry in Bristol cathedral, and he was chaplain-in-ordinary to Queen Victoria and King Edward VII. He died on the 8th of February 1904. Canon Ainger's gentle wit and humour, his generosity and lovable disposition, endeared him to a wide circle. In literature his name is chiefly associated with his sympathetic appreciation of Charles Lamb and Thomas Hood. His works include: *Charles Lamb* (1882) and *Crabbe* (1903) in the "English Men of Letters" series; editions of Lamb's *Essays of Elia* (1883) and of his *Letters* (1888; 2nd ed., 1904), of the *Poems* (1897) of Thomas Hood, with a biographical introduction; *The Life and Works of Charles Lamb* (12 vols., 1899–1900); articles on Tennyson and Du Maurier in the *Dictionary of National Biography*; *The Gospel and Human Life* (1904), sermons; *Lectures and Essays* (2 vols., 1905), edited by the Rev. H. C. Beeching.

See also Edith Sichel, *The Life and Letters of Canon Ainger* (1906).

AINMULLER, MAXIMILIAN EMMANUEL (1807–1870), German artist and glass-painter, was born at Munich on the 14th of February 1807. By the advice of Gartner, director of the royal porcelain manufactory, he devoted himself to the study of glass-painting, both as a mechanical process and as an art, and in 1828 he was appointed director of the newly-founded royal painted-glass manufactory at Munich. The method which he gradually perfected there was a development of the enamel process adopted in the Renaissance, and consisted in actually painting the design upon the glass, which was subjected, as each colour was laid on, to carefully-adjusted heating. The earliest specimens of Ainmuller's work are to be found in the cathedral of Regensburg. With a few exceptions, all the windows in Glasgow cathedral are from his hand. Specimens may also be seen in St Paul's cathedral, and Peterhouse, Cambridge, and Cologne cathedral contains some of his finest productions. Ainmuller had considerable skill as an oil-painter, especially in interiors, his pictures of the Chapel Royal at Windsor and of Westminster Abbey being much admired. He died on the 9th of December 1870.

AINSWORTH, HENRY (1571–1622), English Nonconformist divine and scholar, was born of yeoman stock in 1570/1 at Swanton Morley, Norfolk. He was for four years from December 1587 a scholar of Caius College, Cambridge, and, after associating with the Puritan party in the Church, eventually joined the Separatists. Driven abroad about the year 1593, he found a home in "a blind lane at Amsterdam." He acted as "porter" to a scholarly bookseller in that city, who, on discovering his skill in the Hebrew language, made him known to his countrymen. When part of the London church, of which Francis Johnson (then in prison) was pastor, reassembled in Amsterdam, Ainsworth was chosen as their doctor or teacher. In 1596 he took the lead in drawing up a confession of their faith, which he reissued in Latin in 1598 and dedicated to the various universities of Europe (including St Andrews, Scotland). Johnson joined his flock in 1597, and in 1604 he and Ainsworth composed *An Apology or Defence of such true Christians as are commonly but unjustly called Brownists*. The task of organizing the church was not easy and dissension was rife. Of Ainsworth it may be said that, though often embroiled in controversy, he never put himself forward; yet he was the most steadfast and cultured champion of the principles represented by the early Congregationalists. Amid all the strife of controversy, he steadily pursued his rabbinical studies. The combination was so unique that many, like the encyclopaedists L. Moréri and J. H. Zedler, have made two Henry Ainsworths—one Dr Henry Ainsworth, a learned biblical commentator; the other H. Ainsworth, an arch-heretic and "the ringleader of the Separatists at Amsterdam." Some confusion has also been occasioned through his not unfriendly controversy with one John Ainsworth, who abjured the Anglican for the Roman church. In 1608 Ainsworth answered Richard Bernard's *The Separatist Schisme*. But his ablest and most arduous minor work in controversy was his reply to John Smyth (commonly called "the Se-Baptist"), entitled a *Defence of Holy Scripture, Worship and Ministry used in the Christian Churches separated from Antichrist, against the Challenges, Cavils and Contradictions of Mr Smyth* (1609). In 1610 he was forced reluctantly to withdraw, with a large part of their church, from F. Johnson and those who adhered to him. For some time a difference of principle, as to the church's right to revise its officers' decisions, had been growing between them, Ainsworth taking the more Congregational view. (See CONGREGATIONALISM.) But in spirit he remained a man of peace. His memory abides through his rabbinical learning. The ripe fruit of many years' labour appeared in his *Annotations*—on *Genesis* (1616); *Exodus* (1617); *Leviticus* (1618); *Numbers* (1619); *Deuteronomy* (1619); *Psalms* (including a metrical version, 1612);

Song of Solomon (1623). These were collected in folio in 1627, and again in 1639, and later in various forms. From the outset the *Annotations* took a commanding place, especially among continental scholars, and he established for English nonconformity a tradition of culture and scholarship. There is no probability about the narrative given by Neal in his *History of the Puritans* (ii. 47) that he was poisoned by certain Jews. He died in 1622, or early in 1623, for in that year was published his *Seasonable Discourse, or a Censure upon a Dialogue of the Anabaptists*, in which the editor speaks of him as a departed worthy.

Literature.—John Worthington's *Diary* (Chetham Society), by Crossley, i. 263-266; works of John Robinson (1851); H. M. Dexter, *Congregationalism of the Last Three Hundred Years* (1880); W. E. A. Axon, *H. Ainsworth, the Puritan Commentator* (1889); F. J. Powicke, *Henry Barrow and the Exiled Church of Amsterdam* (1900); J. H. Shakespeare, *Baptist and Congregational Pioneers* (1906).

AINSWORTH, ROBERT (1660–1743), English schoolmaster and author, was born at Eccles, near Manchester, in September 1660. After teaching for some time at Lever's Grammar School in Bolton, he removed to London, where he conducted a boarding-school, first at Bethnal Green and then at Hackney. He soon made a moderate fortune which gave him leisure to pursue his classical studies. Ainsworth's name is associated with his Latin-English Dictionary, begun in 1714, and published in 1736 as *Thesaurus linguae Latinae compendiarius*. It was long extensively used in schools, and often reprinted, the later editions being revised and enlarged by other hands, but it is now superseded. Ainsworth was also the author of some useful works on classical antiquities, and a sensible treatise on education, entitled *The most Natural and Easy Way of Institution* (1698), in which he advocates the teaching of Latin by conversational methods and deprecates punishment of any sort. He died in London on the 4th of April 1743.

AINSWORTH, WILLIAM HARRISON (1805–1882), English novelist, son of Thomas Ainsworth, solicitor, was born at Manchester on the 4th of February 1805. He was educated at Manchester Grammar School and articled to the firm of which his father was a member, proceeding to London in 1824 to complete his legal training at the Inner Temple. At the age of twenty-one he married a daughter of John Ebers the publisher, and started in his father-in-law's line of business. This, however, soon proved unprofitable and he decided to attempt literary work. A novel called *Sir John Chiverton*, in which he appears to have had a share, had attracted the praise of Sir Walter Scott, and this encouragement decided him to take up fiction as a career. In 1834 he published *Rookwood*, which had an immediate success, and thenceforth he was always occupied with the compilation of "historical" novels. He published about forty such stories, of which the best-known are *Jack Sheppard* (1839), *The Tower of London* (1840), *Guy Fawkes* (1841), *Old St Paul's* (1841) and *Windsor Castle* (1843). He edited *Bentley's Miscellany*, in which *Jack Sheppard* was published as a serial, and in 1842 he became proprietor of *Ainsworth's Magazine*. In 1853 it ceased to appear, and Ainsworth bought the *New Monthly Magazine*. He continued his literary activity until his death, but his later stories were less striking than the earlier ones. He died at Reigate on the 3rd of January 1882 and was buried at Kensal Green. Ainsworth had a lively talent for plot, and his books have many attractive qualities. The glorification of Dick Turpin in *Rookwood*, and of Jack Sheppard in the novel that bears his name, caused considerable outcry among straitlaced elders. In his later novels Ainsworth confined himself to heroes less open to criticism. His style was not without archaic affectation and awkwardness, but when his energies were aroused by a striking situation he could be brisk, vigorous and impressive. He did a great deal to interest the less educated classes in the historical romances of their country, and his tales were invariably instructive, clean and manly.

AINTAB (anc. *Doliché*), a town in the vilayet of Aleppo and ancient Cyrrhestica district of N. Syria. Pop. 45,000, two-thirds Moslem. The site of Doliche, famous for its worship of Baal (Zeus Dolichenus), adopted by the Seleucids and eventually spread all over the Roman empire, lies at Duluk, two hours N.W.; but nothing is to be seen there except a mound. The place was probably of Hittite origin and does not appear to have been settled by Greeks. The bazaars of Aintab are a great centre for "Hittite" antiquities, found at various sites from Sakchegözu on the west to Jerablus on the east. The modern town lies in the open treeless valley of the Sajur, a tributary of the Euphrates, and on the right bank, 65 m. north-east of Aleppo, with which it is connected by a *chaussée*, passing through Killis. This road proceeds east to the great crossing of Euphrates at Birejik, and thus Aintab lies on the highway between N. Syria and Urfa-Mosul and has much transit trade and numerous *khans*. In the middle ages its strong castle (Hamtab) was an important strategic point, taken by Saladin about A.D. 1183; and it supplied the last base from which Ibrahim Pasha marched in 1839 to win his decisive victory over the Turks at Nezib, about 25 m. distant north-east. Lying high (3500 ft.) and swept by purifying winds, Aintab is a comparatively clean and healthy spot, though not free from ophthalmia and the "Aleppo button," and it has been selected by the American Mission Board as its centre for N. Syria. "Central Turkey College," educational and medical, lies on high ground west. It was burnt down in 1891, but rebuilt; it has a dependency for girls within the town. Thanks to its presence the Armenian protestants are a large and rich community, which suffered less in the massacre of 1895 than the Gregorians. There is a small Episcopalian body, which has a large unfinished church, and a schismatic "catholicos," who has vainly tried to gain acceptance into the Anglican communion. There is also a flourishing Franciscan mission. Striped cloths and *pekmes*, a sweet paste made from grapes, are the principal manufactures; and tobacco and cereals the principal cultures. The town is unusually well and solidly built, good stone being obtained near at hand. The Moslem inhabitants are mainly of Turkoman origin, and used to owe fealty to chieftains of the family of Chapan Oglu, whose headquarters were at Yuzgat in Cappadocia. (D. G. H.)

AINU ("man"), a race inhabiting the northernmost islands of Japan. Little definite is known about their earliest history, but it is improbable that they are, as has been urged, the aborigines of Japan. The most accurate researches go to prove that they were immigrants, who reached Yezo from the Kuriles, and subsequently crossing Tsugaru strait, colonized a great part of the main island of Japan, exterminating a race of pit-dwellers to whom they gave the name of *koro-pok-guru* (men with sunken places). These *koro-pok-guru* were of such small stature as to be considered dwarfs. They wore skins of animals for clothing, and that they understood the potter's art and used flint arrow-heads is clearly proved by excavations at the sites of their pits. The Ainu, on the contrary, never had any knowledge of pottery. Ultimately the Ainu, coming into contact with the Japanese, who had immigrated from the south and west, were driven northward into the island of Yezo, where, as well as in the Kuriles and in the southern part of Sakhalin, they are still found in some numbers. When, at the close of the 18th and the beginning of the 19th century, Russian enterprises drew the attention of the Japanese government to the northern districts of the empire, the Tokugawa shoguns adopted towards the Ainu a policy of liberality and leniency consistent with the best principles of modern colonization. But the doom of unfitness appears to have begun to overtake the race long ago. History indicates that in ancient times they were fierce fighters, able to offer a stout resistance to the incomparably better armed and more civilized Japanese. To-day they are drunken, dirty, spiritless folk, whom it is difficult to suppose capable of the warlike *rôle* they once played. Their number, between 16,000 and 17,000, is virtually stationary. The Ainu are somewhat taller than the Japanese, stoutly built, well proportioned, with dark-brown eyes, high cheek-bones, short broad noses and faces lacking length. The hairiness of the Ainu has been much exaggerated. They are not more hairy than many Europeans. Never shaving after a certain age, the men have full beards and moustaches, but the stories of Ainu covered with hair like a bear are quite unjustified by facts. Men and women alike cut their hair level with the shoulders at the sides of the head, but trim it semicircularly behind. The women tattoo their mouths, arms, and sometimes their foreheads, using for colour the smut deposited on a pot hung over a fire of birch bark. Their original dress is a robe spun from the bark of the elm tree. It has long sleeves, reaches nearly to the feet, is folded round the body and tied with a girdle of the same material. Females wear also an undergarment of Japanese cloth. In winter the skins of animals are worn, with leggings of deerskin and boots made from the skin of dogs or salmon. Both sexes are fond of ear-rings, which are said to have been made of grape-vine in former times, but are now purchased from the Japanese, as also are bead necklaces, which the women prize highly. Their food is meat, whenever they can procure it—the flesh of the bear, the fox, the wolf, the badger, the ox or the horse—fish, fowl, millet, vegetables, herbs and roots. They never eat raw fish or flesh, but always either boil or roast it. Their habitations are reed-thatched huts, the largest 20 ft. square, without partitions and having a fireplace in the centre. There is no chimney, but only a hole at the angle of the roof; there is one window on the eastern side and there are two doors. Public buildings do not exist, whether in the shape of inn, meeting-place or temple. The furniture of their dwellings is exceedingly scanty. They have no chairs, stools or tables, but sit on the floor, which is covered with two layers of mats, one of rush, the other of flag; and for beds they spread planks, hanging mats around them on poles, and employing skins for coverlets. The men use chop-sticks and moustache-lifters when eating; the women have wooden spoons. Uncleanliness is characteristic of the Ainu, and all their intercourse with the Japanese has not improved them in that respect. The Rev. John Batchelor, in his *Notes on the Ainu*, says that he lived in one Ainu habitation for six weeks on one occasion, and for two months on another, and that he never once saw personal ablutions performed, or cooking or eating utensils washed.

Not having been at any period acquainted with the art of writing, they have no literature and are profoundly ignorant. But at schools established for them by the Japanese in recent times, they have shown that their intellectual capacity is not deficient. No distinct conception of a universe enters into their cosmology. They picture to themselves many floating worlds, yet they deduce the idea of rotundity from the course of the sun, and they imagine that the "Ainu world" rests on the back of a fish whose movements cause earthquakes. It is scarcely possible to doubt that this fancy is derived from the Japanese, who used to hold an identical theory. The Ainu believe in a supreme Creator, but also in a sun-god, a moon-god, a water-god and a mountain-god, deities whose river is the Milky Way, whose voices are heard in the thunder and whose glory is reflected in the lightning. Their chief object of actual worship appears to be the bear. Miss Isabella Bird (Mrs Bishop) writes: "The peculiarity which distinguishes their rude mythology is the worship of the bear, the Yezo bear being one of the finest of his species. But it is impossible to understand the feelings by which this cult is prompted, for although they worship the animal after their fashion and set up its head in their villages, yet they trap it, kill it, eat it and sell its skin. There is no doubt that this wild beast inspires more of the feeling which prompts worship than the inanimate forces of nature, and the Ainos may be distinguished as bear-worshippers, and their greatest religious festival or saturnalia as the Festival of the Bear. . . . Some of their rude chants are in praise of the bear, and their highest eulogy on a man is to compare him to a bear." They have no priests by profession. The village chief performs whatever religious ceremonies are necessary; ceremonies confined to making libations of wine, uttering short prayers and offering willow sticks with wooden shavings attached to them, much as the Japanese set up the well-known *gohei* (sacred offerings) at certain spots. The Ainu gives thanks to the gods before eating, and prays to the deity of fire in time of sickness. He thinks that his spirit is immortal, and that it will be rewarded hereafter in heaven or punished in hell, both of which places are beneath the earth, hell being the land of volcanoes; but he has no theory as to a resurrection of the body or metempsychosis. He preserves a tradition about a flood which seems to be the counterpart of the Biblical deluge, and about an earthquake which lasted a hundred days, produced the three volcanoes of Yezo and created the island by bridging the waters that had previously separated it into two parts.

The Ainu are now governed by Japanese laws and judged by Japanese tribunals, but in former times their affairs were administered by hereditary chiefs, three in each village, and for administrative purposes the country was divided into three districts, Saru, Usu and Ishikari, which were under the ultimate control of Saru, though the relations between their respective inhabitants were not close and intermarriages were avoided. The functions of judge were not entrusted to these chiefs; an indefinite number of a community's members sat in judgment upon its criminals. Capital punishment did not exist, nor was imprisonment resorted to, beating being considered a sufficient and final penalty, except in the case of murder, when the nose and ears of the assassin were cut off or the tendons of his feet severed. Little as the Japanese and the Ainu have in common, intermarriages are not infrequent, and at Sambutsu especially, on the eastern coast, many children of such marriages may be seen. Doenitz, Hilgendorf and Dr B. Scheube, arguing from a minute investigation of the physical traits of the Ainu, have concluded that they are Mongolians; according to Professor A. H. Keane the Ainu "are quite distinct from the surrounding Mongolic peoples, and present several remarkable physical characters which seem to point to a remote connexion with the Caucasic races. Such are a very full beard, shaggy or wavy black or dark-brown hair, sometimes covering the back and chest; a somewhat fair or even white complexion, large nose, straight eyes and regular features, often quite handsome and of European type. They seem to be a last remnant of the Neolithic peoples, who ranged in prehistoric times across the northern hemisphere from the British Isles to Manchuria and Japan. They are bear-worshippers, and have other customs in common with the Manchurian aborigines, but the language is entirely different, and they have traditions of a time when they were the dominant people in the surrounding lands." It should be noted finally that the Ainu are altogether free from ferocity or exclusiveness, and that they treat strangers with gentle kindness.

See Rev. John Batchelor, *The Ainu and their Folk-lore* (London, 1901); Romyn Hitchcock, *The Ainos of Japan* (Washington, 1892); H. von Siebold, *Über die Aino* (Berlin, 1881); Isabella Bird (Mrs Bishop), *Korea and her Neighbours* (1898); Basil Hall Chamberlain, *Language, Mythology and Geographical Nomenclature of Japan viewed in the Light of Aino Studies and Aino Fairy-tales* (1895).

AIR, or ASBEN, a country of West Africa, lying between 15° and 19° N. and 6° and 10° E. It is within the Sahara, of which it forms one of the most fertile regions. The northern portion of the country is mountainous, some of the peaks rising to a height of 5000 ft. Richly wooded hollows and extensive plains are interspersed between the hills. The mimosa, the dum palm and the date are abundant. Some of the plains afford good pasturage for camels, asses, goats and cattle; others are desert tablelands. In the less frequented districts wild animals abound, notably the lion and the gazelle. The country generally is of sandstone or granite formation, with occasional trachyte and basaltic ranges. There are no permanent rivers; but during the rainy season, from August to October, heavy floods convert the water-courses in the hollows of the mountains into broad and rapid streams. Numerous wells supply the wants of the people and their cattle. To the south of this variegated region lies a desert plateau, 2000 ft. above sea-level, destitute of water, and tenanted only by the wild ox, the ostrich and the giraffe. Still farther south is the fairly fertile district of Damerghu, of which Zinder is the chief town. Little of the soil is under cultivation except in the neighbourhood of the villages. Millet, dates, indigo and senna are the principal productions. The great bulk of the food supplies is brought from Damerghu, and the materials for clothing are also imported. A great caravan annually passes through Air, consisting of several thousand camels, carrying salt from Bilma to the Hausa states.

Air was called Asben by the native tribes until they were conquered by the Berbers. The present inhabitants are for the most part of a mixed race, combining the finer traits of the

Berbers with negro characteristics. The sultan of Air is to a great extent dependent on the chiefs of the Tuareg tribes inhabiting a vast tract of the Sahara to the north-west. A large part of his revenue is derived from tribute exacted from the salt caravans. Since 1890 Air has been included in the French sphere of influence in West Africa.

Agades, the capital of the country, which has a circuit of 3½ m., is built on the edge of a plateau 2500 ft. high, and is supposed to have been founded by the Berbers to serve as a secure magazine for their extensive trade with the Songhoi empire. The language of the people is a dialect of Songhoi. In former times Agades was a place of great traffic, and had a population of about 50,000. Since the beginning of the 16th century the prosperity of the town has, however, gradually declined. F. Foureau, who visited Agades in 1899, stated that more than half the total area was deserted and ruinous. The houses, which are built of clay, are low and flat-roofed; and the only buildings of importance are the chief mosque, which is surmounted by a tower 95 ft. high, and the sultan's residence, a massive two-storied structure pierced with small windows. The chief trade is grain. The great salt caravans pass through it, as well as pilgrims on their way to Mecca.

AIR (from an Indo-European root meaning "breathe," "blow"), the atmosphere that surrounds the earth; Gr. ἀήρ, the lower thick air, being distinguished from αἰθήρ, the upper pure air. With the development of analytical and especially of pneumatic chemistry, the air was recognized not to be one homogeneous substance, as was long supposed, and different "airs," or gases, came to be distinguished. Thus oxygen gas, at the end of the 18th century, was known as *dephlogisticated air*, nitrogen or azote as *phlogisticated air*, hydrogen as *inflammable air*, carbonic acid gas as *fixed air*. The name is now ordinarily restricted to what is more accurately called atmospheric air—the air we breathe—the invisible elastic fluid which surrounds the earth (see ATMOSPHERE). Probably the sense of atmosphere or environment led (though this is disputed by etymologists) to the further use of the word "air" to mean "manner" or "appearance"; and so to its employment (cf. Lat. *modus*) in music for "melody." (See ARIA.)

AIRAY, HENRY (1560?–1616), English Puritan divine, was born at Kentmere, Westmorland, but no record remains of the date of either birth or baptism. He was the son of William Airay, the favourite servant of Bernard Gilpin, "the apostle of the North," whose bounty showed itself in sending Henry and his brother Evan (or Ewan) to his own endowed school, where they were educated "in grammatical learning," and were in attendance at Oxford when Gilpin died. From Wood's *Athenae* we glean the details of Airay's college attendance. "He was sent to St Edmund's hall in 1579, aged nineteen or thereabouts. Soon after he was translated to Queen's College, where he became *pauper puer serviens*; that is, a poor serving child that waits on the fellows in the common hall at meals, and in their chambers, and does other servile work about the college." His transference to Queen's is perhaps explained by its having been Gilpin's college, and by his Westmorland origin giving him a claim on Eaglesfield's foundation. He graduated B.A. on the 19th of June 1583, M.A. on the 15th of June 1586, B.D. in 1594 and D.D. on the 17th of June 1600—all in Queen's College. "About the time he was master" (1586) "he entered holy orders, and became a frequent and zealous preacher in the university." His *Commentary on the Epistle to the Philippians* (1618, reprinted 1864) is a specimen of his preaching before his college, and of his fiery denunciation of popery and his fearless enunciation of that Calvinism which Oxford in common with all England then prized. In 1598 he was chosen provost of his college, and in 1606 was vice-chancellor of the university. In the discharge of his vice-chancellor's duties he came into conflict with Laud, who even thus early was manifesting his antagonism to the prevailing Puritanism.

He was also rector of Otmore (or Otmoor), near Oxford, a living which involved him in a trying but successful litigation, whereof later incumbents reaped the benefit. He died on the 6th of October 1616. His character as a man, preacher, divine, and as an important ruler in the university, will be found portrayed in the Epistle by John Potter, prefixed to the *Commentary*. He must have been a fine specimen of the more cultured Puritans—possessed of a robust common-sense in admirable contrast with some of his contemporaries.

AIRD, THOMAS (1802–1876), Scottish poet, was born at Bowden, Roxburghshire, on the 28th of August 1802. He was educated at Edinburgh University, where he made the acquaintance of Carlyle and James Hogg, and he decided to devote himself to literary work. He published *Martzoufle, a Tragedy, with other Poems* (1826), a volume of essays, and a long narrative poem in several cantos, *The Captive of Fez* (1830). For a year he edited the *Edinburgh Weekly Journal*, and for twenty-eight years the *Dumfriesshire and Galloway Herald*. In 1848 he published a collected edition of his poems, which met with much favour. Carlyle said that he found in them "a healthy breath as of mountain breezes." Among Aird's other friends were De Quincey, Lockhart, Stanley (afterwards dean of Westminster) and Motherwell. He died at Dumfries on the 25th of April 1876.

AIRDRIE, a municipal and police burgh of Lanarkshire, Scotland. Pop. (1901) 22,228. It is situated 11 m. E. of Glasgow by the North British railway, and also communicates with Glasgow by the Monkland Canal (which passes within 1 m. of the town), as well as by the Caledonian railway via Coatbridge and Whifflet. The canal was constructed between 1761 and 1790, and connects with the Forth and Clyde Canal near Maryhill. Airdrie was a market town in 1695, but owes its prosperity to the great coal and iron beds in its vicinity. Other industries include iron and brass foundries, engineering, manufactures of woollens and calicoes, silk-weaving, paper-making, oil and fireclay. The public buildings comprise the town hall, county buildings, mechanics' institute, academy, two fever hospitals and free library, the burgh having been the first town in Scotland to adopt the Free Library Act. Airdrie unites with Falkirk, Hamilton, Lanark and Linlithgow in sending one member to parliament. The parish of New Monkland, in which Airdrie lies, was formed (with Old Monkland)in 1640 out of the ancient barony of Monkland, so named from the fact that it was part of the lands granted by Malcolm IV. to the monks of Newbattle.

AIRE, a town of south-western France, in the department of Landes, on the left bank of the Adour, 22 m. S.E. of Mont-de-Marsan on the Southern railway between Morcenx and Tarbes. Pop. (1906) 2283. It is the seat of a bishopric, and has a cathedral of the 12th century and an episcopal palace of the 11th, 17th and 18th centuries. Both have undergone frequent restoration. They are surpassed in interest by the church of St Quitterie in Mas d'Aire, the suburb south-west of the town. The latter is a brick building of the 13th and 14th centuries, with a choir in the Romanesque style, and a fine western portal which has been much disfigured. The crypt contains several Gallo-Roman tombs and the sarcophagus (5th century) of St Quitterie. Aire has two ecclesiastical seminaries.

Aire (*Atura, Vicus Julii*) was the residence of the kings of the Visigoths, one of whom, Alaric II. (*q.v.*), there drew up his famous code. The bishopric dates from the 5th century.

AIRE, a town of northern France, on the river Lys, in the department of Pas-de-Calais, 12 m. S.S.E. of St Omer by rail. Pop. (1906) 4258. The town lies in a low and marshy situation at the junction of three canals. The chief buildings are the church of St Pierre (15th and 16th centuries), which has an imposing tower and rich interior decoration; a hôtel de ville of the 18th century; and the Bailliage (16th century), a small building in the Renaissance style. Aire has flour-mills, leather and oil works, and nail manufactories, and trade in agricultural produce.

In the middle ages Aire belonged to the counts of Flanders, from whom in 1188 it received a charter, which is still extant. It was given to France by the peace of Utrecht 1713.

AIR-ENGINE, the name given to heat-engines which use air for their working substance, that is to say for the substance which is caused alternately to expand and contract by application and removal of heat, this process enabling a portion of the applied heat to be transformed into mechanical work. Just as the working substance which alternately takes in and gives out heat in the steam-engine is water (converted during a part of the action into steam), so in the air-engine it is air. The practical drawbacks to employing air as the working substance of a heat-engine are so great that its use has been very limited. Such attempts as have been made to design air-engines on a large scale have been practical failures, and are now interesting only as steps in the historical development of applied thermodynamics. In the form of motors for producing very small amounts of power air-engines have been found convenient, and within a restricted field they are still met with. But even in this field the competition of the oil-engine and the gas-engine is too formidable to leave to the air-engine more than a very narrow chance of employment.

One of the chief practical objections to air-engines is the great bulk of the working substance in relation to the amount of heat that is utilized in the working of the engine. To some extent this objection may be reduced by using the air in a state of compression, and therefore of greater density, throughout its operation. Even then, however, the amount of operative heat is very small in comparison with that which passes through the steam-engine, per cubic foot swept through by the piston, for the change of state which water undergoes in its transformation into steam involves the taking in of much more heat than can be communicated to air in changing its temperature within such a range as is practicable. Another and not less serious objection is the practical difficulty of getting heat into the working air through the walls of the containing vessel. The air receives heat from an external furnace just as water does in the boiler of a steam-engine, by contact with a heated metallic surface, but it takes up heat from such a surface with much less readiness than does water. The waste of heat in the chimney gases is accordingly greater; and further, the metallic shell is liable to be quickly burned away as a result of its contact at a high temperature with free oxygen. The temperature of the shell is much higher than that of a steam boiler, for in order to secure that the working air will take up a fair amount of heat, the upper limit to which its temperature is raised greatly exceeds that of even high-pressure steam. This objection to the air-engine arises from the fact that the heat comes to it from *external* combustion; it disappears when *internal* combustion is resorted to; that is to say, when the heat is generated within the envelope containing the working air, by the combustion there of gaseous or other fuel. Gas-engines and oil-engines and other types of engine employing internal combustion may be regarded as closely related to the air-engine. They differ from it, however, in the fact that their working substance is not air, but a mixture of gases—a necessary consequence of internal combustion. It is to internal combustion that they owe their success, for it enables them to get all the heat of combustion into the working substance, to use a relatively very high temperature at the top of the range, and at the same time to escape entirely the drawbacks that arise in the air-engine proper through the need of conveying heat to the air through a metallic shell.

A form of air-engine which was invented in 1816 by the Rev. R. Stirling is of special interest as embodying the earliest application of what is known as the "regenerative" principle, the principle namely that heat may be deposited by a substance at one stage of its action and taken up again at another stage with but little loss, and with a great resulting change in the substance's temperature at each of the two stages in the operation. The principle has since found wide application in metallurgical and other operations. In any heat-engine it is essential that the working substance should be at a high temperature while it is taking in heat, and at a relatively low temperature when it is rejecting heat. The highest thermodynamic efficiency will be reached when the working substance is at the top of its temperature range while any heat is being received and at the bottom while any heat is being rejected—as is the case in the cycle of operations of the theoretically imagined engine of Carnot. (See THERMODYNAMICS and STEAM-ENGINE.) In Carnot's cycle the substance takes in heat at its highest temperature, then passes by adiabatic expansion from the top to the bottom of its temperature range, then rejects heat at the bottom of the range, and is finally brought back by adiabatic compression to the highest temperature at which it again takes in heat, and so on. An air-engine working on this cycle would be intolerably bulky and mechanically inefficient. Stirling substituted for the two stages of adiabatic expansion and compression the passage of the air to and fro through a "regenerator," in which the air was alternately cooled by storing its heat in the material of the regenerator and reheated by picking the stored heat up again on the return journey. The essential parts of one form of Stirling's engine are shown in fig. 1. There A is the externally-fired heating vessel, the lower part of which contains hot air which is taking in heat from the furnace beneath. A pipe from the top of A leads to the working cylinder (B). At the top of A is a cooler (C) consisting of pipes through which cold water is made to circulate. In A there is a displacer (D) which is connected (by parts not shown) with the piston in such a manner that it moves down when the piston has moved up. The air-pressure is practically the same above and below D, for these spaces are in free communication with one another through the regenerator (E), which is an annular space stacked loosely with wire-gauze. When D moves down, the hot air is driven up through the regenerator to the upper part of the containing vessel. It deposits its heat in the wire-gauze, becoming lowered in temperature and consequently reduced in pressure. The piston (B) descends, and the air, now in contact with the cooling pipes (C), gives up heat to them. Then the displacer (D) is raised. The air passes down through its regenerator, picking up the heat deposited there, and thereby having its temperature restored and its pressure raised. It then takes in heat from the furnace, expanding in volume and forcing the piston (B) to rise, which completes the cycle. The engine was double-acting, another heating vessel like A being connected with the upper end of the working cylinder at F. The stages at which heat is taken from the furnace and rejected to the cooler (C) are approximately isothermal at the upper and lower limits of temperature respectively, and the cycle accordingly is approximately "perfect" in the thermodynamic sense. The theoretical indicator diagram is made up of two isothermal lines for the taking in and rejection of heat, and two lines of constant volume for the two passages through the regenerator. This engine was the subject of two patents (by R. and S. Stirling) in 1827 and 1840. A double-acting Stirling engine of 50 horse-power, using air which was maintained by a pump at a fairly high pressure throughout the operations, was used for some years in the Dundee Foundry, where it is credited with having consumed only 1·7 lb of coal per hour per indicated horse-power. The coal consumption per brake-horse-power was no doubt much greater. It was finally abandoned on account of the failure of the heating vessels.

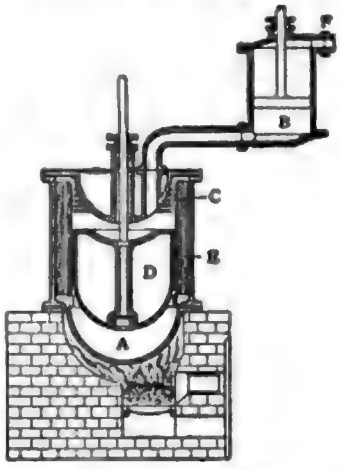

FIG. 1.—Stirling's Air-Engine.

The type survives in some small domestic motors, an example of which, manufactured under the patent of H. Robinson, is shown in fig. 2. In this there is no compressing pump, and the main pressure of the working air is simply that of the atmosphere. The whole range of pressure is so slight that no packing is required. Here A is the vessel in which the air is heated and within which the displacer works. It is heated by a small coke-fire or by a gas flame in C. It communicates through a passage

(D) with the working cylinder (B). The displacer (E), which takes its motion through a rod (I) from a rocking lever (F) connected by a short link to the crank-pin, is itself the regenerator, its construction being such that the air passes up and down through it as in one of the original Stirling forms. The cooler is a water vessel (G) through which water circulates from a tank (H). Messrs. Hayward and Tyler's "Rider" engine may be mentioned as another small hot-air motor which follows nearly the Stirling cycle of operations.

An attempt to develop a powerful air-engine was made in America about 1833 by John Ericsson, who applied it to marine propulsion in the ship "Caloric," but without permanent success. Like Stirling, Ericsson used a regenerator, but with this difference that the pressure instead of the volume of the air remained constant while it passed in each direction through the regenerator. Cold air was compressed by a pump into a receiver, where it was kept cool during compression and from which it passed through a regenerator into the working cylinder. In so passing it took up heat and expanded. It was then allowed to expand further, taking in heat from a furnace under the cylinder and falling in pressure. This expansion was continued till the pressure of the working air fell nearly to that of the atmosphere. It was then discharged through the regenerator, depositing heat for the next charge of air in turn to take up. The indicator diagram approximated to a form made up of two isothermal lines and two lines of constant pressure.

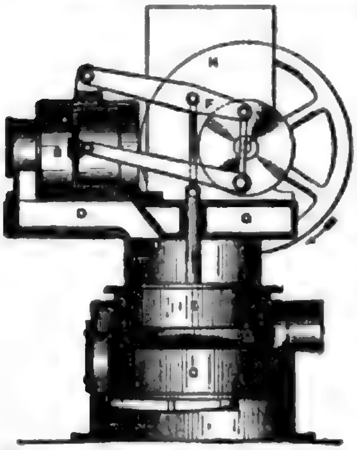

FIG. 2.—Robinson's form of Stirling's Engine.

In the transmission of power by compressed air (see POWER TRANSMISSION) the air-driven motors are for the most part machines resembling steam-engines in the general features of their pistons, cylinders, valves and so forth. Such machines are not properly described as air-engines since their function is not the conversion of heat into work. Incidentally, however, they do in some cases partially discharge that function, namely, when what is called a "preheater" is used to warm up the compressed air before it enters in the motor cylinder. The object of this device is not, primarily, to produce work from heat, but to escape the inconveniences that would otherwise arise through extreme cooling of the air during its expansion. Without preheating the expanding air becomes so cold as to be liable to deposit snow from the moisture held in suspension, and thereby to clog the valves. With preheating this is avoided, and the amount of work done by a given quantity of air is increased by the conversion into work of a part of the supplementary energy which the preheater supplies in the form of heat. (J. A. E.)

AIREY, RICHARD AIREY, BARON (1803–1881), British general, was the son of Lieutenant-General Sir George Airey (1761–1833) and was born in 1803. He entered the army in 1821, became captain in 1825, and served on the staff of Sir Frederick Adam in the Ionian Islands (1827–1830) and on that of Lord Aylmer in North America (1830–1832). In 1838 Airey, then a lieutenant-colonel, went to the Horse Guards, where in 1852 he became military secretary to the commander-in-chief, Lord Hardinge. In 1854 he was given a brigade command in the army sent out to the East; from which, however, he was immediately transferred to the onerous and difficult post of quartermaster-general to Lord Raglan, in which capacity he served through the campaign in the Crimea. He was made a major-general in December 1854, and it was universally recognized in the army that he was the best soldier on Lord Raglan's staff. He was made a K.C.B., and was reported upon most favourably by his superiors, Lord Raglan and Sir J. Simpson. Airey was a quartermaster-general in the older sense of the word, *i.e.* a chief of the general staff, but a different view of the duties of the office was then becoming recognized. Public opinion held him and his department responsible for the failures and mismanagement of the commissariat. Airey demanded an inquiry on his return to England and cleared himself completely, but he never recovered from the effects of the unjust persecution of which he had been made the victim, though the popular view was not shared by his military superiors. He gave up his post at the front to become quartermaster-general to the forces at home. In 1862 he was promoted lieutenant-general, and from 1865 to 1870 he was governor of Gibraltar, receiving the G.C.B. in 1867. In 1870 he became adjutant-general at headquarters, and in 1871 attained the full rank of general. In 1876, on his retirement, he was created a peer, and in 1879–1880 he presided over the celebrated Airey commission on army reform. He died at the house of Lord Wolseley, at Leatherhead, on the 14th of September 1881.

AIR-GUN, a gun in which the force employed to propel the bullet is the elasticity of compressed atmospheric air. It has attached to it, or constructed in it, a reservoir of compressed air, a portion of which, liberated into the space behind the bullet when the trigger is pulled, propels the bullet from the barrel by its expansion. The common forms of air-gun, which are merely toys, are charged by compressing a spiral spring, one end of which forms a piston working in a cylinder; when released by a pull on the trigger, this spring expands, and the air forced out in front of it propels the bullet. Air-guns of this kind are sometimes made to resemble walking-sticks and are then known as air-canes.

AIRY, SIR GEORGE BIDDELL (1801–1892), British Astronomer Royal, was born at Alnwick on the 27th of July 1801. He came of a long line of Airys who traced their descent back to a family of the same name residing at Kentmere, in Westmorland, in the 14th century; but the branch to which he belonged, having suffered in the civil wars, removed to Lincolnshire, where for several generations they lived as farmers. George Airy was educated first at elementary schools in Hereford, and afterwards at Colchester Grammar School. In 1819 he entered Trinity College, Cambridge, as a sizar. Here he had a brilliant career, and seems to have been almost immediately recognized as the leading man of his year. In 1822 he was elected scholar of Trinity, and in the following year he graduated as senior wrangler and obtained first Smith's prize. On the 1st of October 1824 he was elected fellow of Trinity, and in December 1826 was appointed Lucasian professor of mathematics in succession to Thomas Turton. This chair he held for little more than a year, being elected in February 1828 Plumian professor of astronomy and director of the new Cambridge observatory. Some idea of his activity as a writer on mathematical and physical subjects during these early years may be gathered from the fact that previous to this appointment he had contributed no less than three important memoirs to the *Philosophical Transactions of the Royal Society*, and eight to the Cambridge Philosophical Society. At the Cambridge observatory Airy soon gave evidence of his remarkable power of organization. The only telescope erected in the establishment when he took it in charge was the transit instrument, and to this he vigorously devoted himself. By the adoption of a regular system of work, and a careful plan of reduction, he was able to keep his observations reduced practically up to date, and published them annually with a degree of punctuality which astonished his contemporaries. Before long a mural circle was installed, and regular observations were instituted with it in 1833. In the same year the duke of Northumberland presented the Cambridge observatory with a fine object-glass of 12 in. aperture, which was mounted according to Airy's designs and under his superintendence, although the erection was not completed until after his removal to Greenwich in 1835. Airy's writings during this time are divided between mathematical physics and astronomy. The former are for the most part concerned with questions relating to the theory of light, arising out of his professorial lectures, among which may be specially mentioned his paper "On the Diffraction of an Object-Glass with Circular Aperture." In 1831 the Copley medal of the Royal Society was awarded to him for these researches. Of his astronomical writings during this period the most important are his investigation of the mass of Jupiter, his report to the British Association on the progress of astronomy during the 19th century, and his memoir *On an Inequality of Long Period in the Motions of the Earth and Venus*.

One of the sections of his able and instructive report was devoted to "A Comparison of the Progress of Astronomy in England with that in other Countries," very much to the disadvantage of England. This reproach was subsequently to a great extent removed by his own labours.

Airy's discovery of a new inequality in the motions of Venus and the earth is in some respects his most remarkable achievement. In correcting the elements of Delambre's solar tables he had been led to suspect an inequality overlooked by their constructor. The cause of this he did not long seek in vain. Eight times the mean motion of Venus is so nearly equal to thirteen times that of the earth that the difference amounts to only the $\frac{1}{240}$th of the earth's mean motion, and from the fact that the term depending on this difference, although very small in itself, receives in the integration of the differential equations a multiplier of about 2,200,000, Airy was led to infer the existence of a sensible inequality extending over 240 years (*Phil. Trans.* cxxii. 67). The investigation that brought about this result was probably the most laborious that had been made up to Airy's time in planetary theory, and represented the first specific improvement in the solar tables effected in England since the establishment of the theory of gravitation. In recognition of this work the medal of the Royal Astronomical Society was awarded to him in 1833.

In June 1835 Airy was appointed Astronomer Royal in succession to John Pond, and thus commenced that long career of wisely directed and vigorously sustained industry at the national observatory which, even more perhaps than his investigations in abstract science or theoretical astronomy, constitutes his chief title to fame. The condition of the observatory at the time of his appointment was such that Lord Auckland, the first lord of the Admiralty, considered that "it ought to be cleared out," while Airy admitted that "it was in a queer state." With his usual energy he set to work at once to reorganize the whole management. He remodelled the volumes of observations, put the library on a proper footing, mounted the new (Sheepshanks) equatorial and organized a new magnetic observatory. In 1847 an altazimuth was erected, designed by Airy to enable observations of the moon to be made not only on the meridian, but whenever she might be visible. In 1848 Airy invented the reflex zenith tube to replace the zenith sector previously employed. At the end of 1850 the great transit circle of 8 in. aperture and 11 ft. 6 in. focal length was erected, and is still the principal instrument of its class at the observatory. The mounting in 1859 of an equatorial of 13 in. aperture evoked the comment in his journal for that year, "There is not now a single person employed or instrument used in the observatory which was there in Mr Pond's time"; and the transformation was completed by the inauguration of spectroscopic work in 1868 and of the photographic registration of sun-spots in 1873.

The formidable undertaking of reducing the accumulated planetary observations made at Greenwich from 1750 to 1830 was already in progress under Airy's supervision when he became Astronomer Royal. Shortly afterwards he undertook the further laborious task of reducing the enormous mass of observations of the moon made at Greenwich during the same period under the direction, successively, of J. Bradley, N. Bliss, N. Maskelyne and John Pond, to defray the expense of which a large sum of money was allotted by the Treasury. As the result, no less than 8000 lunar observations were rescued from oblivion, and were, in 1846, placed at the disposal of astronomers in such a form that they could be used directly for comparison with the theory and for the improvement of the tables of the moon's motion. For this work Airy received in 1848 a testimonial from the Royal Astronomical Society, and it at once led to the discovery by P. A. Hansen of two new inequalities in the moon's motion. After completing these reductions, Airy made inquiries, before engaging in any theoretical investigation in connexion with them, whether any other mathematician was pursuing the subject, and learning that Hansen had taken it in hand under the patronage of the king of Denmark, but that, owing to the death of the king and the consequent lack of funds, there was danger of his being compelled to abandon it, he applied to the admiralty on Hansen's behalf for the necessary sum. His request was immediately granted, and thus it came about that Hansen's famous *Tables de la Lune* were dedicated to *La Haute Amirauté de sa Majesté la Reine de la Grande Bretagne et d'Irlande*.

One of the most remarkable of Airy's researches was his determination of the mean density of the earth. In 1826 the idea occurred to him of attacking this problem by means of pendulum experiments at the top and bottom of a deep mine. His first attempt, made in the same year, at the Dolcoath mine in Cornwall, failed in consequence of an accident to one of the pendulums; a second attempt in 1828 was defeated by a flooding of the mine, and many years elapsed before another opportunity presented itself. The experiments eventually took place at the Harton pit near South Shields in 1854. Their immediate result was to show that gravity at the bottom of the mine exceeded that at the top by $\frac{1}{19286}$th of its amount, the depth being 1256 ft. From this he was led to the final value of 6·566 for the mean density of the earth as compared with that of water (*Phil. Trans.* cxlvi. 342). This value, although considerably in excess of that previously found by different methods, was held by Airy, from the care and completeness with which the observations were carried out and discussed, to be "entitled to compete with the others on, at least, equal terms."

In 1872 Airy conceived the idea of treating the lunar theory in a new way, and at the age of seventy-one he embarked on the prodigious toil which this scheme entailed. A general description of his method will be found in the *Monthly Notices of the Royal Astronomical Society*, vol. xxxiv. No. 3. It consisted essentially in the adoption of Delauny's final numerical expressions for longitude, latitude and parallax, with a symbolic term attached to each number, the value of which was to be determined by substitution in the equations of motion. In this mode of treating the question the order of the terms is numerical, and though the amount of labour is such as might well have deterred a younger man, yet the details were easy, and a great part of it might be entrusted to a mere computer. The work was published in 1886, when its author was eighty-five years of age. For some little time previously he had been harassed by a suspicion that certain errors had crept into the computations, and accordingly he addressed himself to the task of revision. But his powers were no longer what they had been, and he was never able to examine sufficiently into the matter. In 1890 he tells us how a grievous error had been committed in one of the first steps, and pathetically adds, "My spirit in the work was broken, and I have never heartily proceeded with it since." In 1881 Sir George Airy resigned the office of Astronomer Royal and resided at the White House, Greenwich, not far from the Royal Observatory, until his death, which took place on the 2nd of January 1892.

A complete list of Airy's printed papers, numbering no less than 518, will be found in his *Autobiography*, edited in 1896 by his son, Wilfrid Airy, B. A., M. Inst.C.E. Amongst the most important of his works not already mentioned may be named the following:—*Mathematical Tracts* (1826) *on the Lunar Theory, Figure of the Earth, Precession and Nutation*, and *Calculus of Variations*, to which, in the second edition of 1828, were added tracts on the Planetary Theory and the Undulatory Theory of Light; *Experiments on Iron-built Ships, instituted for the purpose of discovering a correction for the deviation of the Compass produced by the Iron of the Ships* (1839); *On the Theoretical Explanation of* *an apparent new Polarity in Light* (1840); *Tides and Waves* (1842).

He was elected a fellow of the Royal Society in 1836, its president in 1871, and received both the Copley and Royal medals. He was five times president of the Royal Astronomical Society, was correspondent of the French Academy and belonged to many other foreign and American societies. He was D.C.L. of Oxford and LL.D. of Cambridge and Edinburgh. In 1872 he was made K.C.B. In the same year he was nominated a Grand Cross in the Imperial Order of the Rose of Brazil; he also held the Prussian Order "Pour le Mérite," and belonged to the Legion of Honour of France and to the Order of the North Star of Sweden and Norway.

See also *Proc. Roy. Society*, li. 1 (E. J. Routh); *Month. Notices Roy. Astr. Society*, lii. 212; *Observatory*, xv. 74 (E. Dunkin); *Nature*, 31st of Oct. 1878 (A. Winnecke), 7th of Jan. 1892; *The Times*, 5th of Jan. 1892; R. Grant's *Hist. of Phys. Astronomy*; R. P. Graves's *Life of Sir W. Rowan Hamilton*. (A. A. R.*)

AISLABIE, JOHN (1670–1742), English politician, was born at Goodramgate, York, on the 7th of December 1670. He was the fourth son of George Aislabie, principal registrar of the archiepiscopal court of York. In 1695 he was elected member of parliament for Ripon. In 1712 he was appointed one of the commissioners for executing the office of lord high admiral, and in 1714 became treasurer of the navy, being sworn in two years later as a member of the privy council. In March 1718 he became chancellor of the exchequer. The proposal of the South Sea Company to pay off the national debt was strenuously supported by Aislabie, and finally accepted in an amended form by the House of Commons. After the collapse of that company a secret committee of inquiry was appointed by the Commons, and Aislabie, who had in the meantime resigned the seals of his office, was declared guilty of having encouraged and promoted the South Sea scheme with a view to his own exorbitant profit, and was expelled the House. Though committed to the Tower he was soon released, and was allowed to retain the property he possessed before 1718, including his country estate, to which he retired to pass the rest of his days. He died in 1742.

AISLE (from Lat. *ala*, a wing), a term which in its primary sense means the wing of a house, but is generally applied in architecture to the lateral divisions of a church or large building. The earliest example is that found in the basilica of Trajan, which had double aisles on either side of the central area; the same number existed in the original church of St Peter's at Rome, in the basilica at Bethlehem, and according to Eusebius in the church of the Holy Sepulchre at Jerusalem. The aisles are divided from the nave or central area by colonnades or arcades, and may flank also the transept or choir, being distinguished as nave-aisles, transept-aisles or choir-aisles. If the choir is semi-circular, and the aisles, carried round, give access to a series of chapels, the whole arrangement is known as the chevet. As a rule in Great Britain there is only one aisle on each side of the nave, the only exceptions being Chichester and Elgin cathedrals, where there are two. Many European cathedrals have two aisles on each side, as those of Paris, Bourges, Amiens, Troyes, St Sernin, Toulouse, Cologne, Milan, Seville, Toledo; and in those of Paris, Chartres, Amiens and Bourges, Seville and Toledo, double aisles flank the choir on each side. The cathedral at Antwerp has three aisles on each side. In some of the churches in Germany the aisles are of the same height as the nave. These churches are known as *Hallenkirchen*, the principal examples being St Stephen's, Vienna, the Weissekirche at Soest, St Martin's, Landshut, Munich cathedral, and the Marienkirche at Danzig. (R. P. S.)

AISNE, a frontier department in the north-east of France, formed in 1790 from portions of the old provinces of Ile-de-France and Picardy. Area 2866 sq. m. Pop. (1906) 534,495. It is bounded N. by the department of Nord and the kingdom of Belgium, E. by the department of Ardennes, S.E. by that of Marne, S. by that of Seine-et-Marne, and W. by those of Oise and Somme. The surface of the department consists of undulating and well-wooded plains, intersected by numerous valleys, and diversified in the north-east by hilly ground which forms a part of the mountain system of the Ardennes. Its general slope is from north-east, where the culminating point (930 ft.) is found, to south-west, though altitudes exceeding 750 ft. are also found in the south. The chief rivers are the Somme, the Escaut and the Sambre, which have their sources in the north of the department; the Oise, traversing the north-west, with its tributaries the Serre and the Aisne, the latter of which joins it beyond the limits of the department; and the Marne and the Ourcq in the south. The climate is in general cold and humid, especially in the north-east. Agriculture is highly developed; cereals, principally wheat and oats, and beetroot are the chief crops; potatoes, flax, hemp, rape and hops are also grown. Pasturage is good, particularly in the north-east, where dairy-farming flourishes. Wine of medium quality is grown on the banks of the Marne and the Aisne. Bee-farming is of some importance. Large tracts of the department are under wood; the chief forests are those of Nouvion and St Michel in the north, Coucy and St Gobain in the centre, and Villers-Cotterets in the south. The osiers grown in the vicinity of St Quentin supply an active basket-making industry.

Though destitute of metals Aisne furnishes abundance of freestone, gypsum and clay. There are numerous tile and brick works in the department. Its most important industrial establishments are the mirror manufactory of St Gobain and the chemical works at Chauny, and the workshops and foundries of Guise, the property of an association of workpeople organized on socialistic lines and producing iron goods of various kinds. The manufacture of sugar is very important; brewing, distilling, flour-milling, iron-founding, the weaving and spinning of cotton, wool and silk, and the manufacture of iron goods, especially agricultural implements, are actively carried on. Aisne imports coal, iron, cotton and other raw material and machinery; it exports cereals, live-stock and agricultural products generally, and manufactured goods. The department is served chiefly by the lines of the Northern railway; in addition, the main line of the Eastern railway to Strassburg traverses the extreme south. The Oise, Aisne and Marne are navigable, and canals furnish 170 m. of waterway. Aisne is divided into five arrondissements—St Quentin and Vervins in the north, Laon in the centre, and Soissons and Château-Thierry in the south—and contains 37 cantons and 841 communes. It forms part of the educational division (*académie*) of Douai and of the region of the second army corps, its military centre being at Amiens, where also is its court of appeal. Laon is the capital, and Soissons the seat of a bishopric of the province of Reims. Other important places are Château-Thierry, St Quentin and Coucy-le-Château. La Ferté-Milon has remains of an imposing château of the 14th and 15th centuries with interesting fortifications. The ruined church at Longpont (13th century) is the relic of an important Cistercian abbey; Urcel and Mont-Notre-Dame have fine churches, the first entirely in the Romanesque style, the second dating from the 12th and 13th centuries, to which period the church at Braisne also belongs. At Prémontré the buildings of the abbey, which was the cradle of the Premonstratensian order, are occupied by a lunatic asylum.

AÏSSÉ [a corruption of HAIDÉE], MADEMOISELLE (*c.* 1694–1733), French letter-writer, was the daughter of a Circassian chief, and was born about 1694. Her father's palace was pillaged by the Turks, and as a child of four years old she was sold to the comte de Ferriol, the French ambassador at Constantinople. She was brought up in Paris by Ferriol's sister-in-law with her own sons, MM. d'Argental and Pont de Veyle. Her great beauty and romantic history made her the fashion, and she attracted the notice of the regent, Philip, duke of Orleans, whose offers she had the strength of mind to refuse. She formed a deep and lasting attachment to the Chevalier d'Aydie, by whom she had a daughter. She died in Paris on the 13th of March 1733. Her letters to her friend Madame Calandrini contain much interesting information with regard to contemporary celebrities, especially on Mme. du Deffand and Mme. de Tencin, but they are above all of interest in the picture they afford of the writer's own tenderness and fidelity. Her *Lettres* were edited by Voltaire (1787), by J. Ravenel, with a notice by Sainte-Beuve (1846) and by Eugène Asse (1873). Mlle. Aïssé has been the subject of three plays: by A. de Lavergne and P. Woucher (1854), by Louis Bouilhet (1872) and by Dejoux (1898).

See also Courteault, *Une Idylle au XVIIIe siècle, Mlle. Aïssé et le Chevalier d'Aydie* (Maçon, 1900); and notices prefixed to the editions of 1846 and 1873. There is an interesting essay by E. Gosse in his *French Profiles* (1905).

AITON, WILLIAM (1731–1793), Scottish botanist, was born near Hamilton in 1731. Having been regularly trained to the profession of a gardener, he travelled to London in 1754, and became assistant to Philip Miller, then superintendent of the Physic Garden at Chelsea. In 1759 he was appointed director of the newly established botanical garden at Kew, where he remained until his death on the 2nd of February 1793. He effected many improvements at the gardens, and in 1789 he published *Hortus Kewensis*, a catalogue of the plants there cultivated. A second and enlarged edition of the *Hortus* was brought out in 1810–1813 by his eldest son, WILLIAM TOWNSEND AITON (1766–1849), who succeeded him at Kew and was commissioned by George IV. to lay out the gardens at the Pavilion, Brighton.

AITZEMA, LIEUWE (LEO) **VAN** (1600–1669), Dutch historian and statesman, was born at Doccum, in Friesland, on the 19th of November 1600. In 1617 he published a volume of Latin poems under the title of *Poemata Juvenilia*, of which a copy is preserved in the British Museum. He made a special study of politics and political science and was for thirty years resident for the towns of the Hanseatic League at the Hague, where he died on the 23rd of February 1669. His most important work was the *Saken van Staet in Oorlogh in ende omtrent de Vereenigte Nederlanden* (14 vols. 4to, 1655–1671), embracing the period from 1621 to 1668. It contains a large number of state documents, and is an invaluable authority on one of the most eventful periods of Dutch history.

Four continuations of the history, by the poet and historian Lambert van den Bos, were published successively at Amsterdam in 1685, 1688, 1698 and 1699. The *Derde Vervolg Zijnde het vierde Stuck van het Vervolgh op de Historie, &c.*, brings the history down to 1697.

AIVALI (Gr. *Kydonia*), a prosperous town on the W. coast of Asia Minor, opposite the island of Mitylene. Pop. 21,000. It stands near the site of the Aeolian *Heraclea*, on rising ground at the end of a bay which is separated from the Gulf of Adramyttium, and protected from the prevailing winds by the Moschonisi Islands (*Hecatonnesoi*). In 1821 it was burned to the ground during a fight between the Turks and the Greeks, and a large number of its Greek population killed or enslaved. It is one of the most thriving towns in the Levant, with a purely Greek population distinguished for its commercial, industrial and maritime enterprise. The exports are olive oil, grain and wood, and a fleet of fishing-boats supplies Constantinople and Smyrna with fish; the exports in 1902 were valued at £987,070, and the imports at £336,693.

AIWAN, the reception-hall or throne-room of a Parthian or Sassanian palace.

AIX, a city of south-eastern France, capital of an arrondissement in the department of Bouches-du-Rhône, 18 m. N. of Marseilles by rail. Pop. (1906) 19,433. It is situated in a plain overlooking the Arc, about a mile from the right bank of the river. The Cours Mirabeau, a wide thoroughfare, planted with double rows of plane-trees, bordered by fine houses and decorated by three fountains, divides the town into two portions. The new town extends to the south, the old town with its wide but irregular streets and its old mansions dating from the 16th, 17th and 18th centuries lies to the north. Aix is an important educational centre, being the seat of the faculties of law and letters of the university of Aix-Marseille, and the north and east quarter of the town, where the schools and university buildings are situated, is comparable to the Latin Quarter of Paris. The cathedral of St Sauveur, which dates from the 11th, 12th and 13th centuries, is situated in this portion of Aix. It is preceded by a rich portal in the Gothic style with elaborately carved doors, and is flanked on the north by an uncompleted tower. The interior contains tapestry of the 16th century and other works of art. The archbishop's palace and a Romanesque cloister adjoin the cathedral on its south side. The church of St Jean de Malte, dating from the 13th century, contains some valuable pictures. The hôtel de ville, a building in the classical style of the middle of the 17th century, looks on to a picturesque square. It contains some fine wood-work and a large library which includes many valuable MSS. At its side rises a handsome clock-tower erected in 1505. Aix possesses many beautiful fountains, one of which in the Cours Mirabeau is surmounted by a statue of René, count of Provence, who held a brilliant court at Aix in the 15th century. Aix has thermal springs, remarkable for their heat and containing lime and carbonic acid. The bathing establishment was built in 1705 near the site of the ancient baths of Sextius, of which vestiges still remain. The town, which is the seat of an archbishop and court of appeal, and the centre of an *académie* (educational circumscription), numbers among its public institutions a court of assizes, tribunals of first instance and of commerce, and a chamber of arts and manufactures. It also has training-colleges, a lycée, a school of art and technics, museums of antiquities, natural history and painting, and several learned societies. The industries include flour-milling, the manufacture of confectionery, iron-ware and hats, and the distillation of olive-oil. Trade is in olive-oil, almonds and stone from the neighbouring quarries.

Aix (*Aquae Sextiae*) was founded in 123 B.C. by the Roman consul Sextius Calvinus, who gave his name to its springs. In 102 B.C. its neighbourhood was the scene of the defeat inflicted on the Cimbri and Teutones by Marius. In the 4th century it became the metropolis of Narbonensis Secunda. It was occupied by the Visigoths in 477, in the succeeding century was repeatedly plundered by the Franks and Lombards, and was occupied by the Saracens in 731. Aix, which during the middle ages was the capital of the county of Provence, did not reach its zenith until after the 12th century, when, under the houses of Aragon and Anjou, it became an artistic centre and seat of learning. With the rest of Provence, it passed to the crown of France in 1487, and in 1501 Louis XII. established there the *parlement* of Provence which existed till 1789. In the 17th and 18th centuries the town was the seat of the *intendance* of Provence.

AIX-LA-CHAPELLE (Ger. *Aachen*, Dutch *Aken*), a city and spa of Germany, in the kingdom of Prussia, situated in a pleasant valley, 44 m. W. of Cologne and contiguous to the Belgian and Dutch frontiers, to which its municipal boundaries extend. Pop. (1885) 95,725; (1905) including Burtscheid, 143,906. Its position, at the centre of direct railway communications with Cologne and Düsseldorf respectively on the E. and Liège–Brussels and Maestricht-Antwerp on the W., has favoured its rise to one of the most prosperous commerical towns of Germany. The city consists of the old inner town, the former ramparts of which have been converted into promenades, and the newer outer town and suburbs. Of the ancient gates but two remain, the Ponttor on the N.W. and the Marschiertor on the S. Its general appearance is that rather of a spacious modern, than of a medieval city full of historical associations.

Of the cluster of buildings in the centre, which are conspicuous from afar, the town hall (Rathaus) and the cathedral are specially noteworthy. The former, standing on the south side of the market square, is a Gothic structure, erected in 1353–1370 on the ruins of Charlemagne's palace. It contains the magnificent coronation hall of the emperors (143 ft. by 61 ft.), in which thirty-five German kings and eleven queens have banqueted after the coronation ceremony in the cathedral. The two ancient towers, the Granusturm to the W. and the Glockenturm to the E., both of which to a large extent had formed part of the Carolingian palace, were all but destroyed in the fire by which the Rathaus was seriously damaged in 1883. Their restoration was completed in 1902. Behind the Rathaus is the Grashaus, in which Richard of Cornwall, king of the Romans, is said to have held his court. It was restored in 1889 to accommodate the municipal archives. The cathedral is of great historic and architectural interest. Apart from the spire, which was rebuilt in 1884, it consists of two parts of different styles and date. The older portion, the *capella in palatio*, an octagonal building surmounted by a dome, was designed on the model of San Vitale at Ravenna by Udo of Metz, was begun under Charlemagne's auspices in 796 and consecrated by Pope Leo III. in 805. After being almost entirely wrecked by Norman raiders it was rebuilt, on the original lines, in 983, by the emperor Otto III. It is surrounded on the first story by a sixteen-sided gallery (the Hochmünster) adorned by antique marble and granite columns, of various sizes, brought by Charlemagne's orders from Rome, Ravenna and Trier. These were removed by Napoleon to Paris, but restored to their original positions after the peace of 1815. The mosaic representing Christ surrounded by "the four-and-twenty elders," which originally lined the cupola, had almost entirely perished by the 19th century, but was restored in 1882 from a copy made in the 17th century. Interesting too are the magnificent west doors, cast in bronze by native workmen in 804. Underneath the dome, according to tradition, was the tomb of Charlemagne, which, on being opened by Otto III. in 1000, disclosed the body of the emperor, vested in white coronation robes and seated on a marble chair. This chair, now placed in the gallery referred to, was used for centuries in the imperial coronation ceremonies. The site of the tomb is marked by a stone slab, with the inscription *Carlo Magno*, and above it hangs the famous bronze chandelier presented by the emperor Frederick I. (Barbarossa) in 1168. Charlemagne's bones are preserved in an ornate shrine in the Hungarian Chapel, lying to the north of the octagon. The casket was opened in 1906, at the instance of the emperor William II., and the draperies enclosing the body were temporarily removed to Berlin, with a view to the reproduction of similar cloth. The Gothic choir, forming the more modern portion of the cathedral, was added during the latter half of the 14th and the beginning of the 15th century, and contains the tomb of the emperor Otto III. The cathedral possesses many relics, the more sacred of which are exhibited only once every seven years, when they attract large crowds of worshippers.

Of the other thirty-three churches in the city those of St Foillan (founded in the 12th century, but twice rebuilt, in the 15th and 17th centuries, and restored in 1883) and St Paul, with its beautiful stained-glass windows, are remarkable. In addition to those already mentioned, Aix-la-Chapelle possesses several fine secular buildings: the Suermondt museum, containing besides other miscellaneous exhibits the fine collection of pictures by early German, Dutch and Flemish masters, presented to the town by Bartholomäus Suermondt (d. 1887); the public library; the theatre; the post-office; and the fine new central railway station. Among the schools may be mentioned the magnificently equipped Rhenish-Westphalian Polytechnic School (built 1865–1870) and the school of mining and electricity, founded in 1897.

There are many fine streets and squares and some handsome public monuments, notably among the last the fountain on the market square surmounted by a statue of Charlemagne, the bronze equestrian statue of the emperor William I. facing the theatre, the Kriegerdenkmal (a memorial to those who fell in the war of 1870) and the Kongress-Denkmal, a marble hall in antique style erected in 1844 on the Adalberts-Steinweg to commemorate the famous congress of 1818 (see below). Of the squares, the principal is the Friedrich-Wilhelmplatz, on which lies the Elisenbrunnen with its colonnade and garden, the chief resort of visitors taking the baths and waters.

The hot sulphur springs of Aix-la-Chapelle were known to the Romans and have been celebrated for centuries as specific in the cure of rheumatism, gout and scrofulous disorders. There are six in all, of which the Kaiserquelle, with a temperature of 136° F., is the chief. In the neighbouring Burtscheid (incorporated in 1897 with Aix-la-Chapelle) are also springs of far higher temperature, and this suburb, which has also a Kurgarten, is largely frequented during the season.

In respect of trade and industry Aix-la-Chapelle occupies a high place. Its cloth and silk manufactures are important, and owing to the opening up of extensive coalfields in the district almost every branch of iron industry is carried on. It has some large breweries and manufactories of chemicals, and does a considerable trade in cereals, leather, timber and wine. It is also an important banking centre and has several insurance societies of reputation.

The country immediately surrounding Aix-la-Chapelle presents many attractive features. From the Lousberg and the Salvatorberg to the north, the latter crowned by a chapel, magnificent views of the city are obtained; while covering the hills 2 m. west stretches the Stadtwald, a forest with charming walks and drives.

History.—Aix-la-Chapelle is the Aquisgranum of the Romans, named after Apollo Granus, who was worshipped in connexion with hot springs. As early as A.D. 765 King Pippin had a "palace" here, in which it is probable that Charlemagne was born. The greatness of Aix was due to the latter, who between 777 and 786 built a magnificent palace on the site of that of his father, raised the place to the rank of the second city of the empire, and made it for a while the centre of Western culture and learning. From the coronation of Louis the Pious in 813 until that of Ferdinand I. in 1531 the sacring of the German kings took place at Aix, and as many as thirty-two emperors and kings were here crowned. In 851, and again in 882, the place was ravaged by the Northmen in their raids up the Rhine. It was not, however, till late in the 12th century (1172–1176) that the city was surrounded with walls by order of the emperor Frederick I., to whom (in 1166) and to his grandson Frederick II. (in 1215) it owed its first important civic rights. These were still further extended in 1250 by the anti-Caesar William of Holland, who had made himself master of the place and of the imperial regalia, after a long siege, in 1248. The liberties of the burghers were, however, still restrained by the presence of a royal *advocatus* (*Vogt*) and bailiff. In 1300 the outer ring of walls was completed, the earlier circumvallation being marked by the limit of the Altstadt (old city). In the 14th century Aix, now a free city of the Holy Roman Empire, played a conspicuous part, especially in the league which, between 1351 and 1387, kept the peace between the Meuse and the Rhine. In 1450 an insurrection led to the admission of the gilds to a share in the municipal government. In the 16th century Aix began to decline in importance and prosperity. It lay too near the French frontier to be safe, and too remote from the centre of Germany to be convenient, as a capital; and in 1562 the election and coronation of Maximilian II. took place at Frankfort-on-Main, a precedent followed till the extinction of the Empire. The Reformation, too, brought its troubles. In 1580 Protestantism got the upper hand; the ban of the empire followed and was executed by Ernest of Bavaria, archbishop-elector of Cologne in 1598. A relapse of the city led to a new ban of the emperor Matthias in 1613, and in the following year Spinola's Spanish troops brought back the recalcitrant city to the Catholic fold. In 1656 a great fire completed the ruin wrought by the religious wars. By the treaty of Lunéville (1801) Aix was incorporated with France as chief town of the department of the Roer. By the congress of Vienna it was given to Prussia. The contrast between the new régime and the ancient tradition of the city was curiously illustrated in 1818 by a scene described in Metternich's *Memoirs*, when, before the opening of the congress, Francis I., emperor of Austria, regarded by all Germany as the successor of the Holy Roman emperors, knelt at the tomb of Charlemagne amid a worshipping crowd, while the Protestant Frederick William III. of Prussia, the new sovereign of the place, stood in the midst, "looking very uncomfortable."

See Quix, *Geschichte der Stadt Aachen* (1841); Pick, *Aus Aachens Vergangenheit* (Aachen, 1895); Bock, *Karls des grossen Pfalzkapelle* (Cologne, 1867); and Beissel, *Aachen als Kurort* (1889).

AIX-LA-CHAPELLE, CONGRESSES OF. Three congresses have been held at Aix-la-Chapelle: the first in 1668, the second in 1748, the third in 1818.

1. The treaty of the 2nd of May 1668, which put an end to the War of Devolution, was the outcome of that of St Germain

signed on the 15th of April by France and the representatives of the powers of the Triple Alliance. The treaty of Aix-la-Chapelle left to France all the conquests made in Flanders during the campaign of 1667, with all their "*appartenances, dépendances et annexes*," a vague provision of which, after the peace of Nijmwegen (1680), Louis XIV. took advantage to occupy a number of villages and towns adjudged to him by his *Chambres de réunion* as dependencies of the cities and territories acquired in 1668. On the other hand, France restored to Spain the cities of Cambrai, Aire and Saint-Omer, as well as the province of Franche Comté. The treaty of Aix-la-Chapelle was placed under the guarantee of Great Britain, Sweden and Holland, by a convention signed at the Hague on the 7th of May 1669, to which Spain acceded.

See Jean du Mont, baron de Carlscroon, *Corps universel diplomatique* (Amst., 1726–1731).

2. On the 24th of April 1748 a congress assembled at Aix-la-Chapelle for the purpose of bringing to a conclusion the struggle known as the War of Austrian Succession. Between the 30th of April and the 21st of May the preliminaries were agreed to between Great Britain, France and Holland, and to these Maria Theresa, queen of Bohemia and Hungary, the kings of Sardinia and Spain, the duke of Modena, and the republic of Genoa successively gave their adhesion. The definitive treaty was signed on the 18th of October, Sardinia alone refusing to accede, because the treaty of Worms was not guaranteed. Of the provisions of the treaty of Aix-la-Chapelle the most important were those stipulating for (1) a general restitution of conquests, including Cape Breton to France, Madras to England and the barrier towns to the Dutch; (2) the assignment to Don Philip of the duchies of Parma, Piacenza and Guastalla; (3) the restoration of the duke of Modena and the republic of Genoa to their former positions; (4) the renewal in favour of Great Britain of the Asiento contract of the 16th of March 1713, and of the right to send an annual vessel to the Spanish colonies; (5) the renewal of the article of the treaty of 1718 recognizing the Protestant succession in the English throne; (6) the recognition of the emperor Francis and the confirmation of the pragmatic sanction, *i.e.* of the right of Maria Theresa to the Habsburg succession; (7) the guarantee to Prussia of the duchy of Silesia and the county of Glatz.

Spain having raised objections to the Asiento clauses, the treaty of Aix-la-Chapelle was supplemented by that of Madrid (5th of October 1750), by which Great Britain surrendered her claims under those clauses in return for a sum of £100,000.

See A. J. H. de Clercq, *Recueil des traités de la France*; F. A. Wenk, *Corpus juris gentium recentissimi*, 1735–1772, vol. ii. (Leipzig, 1786), p. 337; Comte G. de Garden, *Hist. des traités de paix*, 1848–1887, iii. p. 373.

3. The congress or conference of Aix-la-Chapelle, held in the autumn of 1818, was primarily a meeting of the four allied powers—Great Britain, Austria, Prussia and Russia— to decide the question of the withdrawal of the army of occupation from France and the nature of the modifications to be introduced in consequence into the relations of the four powers towards each other, and collectively towards France. The congress, of which the first session was held on the 1st of October, was attended by the emperor Alexander I. of Russia, the emperor Francis I. of Austria, and Frederick William III. of Prussia, in person. Great Britain was represented by Lord Castlereagh and the duke of Wellington, Austria by Prince Metternich, Russia by Counts Capo d'Istria and Nesselrode, Prussia by Prince Hardenberg and Count Bernstorff. The duc de Richelieu, by favour of the allies, was present on behalf of France. The evacuation of France was agreed to in principle at the first session, the consequent treaty being signed on the 9th of October. The immediate object of the conference being thus readily disposed of, the time of the congress was mainly occupied in discussing the form to be taken by the European alliance, and the "military measures," if any, to be adopted as a precaution against a fresh outburst on the part of France. The proposal of the emperor Alexander I. to establish a "universal union of guarantee" on the broad basis of the Holy Alliance, after much debate, broke down on the uncompromising opposition of Great Britain; and the main outcome of the congress was the signature, on the 15th of November, of two instruments: (1) a secret protocol confirming and renewing the quadruple alliance established by the treaties of Chaumont and Paris (of the 20th of November 1815) against France; (2) a public "declaration" of the intention of the powers to maintain their intimate union, "strengthened by the ties of Christian brotherhood," of which the object was the preservation of peace on the basis of respect for treaties. The secret protocol was communicated in confidence to Richelieu; to the declaration France was invited publicly to adhere.

Besides these questions of general policy, the congress concerned itself with a number of subjects left unsettled in the hurried winding up of the congress of Vienna, or which had arisen since. Of these the most important were the questions as to the methods to be adopted for the suppression of the slave-trade and the Barbary pirates. In neither case was any decision arrived at, owing (1) to the refusal of the other powers to agree with the British proposal for a reciprocal right of search on the high seas; (2) to the objection of Great Britain to international action which would have involved the presence of a Russian squadron in the Mediterranean. In matters of less importance the congress was more unanimous. Thus, on the urgent appeal of the king of Denmark, the king of Sweden (Bernadotte) received a peremptory summons to carry out the terms of the treaty of Kiel; the petition of the elector of Hesse to be recognized as king was unanimously rejected; and measures were taken to redress the grievances of the German mediatized princes. The more important outstanding questions in Germany, *e.g.* the Baden succession, were after consideration reserved for a further conference to be called at Frankfort. In addition to these a great variety of questions were considered, from that of the treatment of Napoleon at St Helena, to the grievances of the people of Monaco against their prince and the position of the Jews in Austria and Prussia. An attempt made to introduce the subject of the Spanish colonies was defeated by the opposition of Great Britain. Lastly, certain vexatious questions of diplomatic etiquette were settled once for all (see DIPLOMACY). The congress, which broke up at the end of November, is of historical importance mainly as marking the highest point reached in the attempt to govern Europe by an international committee of the powers. The detailed study of its proceedings is highly instructive in revealing the almost insurmountable obstacles to any really effective international system.

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AIX-LES-BAINS, a town of France, in the department of Savoie, near the Lac du Bourget, and 9 m. by rail N. of Chambéry. Pop. (1901) 4741. It is 846 ft. above the level of the sea. It was a celebrated bathing-place, under the name of *Aquae Gratianae*, in the time of the Romans, and possesses numerous ancient remains. The hot springs, which are of sulphureous quality, and have a temperature of from 109° to 113° F., are still much frequented, attracting annually many thousands of visitors. They are used for drinking as well as for bathing purposes.

AIYAR, SIR SHESHADRI (1845–1901), native statesman of Mysore, India, was the son of a Brahman of Palghat in the district of Malabar. He was educated at the provincial school at Calicut and the presidency college in Madras, and entered the government service as a translator. In 1868 he was transferred to Mysore under Runga Charlu, and for thirteen years filled various offices in that state; but when Mysore was restored to native rule in 1881, he became personal assistant to Runga Charlu, whom he succeeded as diwan in 1885. For the next seventeen years he laboured assiduously to promote the economic and industrial development of the state, and proved an able assistant to the Maharaja Chamarajendra. By means of railway, irrigation and mining works, he added greatly to the wealth of the state, and put it on a sound financial footing. He retired in 1900, was made K.C.S.I. in 1893 and died on the 13th of September 1901.

AIYAR, SIR TIRUVARUR MUTUSWAMY (1832–1895), native Indian judge of the high court of Madras, was born of poor parents in the village of Vuchuwadi, near Tanjore, on the 28th of January 1832. His widowed mother was forced by poverty to remove with Mutuswamy and his brother to Tiruvarar, where the former learnt Tamil, and soon set to work under the village accountant at a monthly salary of one rupee. About this time he lost his mother, whose memory he cherished with reverence and affection to the last. His duty took him to the court-house of the tehsildar, Mr Naiken, who soon remarked his extraordinary intelligence and industry. There was an English school at Tiruvarar, where Mutuswamy managed to pick up an elementary knowledge of the English language. Mr Naiken then sent him to Sir Henry Montgomery's school at Madras, as a companion to his nephew, and there he won prizes and scholarships year after year. In 1854 he won a prize of 500 rupees offered to the students of the Madras presidency by the council of education for the best English essay. This success brought him to the notice of Sir Alexander Arbuthnot and Mr Justice Holloway. He was offered help to proceed to England and compete for the civil service, but being a Brahman and married, he declined to cross the ocean. Instead he entered the subordinate government service, and was employed in such various posts as school-teacher, record-keeper in Tanjore, and in 1856 deputy-inspector of schools. At this time the Madras authorities instituted the examination for the office of pleaders, and Mutuswamy came out first in the first examination, even beating Sir T. Madhavarao, his senior by many years. Mutuswamy was then appointed in succession district munsiff at Tranquebar, deputy-collector in Tanjore in 1859, sub-judge of south Kanara in 1865, and a magistrate of police at Madras in 1868. While serving in the last post he passed the examination for the degree of bachelor of laws of the local university. He was next employed as a judge of the Madras small causes court, until in 1878 he was raised to the bench of the high court, which office he occupied with ability and distinction for over fifteen years, sometimes acting as the chief justice. He attended by invitation of the viceroy the imperial assemblage at Delhi in 1877. In 1878 he received the honour of C.I.E. and in 1893 the K.C.I.E. was conferred on him. But he did not live long to enjoy this dignity, dying suddenly in 1895. Mutuswamy was too devoted to his offical work to give much time to other pursuits. Still he took his full share in the affairs of the Madras university, of which he was nominated a fellow in 1872 and a syndic in 1877, and was well acquainted with English law, literature and philosophy. He was through life a staunch Brahman, devout and amiable in character, with a taste for the ancient music of India and the study of the Vedas and other departments of Sanskrit literature.

AJACCIO, the capital of Corsica, on the west coast of the island, 210 m. S.E. of Marseilles. Pop. (1906) 19,021. Ajaccio occupies a sheltered position at the foot of wooded hills on the northern shore of the Gulf of Ajaccio. The harbour, lying to the east of the town, is protected on the south by a peninsula which carries the citadel and terminates in the Citadel jetty; to the south-west of this peninsula lies the Place Bonaparte, a quarter frequented chiefly by winter visitors attracted by the mild climate of the town. Apart from one or two fine thoroughfares converging to the Place Bonaparte, the streets are mean and narrow and the town has a deserted appearance. The house in which Napoleon I, was born in 1769 is preserved, and his associations with the town are everywhere emphasized by street-names and statues. The other buildings, including the cathedral of the 16th century, are of little interest. The town is the seat of a bishopric dating at least from the 7th century and of a prefect. It has tribunals of first instance and of commerce, training colleges, a communal college, a museum and a library; the three latter are established in the Palais Fesch, founded by Cardinal Fesch, who was born at Ajaccio in 1763. Ajaccio has small manufactures of cigars and macaroni and similar products, and carries on shipbuilding, sardine-fishing and coral-fishing. Its exports include timber, citrons, skins, chestnuts and gallic acid. The port is accessible by the largest ships, but its accommodation is indifferent. In 1904 there entered 603 vessels with a tonnage of 202,980, and cleared 608 vessels with a tonnage of 202,502. The present town of Ajaccio lies about two miles to the south of its original site, from which it was transferred by the Genoese in 1492. Occupied from 1553 to 1559 by the French, it again fell to the Genoese after the treaty of Cateau Cambrésis in the latter year. The town finally passed to the French in 1768. Since 1810 it has been capital of the department of Corsica.

AJAIGARH, or ADJYGURH, a native state of India, in Bundelkhand, under the Central India agency. It has an area of 771 sq. m., and a population in 1901 of 78,236. The chief, who is a Bundela Rajput, bears the title of sawai maharaja. He has an estimated revenue of about £15,000, and pays a tribute of £460. He resides at the town of Naushahr, at the foot of the hill-fortress of Ajaigarh, from which the state takes its name. This fort is situated on a very steep hill, more than 800 ft. above the town of the same name; and contains the ruins of temples adorned with elaborately carved sculptures. It was captured by the British in 1809. The town is subject to malaria. The state suffered severely from famine in 1868–1869, and again in 1896–1897.

AJANTA (more properly ĀJUNTHĀ), a village in the dominions of the Nizam of Hyderabad in India (N. lat. 20° 32′ by E. long. 75° 48′), celebrated for its cave hermitages and halls. The caves are in a wooded and rugged ravine about 3½ m. from the village. Along the bottom of the ravine runs the river Wâgura, a mountain stream, which forces its way into the valley over a bluff on the east, and forms in its descent a beautiful waterfall, or rather series of waterfalls, 200 ft. high, the sound of which must have been constantly audible to the dwellers in the caves. These are about thirty in number, excavated in the south side of the precipitous bank of the ravine, and vary from 35 to 110 ft. in elevation above the bed of the torrent. The caves are of two kinds—dwelling-halls and meeting-halls. The former, as one enters from the pathway along the sides of the cliff, have a broad verandah, its roof supported by pillars, and giving towards the interior on to a hall averaging in size about 35 ft. by 20 ft. To left and right, and at the back, dormitories are excavated opening on to this hall, and in the centre of the back, facing the entrance, an image of the Buddha usually stands in a niche. The number of dormitories varies according to the size of the hall, and in the larger ones pillars support the roof on all three sides, forming a sort of cloister running round the hall. The meeting-halls go back into the rock about twice as far as the dwelling-halls; the largest of them being 94½ ft. from the verandah to the back, and 41¼ ft. across, including the cloister. They were used as chapter-houses for the meetings of the Buddhist Order. The caves are in three groups, the oldest group being of various dates from 200 B.C. to A.D. 200, the second group belonging, approximately, to the 6th, and the third group to the 7th century A.D. Most of the interior walls of the caves were covered with fresco paintings, of a considerable degree of merit, and somewhat in the style of the early Italian painters. When first discovered, in 1817, these frescoes were in a fair state of preservation, but they have since been allowed to go hopelessly to ruin. Fortunately, the school of art in Bombay, especially under the supervision of J. Griffiths, had copied in colours a number of them before the last vestiges had disappeared, and other copies of certain of the paintings have also been made. These copies are invaluable as being the only evidence we now have of pictorial art in India before the rise of Hinduism. The expression "Cave Temples" used by Anglo-Indians of such halls is inaccurate. Ajanta was a kind of college monastery. Hsüan Tsang informs us that Dinnâga, the celebrated Buddhist philosopher and controversialist, author of well-known books on logic, resided there. In its prime the settlement must have afforded accommodation for several hundreds, teachers and pupils combined. Very few of the frescoes have been identified, but two are illustrations of stories in Ārya Sūra's *Jātaka Mālā*, as appears from verses in Buddhist Sanskrit painted beneath them.

See J. Burgess and Bhagwanlal Indraji, *Inscriptions from the Cave Temples of Western India* (Bombay, 1881); J. Fergusson and J. Burgess, *Cave Temples of India* (London, 1880); J. Griffiths, *Paintings in the Buddhist Cave Temples of Ajanta* (London, 2 vols., 1896–1897). (T. W. R. D.)

AJAX (Gr. Αἴας), a Greek hero, son of Oïleus, king of Locris, called the "lesser" or Locrian Ajax, to distinguish him from Ajax, son of Telamon. In spite of his small stature, he held his own amongst the other heroes before Troy; he was brave, next to Achilles in swiftness of foot and famous for throwing the spear. But he was boastful, arrogant and quarrelsome; like the Telamonian Ajax, he was the enemy of Odysseus, and in the end the victim of the vengeance of Athene, who wrecked his ship on his homeward voyage (*Odyssey*, iv. 499). A later story gives a more definite account of the offence of which he was guilty. It is said that, after the fall of Troy, he dragged Cassandra away by force from the statue of the goddess at which she had taken refuge as a suppliant, and even violated her (*Lycophron*, 360, Quintus Smyrnaeus xiii. 422). For this, his ship was wrecked in a storm on the coast of Euboea, and he himself was struck by lightning (Virgil, *Aen.* i. 40). He was said to have lived after his death in the island of Leukê. He was worshipped as a national hero by the Opuntian Locrians (on whose coins he appears), who always left a vacant place for him in the ranks of their army when drawn up in battle array. He was the subject of a lost tragedy by Sophocles. The rape of Cassandra by Ajax was frequently represented in Greek works of art, for instance on the chest of Cypselus described by Pausanias (v. 17) and in extant works.

AJAX, son of Telamon, king of Cyprus, a legendary hero of ancient Greece. To distinguish him from Ajax, son of Oïleus, he was called the "great" or Telamonian Ajax. In Homer's *Iliad* he is described as of great stature and colossal frame, second only to Achilles in strength and bravery, and the "bulwark of the Achaeans." He engaged Hector in single combat and, with the aid of Athene, rescued the body of Achilles from the hands of the Trojans. In the competition between him and Odysseus for the armour of Achilles, Agamemnon, at the instigation of Athene, awarded the prize to Odysseus. This so enraged Ajax that it caused his death (*Odyssey*, xi. 541). According to a later and more definite story, his disappointment drove him mad; he rushed out of his tent and fell upon the flocks of sheep in the camp under the impression that they were the enemy; on coming to his senses, he slew himself with the sword which he had received as a present from Hector. This is the account of his death given in the *Ajax* of Sophocles (Pindar, *Nemea*, 7; Ovid, *Met.* xiii. 1). From his blood sprang a red flower, as at the death of Hyacinthus, which bore on its leaves the initial letters of his name AI, also expressive of lament (Pausanias i. 35. 4). His ashes were deposited in a golden urn on the Rhoetean promontory at the entrance of the Hellespont. Like Achilles, he is represented as living after his death in the island of Leukê at the mouth of the Danube (Pausanias iii. 19. 11). Ajax, who in the post-Homeric legend is described as the grandson of Aeacus and the great-grandson of Zeus, was the tutelary hero of the island of Salamis, where he had a temple and an image, and where a festival called *Aianteia* was celebrated in his honour (Pausanias i. 35). At this festival a couch was set up, on which the panoply of the hero was placed, a practice which recalls the Roman *lectisternium*. The identification of Ajax with the family of Aeacus was chiefly a matter which concerned the Athenians, after Salamis had come into their possession, on which occasion Solon is said to have inserted a line in the *Iliad* (ii. 557 or 558), for the purpose of supporting the Athenian claim to the island. Ajax then became an Attic hero; he was worshipped at Athens, where he had a statue in the market-place, and the tribe Aiantis was called after his name. Many illustrious Athenians—Cimon, Miltiades, Alcibiades, the historian Thucydides—traced their descent from Ajax.

See D. Bassi, *La Leggenda di Aiace Telamonio* (1890); P. Girard, "Ajax, fils de Télamon," 1905, in *Revue des études grecques*, tome 18; J. Vürtheim, *De Ajacis Origine, Cultu, Patria* (Leiden, 1907), according to whom he and Ajax Oïleus, as depicted in epos, were originally one, a Locrian daemon somewhat resembling the giants. When this spirit put on human form and became known at the Saronic Gulf, he developed into the "greater" Ajax, while among the Locrians he remained the "lesser." In the article GREEK ART, fig. 13 (from a black-figured Corinthian vase) represents the suicide of Ajax.

AJMERE, or AJMER, a city of British India in Rajputana, which gives its name to a district and also to a petty province called Ajmere-Meirwara. It is situated in 26° 27′ N. lat. and 74° 44′ E. long., on the lower slopes of Taragarh hill, in the Aravalli mountains. To the north of the city is a large artificial lake called the Anasagar, whence the water supply of the place is derived.

The chief object of interest is the *darga*, or tomb of a famous Mahommedan saint named Mayud-uddin. It is situated at the foot of the Taragarh mountain, and consists of a block of white marble buildings without much pretension to architectural beauty. To this place the emperor Akbar, with his empress, performed a pilgrimage on foot from Agra in accordance with the terms of a vow he had made when praying for a son. The large pillars erected at intervals of two miles the whole way, to mark the daily halting-place of the imperial pilgrim, are still extant. An ancient Jain temple, now converted into a Mahommedan mosque, is situated on the lower slope of the Taragarh hill. With the exception of that part used as a mosque, nearly the whole of the ancient temple has fallen into ruins, but the relics are not excelled in beauty of architecture and sculpture by any remains of Hindu art. Forty columns support the roof, but no two are alike, and great fertility of invention is manifested in the execution of the ornaments. The summit of Taragarh hill, overhanging Ajmere, is crowned by a fort, the lofty thick battlements of which run along its brow and enclose the table-land. The walls are 2 m. in circumference, and the fort can only be approached by steep and very roughly paved planes, commanded by the fort and the outworks, and by the hill to the west. On coming into the hands of the English, the fort was dismantled by order of Lord William Bentinck, and is now converted into a sanatorium for the troops at Nasirabad. Ajmere was founded about the year 145 A.D. by Aji, a Chauhan, who established the dynasty which continued to rule the country (with many vicissitudes of fortune) while the repeated waves of Mahommedan invasion swept over India, until it eventually became an appanage of the crown of Delhi in 1193. Its internal government, however, was handed over to its ancient rulers upon the payment of a heavy tribute to the conquerors. It then remained feudatory to Delhi till 1365, when it was captured by the ruler of Mewar. In 1509 the place became a source of contention between the chiefs of Mewar and Marwar, and was ultimately conquered in 1532 by the latter prince, who in his turn in 1559 had to give way before the emperor Akbar. It continued in the hands of the Moguls, with occasional revolts, till 1770, when it was ceded to the Mahrattas, from which time up to 1818 the unhappy district was the scene of a continual struggle, being seized at different times by the Mewar and Marwar rajas, from whom it was as often retaken by the Mahrattas. In 1818 the latter ceded it to the British in return for a payment of 50,000 rupees. Since then the country has enjoyed unbroken peace and a stable government.

The modern city is an important station on the Rajputana railway, 615 m. from Bombay and 275 m. from Delhi, with a branch running due south to the Great Indian Peninsula main line. The city is well laid out with wide streets and handsome houses. The city trade chiefly consists of salt and opium. The former is imported in large quantities from the Sambar lake and Ramsur. Oil-making is also a profitable branch of trade. Cotton cloths are manufactured to some extent, for the dyeing of which the city has attained a high reputation. The educational institutions include the Mayo Rajkumar college, opened in 1875, for training the sons of the nobles of Rajputana, on the lines of an

English public school. Population (1901) 73,839, showing an increase of 10 % in the decade.

The District of Ajmere, which forms the largest part of the province of Ajmere-Merwara, has an area of 2069 sq. m. The eastern portion of the district is generally flat, broken only by gentle undulations, but the western parts, from north-west to south-west, are intersected by the great Aravalli range. Many of the valleys in this region are mere sandy deserts, with an occasional oasis of cultivation, but there are also some very fertile tracts; among these is the plain on which lies the town of Ajmere. This valley, however, is not only fortunate in possessing a noble artificial lake, but is protected by the massive walls of the Nagpathar range or Serpent rock, which forms a barrier against the sand. The only hills in the district are the Aravalli range and its offshoots. Ajmere is almost totally devoid of rivers, the Banas being the only stream which can be dignified with that name, and it only touches the south-eastern boundary of the district so as to irrigate the pargana of Samur. Four small streams—the Sagarmati, Saraswati, Khari and Dai—also intersect the district. In the dry weather they are little more than brooks. The population in 1901 was 7453, showing a decrease of 13 % in the decade. Besides the city of Ajmere, the district contains the military station of Nasirabad, with a population of 22,494.

AJMERE-MERWARA, a division or petty province of British India, in Rajputana, consisting of the two districts of Ajmere and Merwara, separated from each other and isolated amid native states. The administration is in the hands of a commissioner, subordinate to the governor-general's agent for Rajputana. The capital is Ajmere city. The area is 2710 sq. m. The plateau, on whose centre stands the town of Ajmere, may be considered as the highest point in the plains of Hindustan; from the circle of hills which hem it in, the country slopes away on every side—towards river valleys on the east, south, west and towards the desert region on the north. The Aravalli range is the distinguishing feature of the district. The range of hills which runs between Ajmere and Nasirabad marks the watershed of the continent of India. The rain which falls on one side drains into the Chambal, and so into the Bay of Bengal; that which falls on the other side into the Luni, which discharges itself into the Runn of Cutch. The province is on the border of what may be called the arid "zone"; it is the debatable land between the north-eastern and south-western monsoons, and beyond the influence of either. The south-west monsoon sweeps up the Nerbudda valley from Bombay and crossing the tableland at Neemuch gives copious supplies to Malwa, Jhalawar and Kotah and the countries which lie in the course of the Chambal river. The clouds which strike Kathiawar and Cutch are deprived of a great deal of their moisture by the hills in those countries, and the greater part of the remainder is deposited on Mount Abu and the higher slopes of the Aravalli mountains, leaving but little for Merwara, where the hills are lower, and still less for Ajmere. It is only when the monsoon is in considerable force that Merwara gets a plentiful supply from it. The north-eastern monsoon sweeps up the valley of the Ganges from the Bay of Bengal and waters the northern part of Rajputana, but hardly penetrates farther west than the longitude of Ajmere. On the varying strength of these two monsoons the rainfall of the district depends. The agriculturist in Ajmere-Merwara can never rely upon two good harvests in succession. A province subject to such conditions can hardly be free from famine or scarcity for any length of time; accordingly it was visited by two famines, one of unprecedented severity, and one scarcity, in the decade 1891–1901. In June 1900 the number of persons in receipt of relief was 143,000, being more than one-fourth of the total population.

In 1901 the population was 476,912, showing a decrease of 12 % in the decade, due to the results of famine. Among Hindus, the Rajputs are land-holders, and the Jats and Gujars are cultivators. The Jains are traders and money-lenders. The aboriginal tribe of Mers are divided between Hindus and Mahommedans. The chief crops are millet, wheat, cotton and oil-seeds. There are several factories for ginning and pressing cotton, the chief trading centres being Beawar and Kekri.

AJODHYA, an ancient city of India, the prehistoric capital of Oudh, in the Fyzabad district of the United Provinces. It is situated on the right bank of the Gogra. In the present day the old city has almost entirely disappeared, and its site is marked only by a heap of ruins; but in remote antiquity Ajodhya was one of the largest and most magnificent of Indian cities. It is said to have covered an area of 96 m., and was the capital of the kingdom of Kosala, the court of the great king Dasaratha, the fifty-sixth monarch of the Solar line in descent from Raja Manu. The opening chapters of the *Ramayana* recount the magnificence of the city, the glories of the monarch and the virtues, wealth and loyalty of his people. Dasaratha was the father of Rama Chandra, the hero of the epic. A period of Buddhist supremacy followed the death of the last king of the Solar dynasty. On the revival of Brahmanism Ajodhya was restored by King Vikramaditya (*c.* 57 B.C.). Kosala is also famous as the early home of Buddhism, and of the kindred religion of Jainism, and claims to be the birthplace of the founders of both these faiths. The Chinese traveller, Hsüan Tsang, in the 7th century, found 20 Buddhist temples with 3000 monks at Ajodhya among a large Brahmanical population. The modern town of Ajodhya contains 96 Hindu temples and 36 Mussulman mosques. Little local trade is carried on, but the great fair of Ramnami held every year is attended by about 500,000 people.

AKABA, Gulf of, the Sinus Aelaniticus of antiquity, the eastern of the two divisions into which the Red Sea bifurcates near its northern extremity. It penetrates into Arabia Petraea in a N.N.E. direction, from 28° to 29° 32′ N., a distance of 100 m., and its breadth varies from 12 to 17 m. The entrance is contracted by Tiran and other islands, so that the passage is rendered somewhat difficult; and its navigation is dangerous on account of the numerous coral reefs, and the sudden squalls which sweep down from the adjacent mountains, many of which rise perpendicularly to a height of 2000 ft. The gulf is a continuation southward of the Jordan-'Araba depression. Raised beaches on the coast show that there has been a considerable elevation of the sea-bed. The only well-sheltered harbour is that of Dahab (the Golden Port) on its western shore, about 33 m. from the entrance and 29 m. E. of Mount Sinai. Near the head of the gulf is Jeziret Faraun (medieval *Graye*), a rocky islet with the ruins of a castle built by Baldwin I. (*c.* 1115).

About 2½ m. from the head of the gulf and on its eastern side is the Town of Akaba, with a picturesque medieval castle, built for the protection of pilgrims on their way from Egypt to Mecca. In the neighbourhood are extensive groves of date palms, and there is an ample supply of good water. Akaba is of considerable historical interest and of great antiquity, being the Elath or Eloth of the Bible, and one of the ports whence Solomon's fleet sailed to Ophir. By the Romans, who made it a military post, it was called Aelana. It continued to be the seat of great commercial activity under the early Moslem caliphs, who corrupted the name to Haila or Ailat. In the 10th century an Arab geographer described it as the great port of Palestine and the emporium of the Hejaz. In the 12th century the town suffered at the hands of Saladin and thereafter fell into decay. In 1841 the town was recognized by Turkey, together with the Sinai peninsula, as part of Egypt. At that time Egyptian pilgrims frequented Akaba in large numbers. In 1892, on the accession of the khedive Abbas II., Turkey resumed possession of Akaba, the Egyptian pilgrims having deserted the land route to Mecca in favour of a sea passage. In 1906 the construction was begun of a branch line joining Akaba to the Mecca railway and thus giving through communication with Beirut. Early in the same year the Turks occupied Taba, a village at the mouth of a small stream 8 m. by land W. by S. of Akaba, near which is the site, not identified, of the Ezion-Geber of Scripture, another of the ports whence the argosies of the Israelites sailed. Taba being on the Egyptian side of the frontier, Great Britain intervened on behalf of Egypt, and in May 1906 secured the withdrawal of the Turks.

AKA HILLS, a tract of country on the north-east frontier of India, occupied by an independent tribe called the Akas. It lies north of the Darrang district of Eastern Bengal and Assam, and is bounded on the east by the Daphla Hills and on the west by independent Bhutia tribes. The Aka country is very difficult of access, the direct road from the plains leading along the precipitous channel of the Bhareli river, which divides the Aka from the Daphla country. The Akas are a brave people, and the men are strong and well-made. Their reputation as raiders is sufficiently shown in the division of the tribe into two clans, the Hazari-khoas or "eaters of a thousand hearths," and the Kapah-chors or "thieves that lurk in the cotton fields." In the early years of British occupation, about 1829, they gave much trouble; and in 1883 they broke out once more into their old habits. They raided into the British district of Darrang and carried off several native forest officers as hostages. An expedition was sent against them under General Sale Hill with 860 troops, which was completely successful. All its objects were satisfactorily accomplished, namely, the recovery of the captives, the surrender of all firearms, the payment of the fine inflicted by government, the complete submission of the tribe and the survey of the country.

AKALKOT, a native state of India, in the Deccan division of Bombay, ranking as one of the Satara Jagirs, situated between the British district of Sholapur and the nizam's dominions. It forms part of the Deccan table-land, and has a cool and agreeable climate. Area 498 sq. m.; pop. (1901) 82,047, showing an increase of 8% in the decade. Estimated revenue, £26,586; the tribute is £1000. The chief, who is a Mahratta of the Bhonsla family, resides at Poona on a pension, while the state is under British management.

The town of Akalkot is situated near the Great Indian Peninsula railway, which traverses the state. Pop. 8348.

AKBAR, Akhbar or Akber, **JELLALADIN MAHOMMED** (1542–1605), one of the greatest and wisest of the Mogul emperors. He was born at Umarkot in Sind on the 14th of October 1542, his father, Humayun, having been driven from the throne a short time before by the usurper Sher Khan. After more than twelve years' exile, Humayun regained his sovereignty, which, however, he had held only for a few months when he died. Akbar succeeded his father in 1556 under the regency of Bairam Khan, a Turkoman noble, whose energy in repelling pretenders to the throne, and severity in maintaining the discipline of the army, tended greatly to the consolidation of the newly recovered empire. Bairam, however, was naturally despotic and cruel; and when order was somewhat restored, Akbar found it necessary to take the reins of government into his own hands, which he did by a proclamation issued in March 1560. The discarded regent lived for some time in rebellion, endeavouring to establish an independent principality in Malwa, but at last he was forced to cast himself on Akbar's mercy. The emperor not only freely pardoned him, but magnanimously offered him the choice of a high place in the army or a suitable escort for a pilgrimage to Mecca, and Bairam preferred the latter alternative. When Akbar ascended the throne, only a small portion of what had formerly been comprised within the Mogul empire owned his authority, and he devoted himself with great determination and success to the recovery of the revolted provinces. Over each of these, as it was restored, he placed a governor, whom he superintended with vigilance and wisdom. He tried by every means to develop and encourage commerce; he had the land accurately measured for the purpose of rightly adjusting taxation; he gave the strictest instructions to prevent extortion on the part of the taxgatherers, and in many other respects displayed an enlightened and equitable policy. Thus it happened that, in the fortieth year of Akbar's reign, the empire had more than regained all that it had lost, the recovered provinces being reduced, not to subjection only as before, but to a great degree of peace, order and contentment. Akbar's method of dealing with what must always be the chief difficulty of one who has to rule widely diverse races, affords perhaps the crowning evidence of his wisdom and moderation. In religion he was at first a Mussulman, but the intolerant exclusiveness of that creed was quite foreign to his character. Scepticism as to the divine origin of the Koran led him to seek the true religion in an eclectic system. He accordingly set himself to obtain information about other religions, sent to Goa, requesting that the Portuguese missionaries there should visit him, and listened to them with intelligent attention when they came. As the result of these inquiries, he adopted the creed of pure deism and a ritual based upon the system of Zoroaster. The religion thus founded, however, having no vital force, never spread beyond the limits of the court, and died with Akbar himself. But though his eclectic system failed, the spirit of toleration which originated it produced in other ways many important results, and, indeed, may be said to have done more to establish Akbar's power on a secure basis than all his economic and social reforms. He conciliated the Hindus by giving them freedom of worship; while at the same time he strictly prohibited certain barbarous Brahmanical practices, such as trial by ordeal and the burning of widows against their will. He also abolished all taxes upon pilgrims as an interference with the liberty of worship, and the capitation tax upon Hindus, probably upon similar grounds. Measures like these gained for him during his lifetime the title of "Guardian of Mankind," and caused him to be held up as a model to Indian princes of later times, who in the matter of religious toleration have only too seldom followed his example.

Akbar was a munificent patron of literature. He established schools throughout his empire for the education of both Hindus and Moslems, and he gathered round him many men of literary talent, among whom may be mentioned the brothers Feizi and Abul Fazl. The former was commissioned by Akbar to translate a number of Sanskrit scientific works into Persian; and the latter (see Abul Fazl) has left, in the *Akbar-Nameh*, an enduring record of the emperor's reign. It is also said that Akbar employed Jerome Xavier, a Jesuit missionary, to translate the four Gospels into Persian.

The closing years of Akbar's reign were rendered very unhappy by the misconduct of his sons. Two of them died in youth, the victims of intemperance; and the third, Salim, afterwards the emperor Jahangir, was frequently in rebellion against his father. These calamities were keenly felt by Akbar, and may even have tended to hasten his death, which occurred at Agra on the 15th of October 1605. His body was deposited in a magnificent mausoleum at Sikandra, near Agra.

See G. B. Malleson, *Akbar* ("Rulers of India" series), 1890.

AKCHA, a town and khanate of Afghan Turkestan. The town lies 42 m. westward of Balkh on the road to Andkhui. It is protected by a mud wall and a citadel. Estimated population 8000, chiefly Uzbegs. The khanate is small, but well watered and populous. The rivers rising in the southern mountains, which no longer reach the Oxus, terminate in vast swamps near Akcha, and into these the debris of such vegetation as yearly springs up on the slopes of the southern hills is washed down in time of flood.

AKEN, a town of Germany, in the kingdom of Prussia, on the Elbe, 25 m. E. S. E. of Magdeburg, with a branch line to Cöthen (8 m.). Pop. (1900) 7358. It has manufactures of cloth, leather, chemicals and optical instruments; large quantities of beetroot sugar are produced in the neighbourhood; and there is a considerable transit trade on the Elbe.

AKENSIDE, MARK (1721–1770), English poet and physician, was born at Newcastle-on-Tyne on the 9th of November 1721. He was the son of a butcher, and was slightly lame all his life from a wound he received as a child from his father's cleaver. All his relations were dissenters, and, after attending the free school of Newcastle, and a dissenting academy in the town, he was sent (1739) to Edinburgh to study theology with a view to becoming a minister, his expenses being paid from a special fund set aside by the dissenting community for the education of their pastors. He had already contributed "The Virtuoso, in imitation of Spenser's style and stanza" (1737) to the *Gentleman's Magazine*, and in 1738 "A British Philippic, occasioned by the Insults of the Spaniards, and the present Preparations for War" (also published separately). After he had spent one winter as a student of theology, he entered his name as a student of medicine. He repaid the money that had been advanced for his theological studies, and with this change of mind he seems to have drifted to a mild deism. His politics, says Dr Johnson, were characterized by an "impetuous eagerness to subvert and confound, with very little care what shall be established," and he is caricatured in the republican doctor of Smollett's *Peregrine Pickle*. He was elected a member of the Medical Society of Edinburgh in 1740. His ambitions already lay outside his profession, and his gifts as a speaker made him hope one day to enter parliament. In 1740 he printed his "Ode on the Winter Solstice" in a small volume of poems. In 1741 he left Edinburgh for Newcastle and began to call himself surgeon, though it is doubtful whether he practised, and from the next year dates his life-long friendship with Jeremiah Dyson (1722–1776). During a visit to Morpeth in 1738 he had conceived the idea of his didactic poem, "The Pleasures of the Imagination." He had already acquired a considerable literary reputation when he came to London about the end of 1743, and offered the work to Dodsley for £120. Dodsley thought the price exorbitant, and only accepted the terms after submitting the MS. to Pope, who assured him that this was "no everyday writer." The three books of this poem appeared in January 1744. His aim, Akenside tells us in the preface, was "not so much to give formal precepts, or enter into the way of direct argumentation, as, by exhibiting the most engaging prospects of nature, to enlarge and harmonize the imagination, and by that means insensibly dispose the minds of men to a similar taste and habit of thinking in religion, morals and civil life." Akenside's powers fell short of this lofty design; his imagination was not brilliant enough to surmount the difficulties inherent in a poem dealing so largely with abstractions; but the work was well received by the general public. His success was not unchallenged. Gray wrote to Thomas Wharton that it was "above the middling," but "often obscure and unintelligible and too much infected with the Hutchinson[1] jargon."

Into a note added by Akenside to the passage in the third book dealing with ridicule, William Warburton chose to read a reflexion on himself. Accordingly he attacked the author of the *Pleasures of the Imagination*—which was published anonymously—in a scathing preface to his *Remarks on Several Occasional Reflections, in answer to Dr Middleton* . . . (1744). This was answered, nominally by Dyson, in *An Epistle to the Rev. Mr Warburton*, in which Akenside no doubt had a hand. It was in the press when he left England in 1744 to secure a medical degree at Leiden. In little more than a month he had completed the necessary dissertation, *De ortu et incremento foetus humani*, and received his diploma. Returning to England he attempted without success to establish a practice in Northampton. In 1744 he published his *Epistle to Curio*, attacking William Pulteney (afterwards earl of Bath) for having abandoned his liberal principles to become a supporter of the government, and in the next year he produced a small volume of *Odes on Several Subjects*, in the preface to which he lays claim to correctness and a careful study of the best models. His friend Dyson had meanwhile left the bar, and had become, by purchase, clerk to the House of Commons. Akenside had come to London and was trying to make a practice at Hampstead. Dyson took a house there, and did all he could to further his friend's interest in the neighbourhood. But Akenside's arrogance and pedantry frustrated these efforts, and Dyson then took a house for him in Bloomsbury Square, making him independent of his profession by an allowance stated to have been £300 a year, but probably greater, for it is asserted that this income enabled him to "keep a chariot," and to live "incomparably well." In 1746 he wrote his much-praised "Hymn to the Naiads," and he also became a contributor to Dodsley's *Museum, or Literary and Historical Register*. He was now twenty-five years old, and began to devote himself almost exclusively to his profession. He was an acute and learned physician. He was admitted M.D. at Cambridge in 1753, fellow of the Royal College of Physicians in 1754, and fourth censor in 1755. In June 1755 he read the Gulstonian lectures before the College, in September 1756 the Croonian lectures, and in 1759 the Harveian oration. In January 1759 he was appointed assistant physician, and two months later principal physician to Christ's Hospital, but he was charged with harsh treatment of the poorer patients, and his unsympathetic character prevented the success to which his undeniable learning and ability entitled him. At the accession of George III. both Dyson and Akenside changed their political opinions, and Akenside's conversion to Tory principles was rewarded by the appointment of physician to the queen. Dyson became secretary to the treasury, lord of the treasury, and in 1774 privy councillor and cofferer to the household.

Akenside died on the 23rd of June 1770, at his house in Burlington Street, where the last ten years of his life had been spent. His friendship with Dyson puts his character in the most amiable light. Writing to his friend so early as 1744, Akenside said that the intimacy had "the force of an additional conscience, of a new principle of religion," and there seems to have been no break in their affection. He left all his effects and his literary remains to Dyson, who issued an edition of his poems in 1772. This included the revised version of the *Pleasures of Imagination*, on which the author was engaged at his death. The first book of this work defines the powers of imagination and discusses the various kinds of pleasure to be derived from the perception of beauty; the second distinguishes works of imagination from philosophy; the third describes the pleasure to be found in the study of man, the sources of ridicule, the operations of the mind, in producing works of imagination, and the influence of imagination on morals. The ideas were largely borrowed from Addison's essays on the imagination and from Lord Shaftesbury. Professor Dowden complains that "his tone is too high-pitched; his ideas are too much in the air; they do not nourish themselves in the common heart, the common life of man." Dr Johnson praised the blank verse of the poems, but found fault with the long and complicated periods. Akenside's verse was better when it was subjected to severer metrical rules. His odes are very few of them lyrical in the strict sense, but they are dignified and often musical, while the few "inscriptions" he has left are felicitous in the extreme.

The best edition of Akenside's *Poetical Works* is that prepared (1834) by Alexander Dyce for the *Aldine Edition of the British Poets*, and reprinted with small additions in subsequent issues of the series. See Dyce's *Life of Akenside* prefixed to his edition, also Johnson's *Lives of the Poets*, and the *Life, Writings and Genius of Akenside* (1832) by Charles Bucke.

AKERMAN, JOHN YONGE (1806–1873), English antiquarian, distinguished chiefly in the department of numismatics, was born in Wiltshire. He became early known in connexion with his favourite study, having initiated the *Numismatic Journal* in 1836. In the following year he became the secretary of the newly established Numismatic Society. In 1848 he was elected secretary to the Society of Antiquaries, an office which he was compelled to resign in 1860 on account of failing health. Akerman published a considerable number of works on his special subject, the more important being a *Catalogue of Roman Coins* (1839); a *Numismatic Manual* (1840); *Roman Coins relating to Britain* (1844); *Ancient Coins—Hispania, Gallia, Britannia* (1846); and *Numismatic Illustrations of the New Testament* (1846). He wrote also a *Glossary of Words used in Wiltshire* (1842); *Wiltshire Tales, illustrative of the Dialect* (1853); and *Remains of Pagan Saxondom* (1855).

AKHALTSIKH (Georgian *Akhaltsikhe*, "new fortress"), a fortified town of Russian Transcaucasia, government of Tiflis, 68 m. E. of Batum, in 41° 40′ N. lat., 43° 1′ E. long., on a tributary of the Kura, at an altitude of 3375 ft. The new town is on the right bank of the river, while the old town and the fortress are on the opposite bank. There is trade in silk, honey and wax, and brown coal is found in the neighbourhood. The silver filigree work is famous. Pop. (1897) 15,387, of whom many were Armenians, as against 15,977 in 1867. From 1579 to 1828 Akhaltsikh was the capital of Turkish Armenia. In the last-mentioned year it was captured by the Russians. The Turks invested it in 1853.

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[1] The reference is to Francis Hutcheson (1694–1746), author of an *Inquiry into the Original of our Ideas of Beauty and Virtue* (1725).

AK-HISSAR (anc. *Thyateira*, the "town of Thya"), a town situated in a fertile plain on the Gürdük Chai (*Lycus*), in the Aidin vilayet, 58 m. N.E. of Smyrna. Pop. about 20,000, Mussulmans forming two-thirds. Thyateira was an ancient town re-peopled with Macedonians by Seleucus about 290 B.C. It became an important station on the Roman road from Pergamum to Laodicea, and one of the "Seven Churches" of Asia (Rev. ii. 18), but was never a *metropolis* or honoured with a neocorate, though made the centre of a *conventus* by Caracalla. The modern town is connected with Smyrna by railway, and exports cotton, wool, opium, cocoons and cereals. The inhabitants are Greeks, Armenians and Turks. The Greeks are of an especially fine type, physical and moral, and noted all through Anatolia for energy and stability. W. M. Ramsay believes them to be direct descendants of the ancient Christian population; but there is reason to think they are partly sprung from more recent immigrants who moved in the 18th century from western Greece into the domain of the Karasmans of Manisa and Bergama, as recorded by W. M. Leake. Cotton of excellent quality is grown in the neighbourhood, and the place is celebrated for its scarlet dyes.

See W. M. Ramsay, *Letters to the Seven Churches* (1904); M. Clerc, *De rebus Thyatirenorum* (1893).

AKHMIM, or Ekhmim, a town of Upper Egypt, on the right bank of the Nile, 67 m. by river S. of Assiut, and 4 m. above Suhag, on the opposite side of the river, whence there is railway communication with Cairo and Assuan. It is the largest town on the east side of the Nile in Upper Egypt, having a population in 1907 of 23,795, of whom about a third were Copts. Akhmim has several mosques and two Coptic churches, maintains a weekly market, and manufactures cotton goods, notably the blue shirts and check shawls with silk fringes worn by the poorer classes of Egypt. Outside the walls are the scanty ruins of two ancient temples. In Abulfeda's days (13th century A.D.) a very imposing temple still stood here. Akhmim was the Egyptian Apu or Khen-min, in Coptic Shmin, known to the Greeks as Chemmis or Panopolis, capital of the 9th or Chemmite nome of Upper Egypt. The ithyphallic Min (Pan) was here worshipped as "the strong Horus." Herodotus mentions the temple dedicated to "Perseus" and asserts that Chemmis was remarkable for the celebration of games in honour of that hero, after the manner of the Greeks, at which prizes were given; as a matter of fact some representations are known of Nubians and people of Puoni (Somalic coast) clambering up poles before the god Min. Min was especially a god of the desert routes on the east of Egypt, and the trading tribes are likely to have gathered to his festivals for business and pleasure, at Coptos (which was really near to Neapolis, Kena) even more than at Akhmim. Herodotus perhaps confused Coptos with Chemmis. Strabo mentions linen-weaving as an ancient industry of Panopolis, and it is not altogether a coincidence that the cemetery of Akhmim is one of the chief sources of the beautiful textiles of Roman and Coptic age that are brought from Egypt. Monasteries abounded in this neighbourhood from a very early date; Shenout (Sinuthius), the fiery apostle and prophet of the Coptic national church, was a monk of Atrēpe (now Suhag), and led the populace to the destruction of the pagan edifices. He died in 451; some years earlier Nestorius, the ex-patriarch, had succumbed perhaps to his persecution and to old age, in the neighbourhood of Akhmim. Nonnus, the Greek poet, was born at Panopolis at the end of the 4th century. (F. Ll. G.)

AKHTAL [Ghiyāth ibn Ḥārith] (*c.* 640–710), one of the most famous Arabian poets of the Omayyad period, belonged to the tribe of Taghlib in Mesopotamia, and was, like his fellow-tribesmen, a Christian, enjoying the freedom of his religion, while not taking its duties very seriously. Of his private life few details are known, save that he was married and divorced, and that he spent part of his time in Damascus, part with his tribe in Mesopotamia. In the wars of the Taghlibites with the Qaisites he took part in the field, and by his satires. In the literary strife between his contemporaries Jarīr and Ferazdaq he was induced to support the latter poet. Akhtal, Jarir and Ferazdaq form a trio celebrated among the Arabs, but as to relative superiority there is dispute. In the 'Abbasid period there is no doubt that Akhtal's Christianity told against his reputation, but Abu 'Ubaida placed him highest of the three on the ground that amongst his poems there were ten flawless *qasidas* (elegies), and ten more nearly so, and that this could not be said of the other two. The chief material of his poems consists of panegyric of patrons and satire of rivals, the latter being, however, more restrained than was usual at the time.

The Poetry of al-Akhtal has been published at the Jesuit press in Beirūt, 1891. A full account of the poet and his times is given in H. Lammens' *Le chantre des Omiades* (Paris, 1895) (a reprint from the *Journal Asiatique* for 1894). (G. W. T.)

AKHTYRKA, a town of Russia, in the government of Kharkov, near the Vorskla river, connected by a branch (11 m.) with the railway from Kiev to Kharkov. It has a beautiful cathedral, built after a plan by Rastrelli in 1753, to which pilgrims resort to venerate an ikon of the Virgin. There are manufactures of light woollen stuffs and a trade in corn, cattle and the produce of domestic industries. The environs are fertile, the orchards producing excellent fruit. A fair is held on the 9th of May. The place was founded by the Poles in 1642. Pop. (1867) 17,411; (1900) 25,965.

AKKA (Tikki-Tikki), a race of African pygmies first seen by the traveller G. A. Schweinfurth in 1870, when he was in the Mangbettu country, N.W. of Albert Nyanza. The home of the Akka is the dense forest zone of the Aruwimi district of the Congo State. They form a branch of the primitive pygmy negroid race, and appear to be divided into groups, each with its own chief. Of all African "dwarfs" the Akka are believed the best representatives of the "little people" mentioned by Herodotus. Giovanni Miani, the Italian explorer who followed Schweinfurth, obtained two young Akka in exchange for a dog and a calf. These, sent to Italy in 1873, were respectively 4 ft. 4 in. and 4 ft. 8 in. high, while the tallest seen by Schweinfurth did not reach 5 ft. None of the four Akka brought to Europe in 1874 and 1876 exceeded 3 ft. 4 in. The average height of the race would seem to be somewhat under 4 ft., but sufficient measurements have not been taken to allow of a conclusive statement. Schweinfurth says the Akka have very large and almost spherical skulls (this last detail proves to be an exaggeration). They are of the colour of coffee slightly roasted, with hair almost the same colour, woolly and tufted; they have very projecting jaws, flat noses and protruding lips, which give them an "ape-like" appearance. Marked physical features are an abdominal protuberance which makes all Akka look like pot-bellied children, and a remarkable hollowing of the spine into a curve like an S. Investigation has shown that these are not true racial characteristics, but tend to disappear, the abdominal enlargement subsiding after some weeks of regular and wholesome diet. The upper limbs are long, and the hands, according to Schweinfurth, are singularly delicate. The lower limbs are short, relatively to the trunk, and curve in somewhat, the feet being bent in too, which gives the Akka a topheavy, tottering gait. There is a tendency to steatopygia among the women. The Akka are nomads, living in the forests, where they hunt game with poisoned arrows, with pitfalls and springs set everywhere, and with traps built like huts, the roofs of which, hung by tendrils only, fall in on the animal. They collect ivory and honey, manufacture poison, and bring these to market to exchange for cereals, tobacco and iron weapons. They are courageous hunters, and do not hesitate to attack even elephants, both sexes joining in the chase. They are very agile, and are said by the neighbouring negroes to leap about in the high grass like grasshoppers. They are timid as children before strangers, but are declared to be malevolent and treacherous fighters. In dress, weapons and utensils they are as the surrounding negroes. They build round huts of branches and leaves in the forest clearings. They seem in no way a degenerate race, but rather a people arrested in development by the forest environment.

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AKKAD (Gr. versions ἀρχαδ and ἀχαδ), a Hebrew name, mentioned only once in the Old Testament (Gen. x. 10), for one of the four chief cities, Akkad, Babel, Erech and Calneh, which constituted the nucleus of the kingdom of Nimrod in the land of Shinar or Babylonia. This Biblical city, Akkad, was most probably identical with the northern Babylonian city known to us as Agade (not Agane, as formerly read), which was the principal seat of the early Babylonian king Sargon I. (*Šargani-Šarâli*), whose date is given by Nabonidus, the last Semitic king of Babylonia (555–537 B.C.), as 3800 B.C., which is perhaps too old by 700 or 1000 years.[1] The probably non-Semitic name Agade occurs in a number of inscriptions[2] and is now well attested as having been the name of an important ancient capital. The later Assyro-Babylonian Semitic form *Akkadû* ("of or belonging to Akkad ") is, in all likelihood, a Semitic loan form from the non-Semitic name Agade, and seems to be an additional demonstration of the identity of Agade and Akkad. The usual signs denoting *Akkadû* in the Semitic narrative inscriptions were read in the non-Semitic idiom *uri-ki* or *ur-ki*, " land of the city," which simply meant that *Akkadû* was the land of the city *par excellence*, *i.e.* of the city of Agade of Sargon I., which remained for a long period the leading city of Babylonia.[3]

It is quite probable that the non-Semitic name Agade may mean "crown (*aga*) of fire (*de*)"[4] in allusion to Ištar, " the brilliant goddess," the tutelar deity of the morning and evening star and the goddess of war and love, whose cult was observed in very early times in Agade. This fact is again attested by Nabonidus, whose record[5] mentions that the Ištar worship of Agade was later superseded by that of the goddess Anunit, another personification of the Ištar idea, whose shrine was at Sippar. It is significant in this connexion that there were two cities named Sippar, one under the protection of Shamash, the sun-god, and one under this Anunit, a fact which points strongly to the probable proximity of Sippar and Agade. In fact, it has been thought that Agade-Akkad was situated opposite Sippar on the left bank of the Euphrates, and was probably the oldest part of the city of Sippar.

In the Assyro-Babylonian literature the name *Akkadû* appears as part of the royal title in connexion with Sumer; viz. non-Semitic: *lugal Kĕngi* (*ki*) *Uru* (*ki*) = *šar mât Šumeri u Akkadî*, " king of Sumer and Akkad," which appears to have meant simply " king of Babylonia." It is not likely, as many scholars have thought, that Akkad was ever used geographically as a distinctive appellation for northern Babylonia, or that the name Sumer (*q.v.*) denoted the southern part of the land, because kings who ruled only over Southern Babylonia used the double title " king of Sumer and Akkad," which was also employed by northern rulers who never established their sway farther south than Nippur, notably the great Assyrian conqueror Tiglathpileser III. (745–727 B.C.). Professor McCurdy has very reasonably suggested[6] that the title "king of Sumer and Akkad" indicated merely a claim to the ancient territory and city of Akkad together with certain additional territory, but not necessarily all Babylonia, as was formerly believed.

A discussion of the interesting question relating to the non-Semitic so-called Sumero-Akkadian language and race will be found in the article Sumer.

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AKKERMAN (in old Slav. *Byelgorod*, "white town"), a town, formerly a fortress, of south-west Russia, in the government of Bessarabia, situated on the right bank of the estuary (*liman*) of the Dniester, 12 m. from the Black Sea. The town stands on the site of the ancient Milesian colony of Tyras. Centuries later it was rebuilt by the Genoese, who called it Mauro Castro. The Turks first acquired possession of it in 1484. It was taken by the Russians in 1770, 1774 and 1806, but each time returned to the Turks, and not definitely annexed to Russia until 1881. A treaty concluded here in 1826 between Russia and the Porte secured considerable advantages to the former. It was the non-observance of this treaty that led to the war of 1828. The harbour is too shallow to admit vessels of large size, but the proximity of the town to Odessa secures for it a thriving business in wine, salt, fish, wool and tallow. The salt is obtained from the saline lakes (*limans*) in the neighbourhood. The town, with its suburbs, contains beautiful gardens and vineyards. It is surrounded by ramparts, and commanded by a citadel. Pop. (1900) 32,470.

AKMOLINSK, one of the governments belonging to the governor-generalship of the Steppes in Asiatic Russia, formerly known as the Kirghiz Steppe; bounded by the government of Turgai on the W., by that of Tobolsk on the N., of Semi-palatinsk on the E., and of Syr-darya on the S. Area 229,544 sq. m., of which 4535 are lakes. In the north the government is low and dotted with salt lakes, and is sandy on the banks of the Irtysh in the north-east. An undulating plateau stretches through the middle, watered by the Ishim and its tributary the Nura. The plains gradually rise southwards, where a broad spur of the Tarbagatai mountains stretches north-westwards, containing gold, copper and coal. Many lakes, of which the largest is Teniz, are scattered along the northern slope of these hills. Farther south, towards Lake Balkash, on the south-eastern frontier, is a wide waterless desert, Bek-pak-dala, or Famine Steppe. This section of the government is drained by the Sary-su and Chu, the latter on the southern boundary-line. The climate is continental and dry, the average temperatures at the town of Akmolinsk being for the year 35°, January 1·5°, July 70°; rainfall, only 9 in. The population, which was 686,863 in 1897 (324,587 women), consists chiefly of Russians in the northern and middle portions, and of Kirghiz (about 350,000), who breed cattle, horses and sheep. The urban population was only 74,069. Agriculture is successfully carried on in the north, the Siberian railway running between Petropavlovsk and Omsk through a very fertile, well-populated region. Steamers ply on the Irtysh. The government is divided into five districts, the chief towns of which are: Omsk (pop. 53,050 in 1900), formerly capital of West Siberia, now capital of this government and also of the governor-generalship of the Steppes; Akmolinsk, or Akmolly (9560 in 1897), on the Ishim, 260 m. S.S.W. of Omsk, and chief centre for the caravans coming from Tashkent and Bokhara; Atbasar (3030); Kokchetav (5000); and Petropavlovsk (21,769 in 1901).

AKOLA, a town and district of India, in Berar, otherwise known as the Hyderabad Assigned Districts. The town is on the Murna tributary of the Purna river, 930 ft. above the sea, Akola proper being on the west bank, and Tajnapeth, containing the government buildings and European residences, on the east bank. It is a station on the Nagpur branch of the Great Indian Peninsula railway and is 383 m. E.N.E. of Bombay. It had a population (1901) of 29,289. It is walled, and has a citadel built in the early years of the 19th century. Akola is one of the chief centres of the cotton trade in Berar, and has numerous ginning factories and cotton presses. Among the educational establishments are a government high school, and an industrial school supported by a Protestant mission.

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[1] Prince, *Nabonidus*, p. v.

[2] In the Sargon inscriptions; *Bab. Exped. of the Univ. of Penn.* i. pl. 1, nr. 1, line 6; pl. 2, nr. 2, line 5; pl. 3, nr. 3, line 3b; also xi. pl. 49, nr. 119 and in Nebuchadnezzar, col. ii. line 50 (Hilprecht, *Freibrief Neb.*); *Cun. Texts from Bab. Tablets*, pl. 1, nr. 91146, line 3.

[3] Rogers, *History of Babylonia and Assyria*, i. pp. 365, 373-374.

[4] Prince, " Materials for a Sumerian Lexicon," pp. 23, 73, *Journal of Biblical Literature*, 1906.

[5] I. Rawl. 69, col. ii. 48 and iii. 28.

[6] *History, Prophecy and the Monuments*, i. § 110.

The DISTRICT OF AKOLA as reconstituted in 1905 has an area of 4111 sq. m., the population of this area in 1901 being 754,804. (Before the alteration of the boundaries the area of the district was 2678 sq. m., and the population 582,540.) The surface of the country is generally flat, the greater part being situated in the central valley of Berar. On the north it is bounded by the Melghat hills. By the addition of Basim and Mangrul *taluks* in 1905, the district includes the eastern part of the Ajanta hills, with peaks rising to 2000 ft., and the tableland of Basim (*q.v.*). North of the Ajanta hills the country is drained eastward by the Purna affluent of the Tapti and its tributaries. None of the rivers is navigable. The climate resembles that of Berar generally, but the heat during April to mid-June, when the rains begin, is very great, the average temperature at the town of Akola in May for the twenty-five years ending 1901 being 94·4° F. But even during the hot season the nights are cool. The annual rainfall averages 34 in. In the Purna valley the soil is everywhere a rich black loam, and nearly the whole of the land is cultivated. Very little land is under irrigation. The principal crop is cotton, and the staple grain millet. Wheat and pulses are also grown. The history of Akola is not distinguished from that of the other portions of Berar. In 1317–1318 it was added to the Delhi empire, became independent under the Bahmani dynasty in 1348, and in 1596 again fell under the sway of the Moguls. In 1724 it came, with the rest of Berar, under the dominion of the nizam, being assigned to the British in 1853.

AKRON, a city and the county-seat of Summit county, Ohio, U.S.A., on the Little Cuyahoga river, about 35 m. S. by E. of Cleveland. Pop. (1890) 27,601; (1900) 42,728, of whom 7127 were foreign-born (3227 being German, 1104 English, and 641 Irish); (1910) 69,067. It is served by the Baltimore & Ohio, the Erie, the Northern Ohio, and the Cleveland, Akron & Columbus railways, by inter-urban electric lines and by the Ohio Canal. The city is situated in a region abounding in lakes, springs and hills; it is about 1000 ft. above sea-level, whence its name (from Gr. *ἄκρον*, height); and attracts many summer visitors. It is the seat of Buchtel College (co-educational; non-sectarian), which was founded by the Ohio Universalist Convention in 1870, was opened in 1872, and was named in honour of its most liberal benefactor, John R. Buchtel (1822–1892), a successful business man who did much to promote the industrial development of Akron. Buchtel College provides three courses leading to the degrees of A.B., Ph.B. and S.B.; it has a school of music, a school of art and an academy; in 1908 there were 267 students. Coal is mined in the neighbourhood. The river furnishes considerable water-power; and among the city's most important manufactures are rubber and elastic goods (value, 1905, $13,396,974; 83·9 % of the total of this industry in the state and 21·3% of the total for the United States, Akron ranking first among the cities of the country in this industry), printing and publishing product (value, 1905, $2,834,639), foundry and machine-shop product (value, 1905, $2,367,764), and pottery, terra-cotta and fire-clay (value, 1905, $1,718,033; nearly twice the value of the output in 1900, Akron ranking fourth among the cities of the United States in this industry in 1905). Other important manufactures are food preparations (especially of oats) and flour and grist mill products. The value of the total manufactured products (under the "factory" system) in 1905 was $34,004,243, an increase in five years of 54·5%. Akron was settled about 1825, was incorporated as a village in 1836, was made the county-seat in 1842, and in 1865 was chartered as a city.

See S. A. Lane, *Fifty Years and over of Akron and Summit County* (Akron, 1892).

AK-SHEHR (anc. *Philomelion*), a town in Asia Minor, in the Konia vilayet, situated at the edge of a fertile plain, on the north side of the Sultan Dagh. Philomelion was probably a Pergamenian foundation on the great Graeco-Roman highway from Ephesus to the east, and to its townsmen the Smyrniotes wrote the letter that describes the martyrdom of Polycarp. Cicero, on his way to Cilicia, dated some of his extant correspondence there; and the place played a considerable part in the frontier wars between the Byzantine emperors and the sultanate of Rum. It became an important Seljuk town, and late in the 14th century passed into Ottoman hands. There Bayezid Yilderim is said by Ali of Yezd to have died after his defeat at Angora. The place still enjoys much repute among Turks, as the burial-place of Nur-ed-din Khoja. The town has a station on the Anatolian railway, about 60 m. from Afium-Kara-Hissar and 100 m. from Konia.

AKSU (White Water), a town of the Chinese empire, Eastern Turkestan, in 41° 7′ N. and 79° 7′ E. of Uch-Turfan and 270 m. N.E. of Yarkand, near the left bank of the Aksu river, which takes its origin in the T'ien-shan (Tian-shan) mountains and joins the Tarim. It belongs to the series of oases (Uch-Turfan, Bai, Koucha, &c.) situated at the southern foot of the eastern T'ien-shan mountains. The town, which is supposed to have about 6000 houses, is enclosed by a wall. It is an important centre for caravan routes and has a considerable trade. There are some cotton manufactures; and the place is celebrated for its richly ornamented saddlery made from deerskin. A Chinese garrison is stationed here, and copper and iron are wrought in the neighbourhood by exiled Chinese criminals. Extensive cattle-breeding is carried on by the inhabitants.

AKYAB, a city and district in the Arakan division of Burma. The city is situated at the confluence of the three large rivers Myu, Koladaing and Lemyu, and is the most flourishing city in the Arakan division. Originally it was a mere fishing village, but when the British government in 1826 removed the restrictions on trade imposed by the Burmese, Akyab quickly grew into an important seat of maritime commerce. After the cession of Arakan by the treaty of Yandaboo in that year the old capital of Myohaung was abandoned as the seat of government, and Akyab on the sea-coast selected instead. During the first forty years of British rule it increased from a village to a town of 15,536 inhabitants, and now it is the third port of Burma, with a population in 1901 of 31,687. It contains the usual public buildings and several large rice mills. The chief exports are rice and oil.

The district lies along the north-eastern shores of the Bay of Bengal, with an area of 5136 sq. m. and a population in 1901 of 481,666. It forms the northernmost district of Lower Burma, and consists of the level tract lying between the sea and the Arakan Yoma mountains, and of the broken country formed by a portion of their western spurs and valleys. The forests form a most important feature of Akyab district and contain a valuable supply of timber of many kinds. The central part of the district consists of three fertile valleys, watered by the Myu, Koladaing and Lemyu. These rivers approach each other at their mouths, and form a vast network of tidal channels, creeks and islands. Their alluvial valleys yield inexhaustible supplies of rice, which the abundant water carriage brings down to the port of Akyab at a very cheap rate. The four chief towns are Khumgchu in the extreme north-east of the district; Koladaing in the centre; Arakan, farther down the rivers; and Akyab on the coast, where their mouths converge. This district passed into the hands of the British, together with the rest of Arakan division, at the close of the first Burmese war of 1825–1826.

Akyab was the metropolitan province of the native kingdom of Arakan, and the history of that country centres in it. In 1871 the frontier or hill tracts of the district were placed under a special administration, with a view to the better government of the wild tribes which inhabit them. (J. G. Sc.)

ALA (from Lat. *ala*, a wing), a word used technically by analogy with its meaning of "wing." In physiology, it means any wing-like process, such as one of the lateral cartilages of the nose. In botany, one of the side petals of a papilionaceous corolla, &c. In architecture, a side apartment or recess of a Roman house (the origin of "aisle").

ALABAMA, a southern state of the American Union, situated between 84° 51′ and 88° 31′ W. long. and about 30° 13′ and 35° N. lat., bounded N. by Tennessee, E. by Georgia, S. by Florida and the Gulf of Mexico, and W. by Mississippi. Its total area is 51,998 sq. m., of which 719 are water surface.

Physical Features.—The surface of Alabama in the N. and N.E., embracing about two-fifths of its area, is diversified and picturesque; the remaining portion is occupied by a gently undulating plain having a general incline south-westward toward the Mississippi and the Gulf. Extending entirely across the state of Alabama for about 20 m. S. of its N. boundary, and in the middle stretching 60 m. farther S., is the Cumberland Plateau, or Tennessee Valley region, broken into broad table-lands by the dissection of rivers. In the N. part of this plateau, W. of Jackson county, there are about 1000 sq. m. of level highlands from 700 to 800 ft. above the sea. South of these highlands, occupying a narrow strip on each side of the Tennessee river, is a delightful country of gentle rolling lowlands varying in elevation from 500 to 800 ft. To the N.E. of these highlands and lowlands is a rugged section with steep mountain-sides, deep narrow coves and valleys, and flat mountain-tops. Its elevations range from 400 to 1800 ft. In the remainder of this region, the S. portion, the most prominent feature is Little Mountain, extending about 80 m. from E. to W. between two valleys, and rising precipitously on the N. side 500 ft. above them or 1000 ft. above the sea. Adjoining the Cumberland Plateau region on the S.E. is the Appalachian Valley (locally known as Coosa Valley) region, which is the S. extremity of the great Appalachian Mountain system, and occupies an area within the state of about 8000 sq. m. This is a limestone belt with parallel hard rock ridges left standing by erosion to form mountains. Although the general direction of the mountains, ridges and valleys is N.E. and S.W., irregularity is one of the most prominent characteristics. In the N.E. are several flat-topped mountains, of which Raccoon and Lookout are the most prominent, having a maximum elevation near the Georgia line of little more than 1800 ft. and gradually decreasing in height toward the S.W., where Sand Mountain is a continuation of Raccoon. South of these the mountains are marked by steep N.W. sides, sharp crests and gently sloping S.E. sides. South-east of the Appalachian Valley region, the Piedmont Plateau also crosses the Alabama border from the N.E. and occupies a small triangular-shaped section of which Randolph and Clay counties, together with the N. part of Tallapoosa and Chambers, form the principal portion. Its surface is gently undulating and has an elevation of about 1000 ft. above the sea. The Piedmont Plateau is a lowland worn down by erosion on hard crystalline rocks, then uplifted to form a plateau. The remainder of the state is occupied by the coastal plain. This is crossed by foot-hills and rolling prairies in the central part of the state, where it has a mean elevation of about 600 ft., becomes lower and more level toward the S.W., and in the extreme S. is flat and but slightly elevated above the sea. The Cumberland Plateau region is drained to the W.N.W. by the Tennessee river and its tributaries; all other parts of the state are drained to the S.W. In the Appalachian Valley region the Coosa is the principal river; and in the Piedmont Plateau, the Tallapoosa. In the Coastal Plain are the Tombigbee in the W., the Alabama (formed by the Coosa and Tallapoosa) in the W. central, and in the E. the Chattahoochee, which forms almost half of the Georgia boundary. The Tombigbee and Alabama unite near the S.W. corner of the state, their waters discharging into Mobile Bay by the Mobile and Tensas rivers. The Black Warrior is a considerable stream which joins the Tombigbee from the E. The valleys in the N. and N.E. are usually deep and narrow, but in the Coastal Plain they are broad and in most cases rise in three successive terraces above the stream. The harbour of Mobile was formed by the drowning of the lower part of the valley of the Alabama and Tombigbee rivers as a result of the sinking of the land here, such sinking having occurred on other parts of the Gulf coast.

The fauna and flora of Alabama are similar to those of the Gulf states in general and have no distinctive characteristics.

Climate and Soil.—The climate of Alabama is temperate and fairly uniform. The heat of summer is tempered in the S. by the winds from the Gulf of Mexico, and in the N. by the elevation above the sea. The average annual temperature is highest in the S.W. along the coast, and lowest in the N.E. among the highlands. Thus at Mobile the annual mean is 67° F., the mean for the summer 81°, and for the winter 52°; and at Valley Head, in De Kalb county, the annual mean is 59°, the mean for the summer 75°, and for the winter 41°. At Montgomery, in the central region, the average annual temperature is 66°, with a winter average of 49°, and a summer average of 81°. The average winter minimum for the entire state is 35°, and there is an average of 35 days in each year in which the thermometer falls below the freezing-point. At extremely rare intervals the thermometer has fallen below zero, as was the case in the remarkable cold wave of the 12th–13th of February 1899, when an absolute minimum of 17° was registered at Valley Head. The highest temperature ever recorded was 109° in Talladega county in 1902. The amount of precipitation is greatest along the coast (62 in.) and evenly distributed through the rest of the state (about 52 in.). During each winter there is usually one fall of snow in the S. and two in the N.; but the snow quickly disappears, and sometimes, during an entire winter, the ground is not covered with snow. Hail-storms occur in the spring and summer, but are seldom destructive. Heavy fogs are rare, and are confined chiefly to the coast. Thunderstorms occur throughout the year, but are most common in the summer. The prevailing winds are from the S. As regards its soil, Alabama may be divided into four regions. Extending from the Gulf northward for one hundred and fifty miles is the outer belt of the Coastal Plain, also called the "Timber Belt," whose soil is sandy and poor, but responds well to fertilization. North of this is the inner lowland of the Coastal Plain, or the "Black Prairie," which includes some 13,000 sq. m. and seventeen counties. It receives its name from its soil (weathered from the weak underlying limestone), which is black in colour, almost destitute of sand and loam, and rich in limestone and marl formations, especially adapted to the production of cotton; hence the region is also called the "Cotton Belt." Between the "Cotton Belt" and the Tennessee Valley is the mineral region, the "Old Land" area—"a region of resistant rocks"—whose soils, also derived from weathering *in situ*, are of varied fertility, the best coming from the granites, sandstones and limestones, the poorest from the gneisses, schists and slates. North of the mineral region is the "Cereal Belt," embracing the Tennessee Valley and the counties beyond, whose richest soils are the red clays and dark loams of the river valley; north of which are less fertile soils, produced by siliceous and sandstone formations.

Agriculture.—Agriculture is the principal occupation in Alabama, giving employment to 64·5% of the population. The farm acreage in 1900 was 20,685,427 acres (62% of the entire surface of the state), of which 8,654,991 acres (41·8%) were improved. Under the system of slave labour which existed before 1860, the average size of the plantations tended to increase, but since 1860 the reverse has been true, the average plantation in 1860 being 346 acres, and in 1900 92·7 acres. The average value per acre of farm land was $11·86 in 1860 and $8·67 in 1900. As to method of cultivation, 36·3 per cent of the farms were in 1900 managed by the owners, 33·3% by cash renters, 24·4% by share tenants, and the remaining 6% by other methods. The chief product is cotton, cultivated extensively in the "Black Belt" and less extensively in the other portions of the state. Cotton has always been the principal source of wealth, the amount of its exports at Mobile increasing from 7000 bales in 1818 to 25,000 bales in 1821, and the total product of the state in 1840 being double that of 1830. This was accompanied by an extensive employment of slave labour, and from 1820 until 1860 the rate of increase of the blacks was greater than that of the whites. The success of the economic system was such that in 1860 the cotton crop of Alabama was nearly 1,000,000 bales (989,955 bales), being 18·4% of the entire cotton product of the United States. The disorganization of labour resulting from the

Civil War and the emancipation of slaves, was the cause of a temporary decline in the cotton crop. In 1889 the crop again approximated to 1,000,000 bales (915,210 bales, being 12·2% of the entire crop of the United States), and in 1899 it exceeded that amount, Alabama being fourth among the states of the entire country. The total value of the farm products of Alabama in 1899 was $91,387,409; in 1889, $66,240,190; and in 1879, $56,872,994. The average yield per acre has also increased under the system of free labour. In recent years there has been a tendency to diversify crops, Indian corn, wheat and oats being raised extensively in the "Cereal Belt." In 1906, according to the *Year-Book* of the Department of Agriculture, the following were the acreages, yields and values of Alabama's more important crops (excepting cotton):—Indian corn, 2,990,387 acres, 47,840,392 bushels, $30,623,611; wheat, 98,639 acres, 1,085,029 bushels, $1,019,927; oats, 184,179 acres, 3,167,879 bushels, $1,615,618; hay, 56,350 acres, 109,882 tons, $1,461,431.

Minerals.—The chief feature of Alabama's industrial life since 1880 has been the exploitation of her iron and coal resources. The iron ore (found chiefly in the region of which Birmingham is the centre) is primarily red haematite and (much less important) brown haematite; though as regards the latter Alabama ranked first among the states of the Union in 1905 (with 781,561 tons). The total production of all classes of iron ores was 3,782,831 tons in 1905, Alabama ranking third in the Union in this respect. The production of bituminous coal has also increased very rapidly. Coal was first discovered in the state in 1834, and in 1840 the total production was 946 tons; in 1870 it was 13,200 short tons. The real development of the mines began in 1881 and 1882, and the product increased from 420,000 tons in 1881 to 1,568,000 in 1883. By 1890 it had increased to 4,090,409 tons, by 1900 to 8,394,275 tons, and by 1905 to 11,866,069 tons, valued at $14,387,721, making Alabama sixth of the coal-producing states. Nearly 85 % of the coal is produced in three counties (Jefferson, Walker and Bibb), though the coal-bearing formations cover about 40 % of the northern half of the state. Gold, silver, lead, copper, tin and bauxite have also been discovered, but the greater richness of the iron and coal deposits has prevented their development.

Manufactures.—The growth of manufactures in Alabama has been as remarkable as the revelation of mineral wealth. In 1880 the capital invested in manufactures was $9,668,008, little more than that ($9,098,181) in 1860; by 1890 it had increased to $46,122,571, or 377·1 %; and in 1900 it amounted to $70,370,081, or 52·6 % more than in 1890.[1] On account of the proximity of coal, iron and limestone, the manufactures of iron and steel are the most extensive. In 1895 it was demonstrated that Alabama pig-iron could be sent to Liverpool and sold cheaper than the English product, and Birmingham (Alabama) came consequently to rank next to Middlesborough and Glasgow among the world centres of the pig-iron trade. The pig-iron produced in the state in 1860 was valued at $64,590, in 1870 at $210,258, in 1880 at $1,405,356, in 1900 at $13,487,769, and in 1905 at $16,614,577. In the production of foundry pig-iron Alabama held first rank both in 1900 and in 1905. The manufacture of steel, though in its infancy, gave promise of equalling that of iron, and the coke industry is also of growing importance, the product of Alabama during the five years from 1896 to 1901 showing a greater increase, relatively, than that of the other states. In 1900 the state ranked sixth and in 1905 fifth among the states of the United States in the manufactures of iron and steel. In 1905 the value of the product was 2·7 % of the value of the total iron and steel product of the country, and 22·6 % of the value of all the state's factory products. In 1900 and in 1905 Alabama ranked second among the states of the Union in the production of coke, its product being more than one-tenth of that for the whole country, and more than one-twentieth (5·2 % in 1900; 5·7 % in 1905) of all the factory products of the state. The demand for coke is due to the rapidly growing iron and steel industry. Great possibilities were also shown for the production of lumber and naval stores. Approximately three-fourths of the total area of the state is woodland. In the "Timber Belt" the forests of long leaf pine have an estimated stand of 21,192 million ft.; and in 1905 the product of sawed lumber was valued at $13,563,815. Of this, yellow pine represented $11,320,909, oak $886,746, and poplar $627,666. In the decade 1890–1900 the number of turpentine factories increased from 7 to 152, and their product in 1900 and in 1905 ranked Alabama third among the states in that industry. The value of the turpentine and rosin products in 1905 was $2,434,365.

The manufacture of cotton goods has also developed rapidly. As late as 1890 there were only 13 cotton mills in Alabama, one more than the number in 1850; in 1900 there were 31, representing a capital of $11,638,757 and an annual product valued at $8,153,136, an increase of 272·2 % over the product ($2,190,771) of 1890; in 1905 there were 46 establishments, representing a capital of $24,758,049 (an increase of 112·7 % over that of 1900), and having a product (for the year) of $16,760,332, an increase of 105·6 % over that for 1900. To encourage the establishment of cotton mills the legislature of 1896–1897 exempted from taxation during the succeeding ten years all capital that should be invested in the manufacture of cotton, provided that $50,000 or more be invested in buildings and machinery. Other industries of less importance are flour, fertilizers and tanned leather.

Communications.—The navigable mileage of the Alabama rivers is 2000 m., but obstructions often prevent the formation of a continuous route, notably the "Muscle Shoals" of the Tennessee, extending from a point 10 m. below Decatur to Florence, a distance of 38 m. To remove or circumvent these impediments, and to improve the Mobile harbour, the United States government spent, between 1870 and 1904, approximately $12,000,000. As the streams in the mineral region are not navigable, the railways are the carriers of its products.[2] Here all the large systems of the southern states find an entrance, the Mobile & Ohio, the Southern (Queen & Crescent Route), the Louisville & Nashville, and the 'Frisco system affording communication with the Mississippi and the west, and the Southern, Seaboard Air Line, Atlantic Coast Line, and the Central of Georgia forming connexions with northern and Atlantic states. Mobile, the only seaport of the state, has a channel 30 ft. deep, on which the national government spends large sums of money; yet an increasing amount of Alabama cotton is sent to New Orleans for shipment, and Pensacola, Florida, receives much of the lumber.

Population.—In 1880 the inhabitants of Alabama numbered 1,262,505; in 1890, 1,513,017, an increase of 17 %; in 1900, 1,828,697, a further increase of 20 %. This population is notable for its large proportion of negroes (45·23 %), its insignificant foreign element (·08 %), and the small percentage of urban inhabitants (10 %). As regards church membership, the Baptists are much the most numerous, followed by the Methodists, the Roman Catholics and the Presbyterians. In 1900 there were 201 incorporated cities, towns and villages in the state, but of these only nine had a population in excess of 5000, and only three a population in excess of 25,000. These three were Mobile (38,469), Birmingham (38,415), and Montgomery (30,346), the capital of the state. Other important cities, with their populations, were Selma (8713), Anniston (9695), Huntsville (8068), Bessemer (6358), Tuscaloosa (5094), Talladega (5056), Eufaula (4532) and Tuskegee (2170). In 1910 the population was 2,138,093.

Government.—Alabama has been governed under five constitutions, the original constitution of 1819, the revision of 1865, the constitutions of 1868 and 1875, and the present constitution, which was framed in 1901. The last has a number of notable provisions. It lengthened the term of service of executive and legislative officials from two to four years, made that of the

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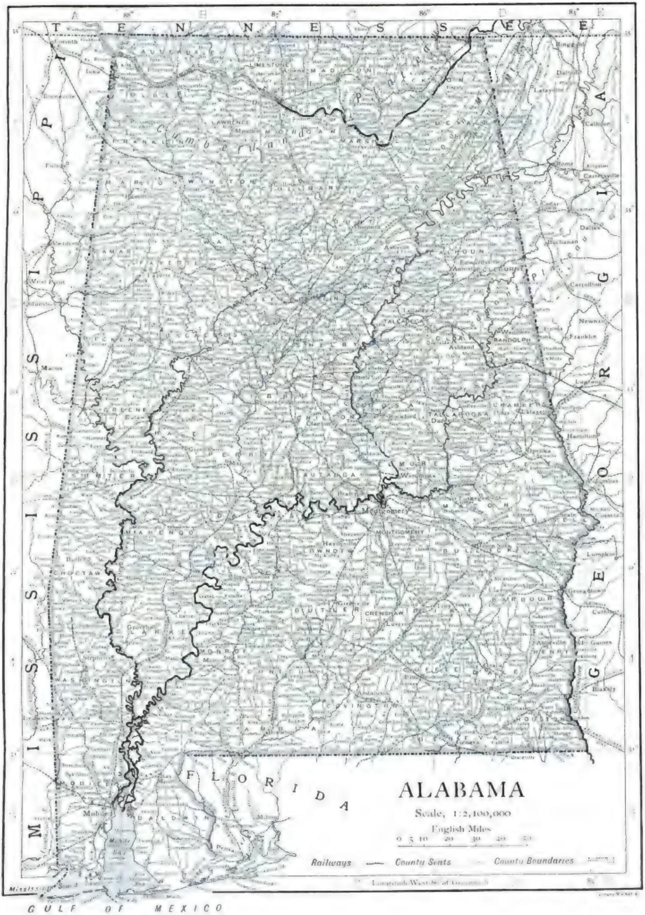
[1] The special census of manufactures taken in 1905 was confined to manufacturing establishments conducted under the so-called "factory system." According to this census the capital invested was $105,382,859, and the value of products was $109,169,922. The corresponding figures for 1900, if the same standard be taken for purposes of comparison, would be $60,165,904 and $72,109,929. During the five years, therefore, the capital invested in establishments under the factory system increased 75·2 %, and the value of products 51·4 %.

[2] The railway mileage of the state on the 31st of December 1906 was 4805·58 m.


ALABAMA
Scale, 1:2,100,000
English Miles
0 5 10 20 30 40 50
Railways
County Seats
County Boundaries
TENNESSEE
MISSISSIPPI
GEORGIA
FLORIDA
GULF OF MEXICO
Mississippi Sound
Mobile Bay
Longitude West 88° of Greenwich
88°
87°
86°
85°
A
B
C
D
E
LAUDERDALE
LIMESTONE
MADISON
JACKSON
COLBERT
LAWRENCE
MORGAN
MARSHALL
DE KALB
FRANKLIN
MARION
WINSTON
CULLMAN
ETOWAH
BLOUNT
LAMAR
FAYETTE
WALKER
ST. CLAIR
CALHOUN
CLEBURNE
JEFFERSON
TALLADEGA
CLAY
RANDOLPH
PICKENS
TUSCALOOSA
SHELBY
COOSA
TALLAPOOSA
CHAMBERS
GREENE
HALE
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CHILTON
ELMORE
LEE
SUMTER
PERRY
AUTAUGA
MACON
RUSSELL
MARENGO
DALLAS
LOWNDES
MONTGOMERY
BULLOCK
CHOCTAW
WILCOX
BUTLER
CRENSHAW
PIKE
BARBOUR
CLARKE
MONROE
CONECUH
COFFEE
DALE
HENRY
WASHINGTON
ESCAMBIA
COVINGTON
GENEVA
HOUSTON
MOBILE
BALDWIN
Cumberland
Plateau
Mobile
Montgomery
Huntsville
Athens
Decatur
Tuscumbia
Hamilton
Oneonta
Ashville
Anniston
Edwardsville
Ashland
Talladega
Dadeville
Rockford
Wetumpka
Opelika
Clanton
Marion
Eutaw
Greensboro
Livingston
Hayneville
Greenville
Luverne
Troy
Union Springs
Abbeville
Andalusia
Geneva
Grove Hill
Butler
Clayton
Eufaula
Corinth
Iuka
Fulton
Columbus
West Point
Macon
Aberdeen
Ringgold
Dalton
Lafayette
Calhoun
Rome
Cartersville
Cedartown
Dallas
Buchanan
Carrollton
Newnan
Franklin
La Grange
Hamilton
Columbus
Cuthbert
Georgetown
Fort Gaines
Blakely
Lumpkin
Bainbridge

judiciary six years, provided for quadrennial sessions of the legislature, and introduced the office of lieutenant-governor. The passage of local or special bills by the legislature was prohibited. A provision intended to prevent lobbying is that no one except legislators and the representatives of the press may be admitted to the floor of the House except by unanimous vote. No executive official can succeed himself in office, and the governor cannot be elected or appointed to the United States Senate, or to any state office during his term as governor, or within one year thereafter. Sheriffs whose prisoners suffer mob violence may be impeached. The constitution eliminated the negro from politics by a suffrage clause which went into effect in 1903. This limits the right to vote to those who can read and write any article of the constitution of the United States, and have worked or been regularly engaged in some lawful employment, business or occupation, trade or calling for the greater part of the twelve months next preceding the time they offer to register, unless prevented from labour or ability to read and write by physical disability, or who own property assessed at $300 upon which the taxes have been paid; but those who have served in the army or navy of the United States or of the Confederate States in time of war, their lawful descendants in every degree, and persons of good character "who understand the duties and obligations of citizenship under a republican form of government," are relieved from the operation of this law provided they registered prior to the 20th of December 1902. The second of these exceptions is known as the "Grandfather Clause." No man may vote in any election who has not by the 1st of February next preceding that election paid all poll taxes due from him to the state. In 1902 nine-tenths of the negroes in the state were disqualified from voting.[1] The constitution of 1901 (like that of 1867) and special statutes require separate schools for white and negro children. A "Jim Crow" law was enacted in 1891. Buying, selling or offering to buy or sell a vote has for penalty disfranchisement, and since 1891 the Australian ballot system has been used. The governor, auditor and attorney-general are required to prepare and present to each legislature a general revenue bill, and the secretary of state, with the last two officers, constitute a board of pardons who make recommendations to the governor, who, however, is not bound to follow their advice in the exercise of his pardoning power. State officials are forbidden to accept railway passes from railway companies, and individuals are forbidden to receive freight rebates. The constitution of 1901 exempted a homestead of 80 acres of farm land, or of a house and lot not exceeding $2000 in value, from liability for any debt contracted since the 30th of July 1868 except for a mortage on it to which the wife consented; personal property to the value of $1000 is exempted. Under the civil code of 1897 the earnings of a wife are her separate property, and it is provided that "no woman, nor any boy under age of twelve years, shall be employed to work or labour in or about any mine in this state." By acts of 1903 child labour under 12 years is forbidden in any factory unless for support of "a widowed mother or aged or disabled father," or unless the child is an indigent orphan; "no child under the age of ten years shall be so employed under any circumstances." Certificates of children's ages are necessary before a child is employed; false certification is forbidden under penalty of a fine of from $5 to $100 or hard labour not exceeding three months. No child under 13 may do night work at all. No child under 16 may do more than 48 hours a week of night work. No child of less than 12 is allowed to work more than 66 hours in any one week. An able-bodied parent who does not work when he has the opportunity, unless "idle under strike orders, or lock-outs," and who hires out his minor children, is declared a vagrant and may be fined $500 and imprisoned or sentenced to hard labour for not more than six months.

All amendments to the constitution must be approved by a three-fifths vote of each house of the legislature and then ratified by the people. The legislature of 1900–1901 established a department of archives and history whose aim is to preserve documents and historical records.

Education.—Public education for Mobile was authorized by the legislature of 1826, but it was not provided until 1852. Two years later (1854) a school system for the entire state was inaugurated. Its support was derived from public land given by the United States to the state of Alabama for educational purposes in 1819, and special taxes or tuition fixed by each township. The Civil War demoralized the nascent system. An important step in its revival seemed to be made in the constitution of 1868, which forbade any private recompense for instruction in the public schools and appropriated one-fifth of the state's revenue to common schools. But the attempt to teach whites and blacks in the same schools, and the corruption in the administration of funds, made the results unsatisfactory. The constitution of 1875 abolished the one-fifth revenue provision, made the support of the schools, except that derived from the land grant of 1819, and poll taxes, depend upon the appropriation of the legislature, and established separate schools for whites and blacks. Progress has been slow but steady. According to the constitution of 1901 the legislature is required to levy, in addition to the poll tax, an annual tax for education at the rate of 30 to 65 cents on the hundred dollars' worth of property, and practically every county in the state had made in 1906 an appropriation for its schools of a one mill tax on $100. The school fund in 1900 amounted to $1,000,000, an increase of 37 % over the average annual fund of the preceding decade; for the year ending the 30th of September 1907 the amount certified for apportionment by the state was $1,150,261·40, and the total annual expenditure was about $1,600,000; in 1906 the school census showed 697,465 children of school age. The legislature of 1907 voted an increase of $300,000 in the appropriation for the common school fund, and granted state-aid for rural school-houses; but its most important work probably was the establishment of county high schools. The rural schools have an annual term of five to seven months only. The percentage of illiterates declined from 50·97 % in 1880 to 41 % in 1890, and 34 % in 1900, when Alabama ranked third among the states in illiteracy.

There are also a number of institutions for higher education in Alabama. The most important of these are the university of Alabama (co-educational—opened in 1831), at Tuscaloosa, the institution being part of the public school system maintained by the state; the Alabama Polytechnic Institute at Auburn, a "state college for the benefit of agriculture and the mechanic arts," organized in 1872 according to the United States land grant act for the promotion of industrial education; the Southern University (incorporated 1856—Methodist Episcopal, South), at Greensboro; Howard College (Baptist), at East Lake (Birmingham); Spring Hill College (1830—Roman Catholic), near Mobile; Talladega College (for negroes), at Talladega; the Tuskegee Normal and Industrial Institute (for negroes), at Tuskegee; and state normal schools at Florence, Jacksonville, Troy and Livingston, and, for negroes, at Montgomery, Tuskegee and Normal.

Public Institutions.—Alabama supports various philanthropic and penal institutions: a home for Confederate veterans, at Mountain Creek; an institution for the deaf, an academy for the blind, and a school for the negro deaf, dumb and blind, all at Talladega; a hospital for the insane, opened in 1860, at Tuscaloosa; a penitentiary, established in 1839, at Wetumpka; and a state industrial school for white boys, at East Lake (Birmingham), and a state industrial school for white girls at Montevallo.

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[1] In Giles *v.* Harris, 189 U.S. 474, a negro asked that the defendant board of registry be required to enrol his name and the names of other negroes on the registration lists, and that certain sections of the constitution of Alabama be declared void as being contrary to the fourteenth and fifteenth amendments to the federal constitution. The Supreme Court dismissed the bill on the grounds that equity has no jurisdiction over political matters; that, assuming the fraudulent character of the objectionable constitutional provisions, the court was in effect asked to assist in administering a fraud; and that relief "must be given by them [the people of the state] or by the legislative and political departments of the government of the United States." The case attracted much attention; and it is often erroneously said that the court upheld the disfranchising clauses of the Alabama constitution.

These institutions are managed by trustees who are appointed by the governor. In addition to the usual method of employing convicts in the penitentiary or on state farms, Alabama, like other southern states, also hires its convicts to labour for private individuals. Reports of abuses under this system caused the legislature in 1901 to order a special investigation, the results of which led in 1903 to a new system of leasing to contractors, whereby the prisoners are kept under the direct supervision of state officials. In this same year a system of peonage that had grown up in the state attracted wide attention, and a Federal grand jury at a single term of court indicted a number of men for holding persons as "peons." Many similar cases were found later in other southern states, but those in Alabama being the first discovered attracted the most attention. The system came into existence in isolated communities through the connivance of justices of the peace with white farmers. The justices have jurisdiction over petty offences, of which negroes are usually the guilty parties, and the fines imposed would sometimes be paid by a white farmer, who would thus save the accused from imprisonment, but at the same time would require him to sign a contract to repay by his labour the sum advanced. By various devices the labourer would then be kept constantly in debt to his employer and be held in involuntary servitude for an indefinite time. The "peons" as a rule were negroes, but a few white ones were found; and in several instances negroes were found holding members of their own race in peonage. A law forbidding under severe penalties a labourer from hiring himself to a second employer without giving notice of a prior contract, and an employer from hiring a labourer known by him to be bound by such a contract, had aided in the development of the system, though it had been enacted for a different purpose. The Federal authorities, as soon as the existence of peonage became known, took active measures to stamp it out, and were supported by the press and by the leading citizens of the state. Up to 1907 the state licensed the sale of liquor, and liquor licence fees were partly turned over to the public school fund; there was a dispensary system in some counties; and in 1907 one-third of the counties of the state (22 out of 67) were "dry." Besides, saloons had been forbidden within 5 m. of certain churches and school-houses, so that liquor was sold scarcely at all except in incorporated towns, where in many cases local dispensaries were established. In the 1907 state legislature a county local option bill was passed in February, and immediately afterward the Sherrod anti-shipping bill was enacted forbidding the acceptance of liquors for shipment, transportation or delivery to prohibition districts, and penalising the soliciting of orders for liquor in "dry" districts with a punishment of $500 fine and six months' imprisonment with hard labour. In a special session of the legislature in November 1907 a law was passed forbidding the sale of liquor within the state, this prohibition to come into effect on the 1st of January 1909.

Finance.—One-half of the income of the state is derived from general taxes, the other sources of revenue being licences, a special school tax, poll tax and the lease of the convicts. The state debt, for which legislative corruption in the years 1868–1872 was largely responsible, amounted on the 1st of October 1906 to $9,057,000. Measures for its refunding, but not for its extinction, have been taken. The constitution of 1901 prohibits the increase of the debt for any other purposes than the suppression of insurrection or resistance to invasion, and the assumption of corporate debts by cities and towns is also restricted. All banks, except national banks, are subject to examination by a public official, and their charters expire within twenty years of their issue.

History.—The first Europeans to enter the limits of the present state of Alabama were Spaniards, who claimed this region as a part of Florida. It is possible that a member of Panfilo de Narvaez's expedition of 1528 entered what is now southern Alabama, but the first fully authenticated visit was that of Hernando de Soto, who made an arduous but fruitless journey along the Coosa, Alabama and Tombigbee rivers in 1539. The English, too, claimed the region north of the Gulf of Mexico, and the territory of modern Alabama was included in the province of Carolina, granted by Charles II. to certain of his favourites by the charters of 1663 and 1665. English traders of Carolina were frequenting the valley of the Alabama river as early as 1687. Disregarding these claims, however, the French in 1702 settled on the Mobile river and there erected Fort Louis, which for the next nine years was the seat of government of Louisiana. In 1711 Fort Louis was abandoned to the floods of the river, and on higher ground was built Fort Condé, the germ of the present city of Mobile, and the first permanent white settlement in Alabama. Later, on account of the intrigues of the English traders with the Indians, the French as a means of defence established the military posts of Fort Toulouse, near the junction of the Coosa and Tallapoosa rivers, and Fort Tombecbé on the Tombigbee river. The grant of Georgia to Oglethorpe and his associates in 1732 included a portion of what is now northern Alabama, and in 1739 Oglethorpe himself visited the Creek Indians west of the Chattahoochee river and made a treaty with them. The peace of Paris, in 1763, terminated the French occupation, and England came into undisputed possession of the region between the Chattahoochee and the Mississippi. The portion of Alabama below the 31st parallel then became a part of West Florida, and the portion north of this line a part of the "Illinois country," set apart, by royal proclamation, for the use of the Indians. In 1767 the province of West Florida was extended northward to 32° 28′ N. lat., and a few years later, during the War for Independence, this region fell into the hands of Spain. By the treaty of Versailles, on the 3rd of September 1783, England ceded West Florida to Spain; but by the treaty of Paris, signed the same day, she ceded to the United States all of this province north of 31°, and thus laid the foundation for a long controversy. By the treaty of Madrid, in 1795, Spain ceded to the United States her claims to the lands east of the Mississippi between 31° and 32° 28′; and three years later (1798) this district was organized by Congress as the Mississippi Territory. A strip of land 12 or 14 m. wide near the present northern boundary of Alabama and Mississippi was claimed by South Carolina; but in 1787 that state ceded this claim to the general government. Georgia likewise claimed all the lands between the 31st and 35th parallels from its present western boundary to the Mississippi river, and did not surrender its claim until 1802; two years later the boundaries of the Mississippi Territory were extended so as to include all of the Georgia cession. In 1812 Congress annexed to the Mississippi Territory the Mobile District of West Florida, claiming that it was included in the Louisiana Purchase; and in the following year General James Wilkinson occupied this district with a military force, the Spanish commandant offering no resistance. The whole area of the present state of Alabama then for the first time became subject to the jurisdiction of the United States. In 1817 the Mississippi Territory was divided; the western portion became the state of Mississippi, and the eastern the territory of Alabama, with St Stephens, on the Tombigbee river, as the temporary seat of government. In 1819 Alabama was regularly admitted to the Union as a state.

One of the first problems of the new commonwealth was that of finance. Since the amount of money in circulation was not sufficient to meet the demands of the increasing population, a system of state banks was instituted. State bonds were issued and public lands were sold to secure capital, and the notes of the banks, loaned on security, became a medium of exchange. Prospects of an income from the banks led the legislature of 1836 to abolish all taxation for state purposes. This was hardly done, however, before the panic of 1837 wiped out a large portion of the banks' assets; next came revelations of grossly careless and even of corrupt management, and in 1843 the banks were placed in liquidation. After disposing of all their available assets, the state assumed the remaining liabilities, for which it had pledged its faith and credit, and these form a part ($3,445,000) of its present indebtedness.

The Indian problem was important. With the encroachment of the white settlers upon their hunting-grounds the Creek

Indians began to grow restless, and the great Shawnee chief Tecumseh, who visited them in 1811, fomented their discontent. When the outbreak of the second war with Great Britain in 1812 gave the Creeks assurance of British aid they rose in arms, massacred several hundred settlers who had taken refuge in Fort Mims, near the junction of the Alabama and Tombigbee rivers, and in a short time no white family in the Creek country was safe outside a palisade. The Chickasaw and Choctaw Indians, however, remained the faithful allies of the whites, and volunteers from Georgia, South Carolina and Tennessee, and later United States troops, marched to the rescue of the threatened settlements. In the campaign that followed the most distinguished services were rendered by General Andrew Jackson, whose vigorous measures broke for ever the power of the Creek Confederacy. By the treaty of Fort Jackson (9th of August 1814) the Creeks ceded their claims to about one-half of the present state; and cessions by the Cherokees, Chickasaws and Choctaws in 1816 left only about one-fourth of Alabama to the Indians. In 1832 the national government provided for the removal of the Creeks; but before the terms of the contract were effected, the state legislature formed the Indian lands into counties, and settlers flocked in. This caused a disagreement between Alabama and the United States authorities; although it was amicably settled, it engendered a feeling that the policy of the national government might not be in harmony with the interests of the state—a feeling which, intensified by the slavery agitation, did much to cause secession in 1861.

The political history of Alabama may be divided into three periods, that prior to 1860, the years from 1860 to 1876, and the period from 1876 onwards.

The first of these is the only period of altogether healthy political life. Until 1832 there was only one party in the state, the Democratic, but the question of nullification caused a division that year into the (Jackson) Democratic party and the State's Rights (Calhoun Democratic) party; about the same time, also, there arose, chiefly in those counties where the proportion of slaves to freemen was greater and the freemen were most aristocratic, the Whig party. For some time the Whigs were nearly as numerous as the Democrats, but they never secured control of the state government. The State's Rights men were in a minority; nevertheless under their active and persistent leader, William L. Yancey (1814–1863), they prevailed upon the Democrats in 1848 to adopt their most radical views. During the agitation over the introduction of slavery into the territory acquired from Mexico, Yancey induced the Democratic State Convention of 1848 to adopt what is known as the "Alabama Platform," which declared in substance that neither Congress nor the government of a territory had the right to interfere with slavery in a territory, that those who held opposite views were not Democrats, and that the Democrats of Alabama would not support a candidate for the presidency if he did not agree with them on these questions. This platform was endorsed by conventions in Florida and Virginia and by the legislatures of Georgia and Alabama. Old party lines were broken by the Compromise of 1850. The State's Rights party, joined by many Democrats, founded the Southern Rights party, which demanded the repeal of the Compromise, advocated resistance to future encroachments and prepared for secession, while the Whigs, joined by the remaining Democrats, formed the party known as the "Unionists," which unwillingly accepted the Compromise and denied the "constitutional" right of secession. The "Unionists" were successful in the elections of 1851 and 1852, but the feeling of uncertainty engendered in the south by the passage of the Kansas-Nebraska Bill and the course of the slavery agitation after 1852 led the State Democratic convention of 1856 to revive the "Alabama Platform"; and when the "Alabama Platform" failed to secure the formal approval of the Democratic National convention at Charleston, South Carolina, in 1860, the Alabama delegates, followed by those of the other cotton "states," withdrew. Upon the election of Abraham Lincoln, Governor Andrew B. Moore, according to previous instructions of the legislature, called a state convention on the 7th of January 1861. After long debate this convention adopted on the 11th of January an ordinance of secession, and Alabama became one of the Confederate states of America, whose government was organized at Montgomery on the 4th of February 1861. Yet secession was opposed by many prominent men, and in North Alabama an attempt was made to organize a neutral state to be called Nickajack; but with President Lincoln's call to arms all opposition to secession ended.

In the early part of the Civil War Alabama was not the scene of military operations, yet the state contributed about 120,000 men to the Confederate service, practically all her white population capable of bearing arms, and thirty-nine of these attained the rank of general. In 1863 the Federal forces secured a foothold in northern Alabama in spite of the opposition of General Nathan B. Forrest, one of the ablest Confederate cavalry leaders. In 1864 the defences of Mobile were taken by a Federal fleet, but the city held out until April 1865; in the same month Selma also fell.

According to the presidential plan of reorganization, a provisional governor for Alabama was appointed in June 1865; a state convention met in September of the same year, and declared the ordinance of secession null and void and slavery abolished; a legislature and a governor were elected in November, the legislature was at once recognized by the National government, and the inauguration of the governor-elect was permitted after the legislature had, in December, ratified the thirteenth amendment. But the passage, by the legislature, of vagrancy and apprenticeship laws designed to control the negroes who were flocking from the plantations to the cities, and its rejection of the fourteenth amendment, so intensified the congressional hostility to the presidential plan that the Alabama senators and representatives were denied their seats in Congress. In 1867 the congressional plan of reconstruction was completed and Alabama was placed under military government. The negroes were now enrolled as voters and large numbers of white citizens were disfranchised.[1] A Black Man's Party, composed of negroes, and political adventurers known as "carpet-baggers," was formed, which co-operated with the Republican party. A constitutional convention, controlled by this element, met in November 1867, and framed a constitution which conferred suffrage on negroes and disfranchised a large class of whites. The Reconstruction Acts of Congress required every new constitution to be ratified by a majority of the legal voters of the state. The whites of Alabama therefore stayed away from the polls, and, after five days of voting, the constitution wanted 13,550 to secure a majority. Congress then enacted that a majority of the votes cast should be sufficient, and thus the constitution went into effect, the state was admitted to the Union in June 1868, and a new governor and legislature were elected.

The next two years are notable for legislative extravagance and corruption. The state endorsed railway bonds at the rate of $12,000 and $16,000 a mile until the state debt had increased from eight millions to seventeen millions of dollars, and similar corruption characterized local government. The native white people united, formed a Conservative party and elected a governor and a majority of the lower house of the legislature in 1870; but, as the new administration was largely a failure, in 1872 there was a reaction in favour of the Radicals, a local term applied to the Republican party, and affairs went from bad to worse. In 1874, however, the power of the Radicals was finally broken, the Conservative Democrats electing all state officials. A commission appointed to examine the state debt found it to be $25,503,000; by compromise it was reduced to $15,000,000. A new constitution was adopted in 1875, which omitted the guaranty of the previous constitution that no one should be denied suffrage on account of race, colour or previous condition of servitude, and forbade the state to engage in internal improvements or to give its credit to any private enterprise.

Since 1874 the Democratic party has had constant control of the state administration, the Republicans failing to make nominations for office in 1878 and 1880 and endorsing the ticket of the Greenback party in 1882. The development of mining and manufacturing was accompanied by economic distress among the farming classes, which found expression in the Jeffersonian Democratic party, organized in 1892. The regular Democratic ticket was elected and the new party was then merged into the Populist party. In 1894 the Republicans united with the Populists, elected three congressional representatives, secured control of many of the counties, but failed to carry the state, and continued their opposition with less success in the next campaigns. Partisanship became intense, and charges of corruption of the ignorant negro electorate were made. Consequently after division on the subject among the Democrats themselves, as well as opposition of Republicans and Populists, a new constitution with restrictions on suffrage was adopted in 1901.

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[1] The enrolment was 104,518 blacks and 61,295 whites.

The following is a list of the territorial and state governors of Alabama:—

	Governor of the Territory.	
William Wyatt Bibb	1817–1819	
	Governors of the State.	
William Wyatt Bibb	1819–1820	Democrat.
Thomas Bibb[1]	1820–1821	„
Israel Pickens	1821–1825	„
John Murphy	1825–1829	„
Gabriel Moore	1829–1831	„
Samuel B. Moore	1831	„
John Gayle	1831–1835	„
Clement C. Clay	1835–1837	„
Hugh M'Vay[2]	1837	„
Arthur P. Bagby	1837–1841	„
Benjamin Fitzpatrick[3]	1841–1845	„
Joshua L. Martin	1845–1847	„
Reuben Chapman	1847–1849	„
Henry W. Collier	1849–1853	„
John A. Winston	1853–1857	„
Andrew B. Moore	1857–1861	„
John Gill Shorter	1861–1863	„
Thomas H. Watts	1863–1865	„
Lewis E. Parsons	1865	Provisional Governor.
Robert M. Patton	1865–1867	Republican.
Wager Swayne	1867–1868	Military Governor.
William H. Smith	1868–1870	Republican.
Robert B. Lindsay	1870–1872	Democrat.
David P. Lewis	1872–1874	Republican.
George S. Houston	1874–1878	Democrat.
Rufus W. Cobb	1878–1882	„
Edward A. O'Neal	1882–1886	„
Thomas Seay	1886–1890	„
Thomas G. Jones	1890–1894	„
William C. Oates	1894–1896	„
Joseph F. Johnston	1896–1900	„
William J. Samford	1900–1901	„
William D. Jelks	1901–1907	„
B. B. Comer	1907	„

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Information regarding the resources, climate, population and industries of Alabama may be found in the reports of the United States Census, and in the publications of the United States Department of Agriculture, the United States Geological Survey, the Bulletins of the Alabama Agricultural Experiment Station (published at Auburn, from 1888), the Bulletins and Reports of the Alabama Geological Survey (published at Tuscaloosa and Montgomery), and in the following works:—B. F. Riley's *Alabama As It Is* (Montgomery, 1893), and Saffold Berney's *Handbook of Alabama* (2nd ed., Birmingham, 1892).

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In addition, W. G. Clark's *History of Education in Alabama* (Washington, 1889); W. E. Martin's *Internal Improvements in Alabama* (Baltimore, 1902; Johns Hopkins University Studies, series 20, No. 4); and W. L. Martin's *Code of Alabama* (2 vols., Atlanta, Ga., 1897) may be consulted.

Information concerning the aboriginal remains in the state may be found in two papers by Clarence B. Moore, "Certain Aboriginal Remains of the Tombigbee River" and "Certain Aboriginal Remains of the Alabama River," published in the *Journal of the Academy of Natural Sciences*, series 2, vol. ii. (Philadelphia, 1900).

"ALABAMA" ARBITRATION.—This is one of those arbitrations on pecuniary claims, made by one state, on behalf of its subjects, against another state, which are referred to in the article ARBITRATION, INTERNATIONAL. The case is important, both from a historical and a juridical point of view, and affords a conspicuous example of the value of arbitration as a means of averting war. The facts are as follows:—

In 1861 the Southern States of North America seceded from the rest on the slavery question and set up a separate government under President Jefferson Davis. Hostilities began with the capture of Fort Sumter by the Confederates on the 13th of April 1861. On the 19th of April President Abraham Lincoln declared a blockade of the southern ports. On the 14th of May the British government issued a proclamation of neutrality, by which the Confederates were recognized as belligerents. This example was followed shortly afterwards by France and other nations. The blockade of the southern ports was not at first effective, and blockade-running soon became an active industry. The Confederates established agencies in England for the purchase of arms, which they despatched in ordinary merchant vessels to the Bahamas, whence they were transhipped into fast steamers especially constructed for the purpose.

In June 1862 the vessel, the "Alabama," originally known as "No. 290," was being built by Messrs. Laird at Birkenhead. She was then nearly completed and was obviously intended for a man-of-war. On the 23rd of June Mr C. F. Adams forwarded to Earl Russell a letter from the United States consul at Liverpool giving certain particulars as to her character. This letter was laid before the law officers, who advised that, if these particulars were correct, the vessel ought to be detained. On the 21st of July sworn evidence, which was supplemented on the 23rd of July, was obtained and laid before the commissioners of customs (who were the proper authorities to enforce the provisions of the Foreign Enlistment Act of 1819), but they declined to move. On the 23rd of July the same evidence was laid before the law officers, who advised that there was sufficient ground for detention. By some accident, which has never been satisfactorily explained, but was probably connected with the severe illness of Sir John Harding, the queen's advocate, the papers were not returned till the 29th of July. Instructions were then issued to seize the vessel, but she had already sailed on the evening of the 28th. Although she remained for two days off the coast of Anglesey, there was no serious attempt at pursuit. She afterwards made her way to the Azores, where she received her armament, which was brought from Liverpool in two British ships. Captain Semmes there took command of her under a commission from the Confederate government. After a most destructive career she was sunk off Cherbourg by the "Kearsarge" on the 19th of June 1864.

On these facts the United States government alleged against Great Britain two grievances, or sets of grievances. The first was the recognition of the Southern States as belligerents and a general manifestation of unfriendliness in other ways. The second was in respect of breaches of neutrality in allowing the "Alabama," the "Florida" (originally the "Oreto"), the "Shenandoah" and other Confederate vessels to be built and equipped on British territory. Correspondence ensued extending over several years. At length in February 1871 a commission was appointed to sit at Washington in order, if possible, to arrive at some common understanding as to the mode in which the questions at issue might be settled. With respect to the "Alabama" claims the British commissioners suggested that they should be submitted to arbitration. The American commissioners refused "unless the principles which should govern the arbitrators in the consideration of the facts could be first agreed upon." After some discussion the British commissioners consented that the three following rules should apply. A neutral government is bound—(1) to use due diligence to prevent the fitting out, arming or equipping within its jurisdiction of any vessel, which it has reasonable ground to believe is intended to cruise or to carry on war against a power with which it is at peace, and also to use like diligence to prevent the departure from its jurisdiction of any vessel intended to cruise or carry on war as above, such vessel having been specially adapted, in whole or in part, within such jurisdiction, to warlike use; (2) not to permit or suffer either belligerent to make use of its ports or waters as the base of naval operations against the other, or for the purpose of the renewal or augmentation of military supplies or arms or the recruitment of men; (3) to exercise due diligence in its own ports and waters, and as to all persons within its jurisdiction to prevent any violation of the foregoing obligation and duties. The arrangements made by the commission were embodied in the treaty of Washington, which was signed on the 8th of May 1871, and approved by the Senate on the 24th of May. Article 1, after expressing the regret felt by Her Majesty's government for the escape, in whatever circumstances, of the "Alabama" and other vessels from British ports, and for the depredations committed by these vessels, provided that "the claims growing out of the acts of the said vessels, and generically known as the 'Alabama' claims" should be referred to a tribunal composed of five arbitrators, one to be named by each of the contracting parties and the remaining three by the king of Italy, the president of the Swiss Confederation and the emperor of Brazil respectively. By Article 2 all questions submitted were to be decided by a majority of the arbitrators, and each of the contracting parties was to name one person to attend as agent. Article 6 provided that the arbitrators should be governed by the three rules quoted above, and by such principles of international law not inconsistent therewith as the arbitrators should determine to be applicable to the case. By the same article the parties agreed to observe these rules as between themselves in future, and to bring them to the knowledge of other maritime powers. Article 7 provided that the decision should be made within three months from the close of the argument, and gave power to the arbitrators to award a sum in gross in the event of Great Britain being adjudged to be in the wrong.

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[1] William Wyatt Bibb died in 1820, and Thomas Bibb, then president of the state senate, filled the unexpired term of one year (1820).

[2] In 1837 Governor Clay was elected United States Senator, and Hugh M'Vay, the president of the state senate, filled the unexpired term.

[3] Until 1845 the term of state officials was one year; from then until 1901 it was two years; since 1901 it has been four years.

The treaty was, on the whole, welcomed in England. The United States appointed Mr C. F. Adams as arbitrator and Mr J. C. Bancroft Davis as agent. The British government appointed Sir Alexander Cockburn as arbitrator and Lord Tenterden as agent. The arbitrators appointed by the three neutral powers were Count Sclopis (Italy), M. Staempfli (Switzerland), Baron d'Itajuba (Brazil). The first meeting of the tribunal took place on the 15th of December 1871 in the Hôtel de Ville, Geneva. As soon as the cases had been formally presented, the tribunal adjourned till the following June. There followed immediately a controversy which threatened the collapse of the arbitration. It was found that in the American case damages were claimed not only for the property destroyed by the Confederate cruisers, but in respect of certain other matters known as "indirect losses," viz. the transference of the American marine to the British flag, the enhanced payments of insurance, the expenses of pursuit and the prolongation of the war. But this was not all. The American case revived the charges of "insincere neutrality" and "veiled hostility" which had figured in the diplomatic correspondence, and had been repudiated by Great Britain. It dwelt at length upon such topics as the premature recognition of belligerency, the unfriendly utterances of British politicians and the material assistance afforded to the Confederates by British traders. The inclusion of the indirect losses and the other matters just referred to caused great excitement in England. That they were within the treaty was disputed, and it was argued that, if they were, the treaty should be amended or denounced. In October 1872 Lord Granville notified to General Schenck, the United States minister, that the British government did not consider that the indirect losses were within the submission, and in April the British counter-case was filed without prejudice to this contention. On the 15th of June the tribunal reassembled and the American argument was filed. The British agent then applied for an adjournment of eight months, ostensibly in order that the two governments might conclude a supplemental convention, it having been meanwhile privately arranged between the arbitrators that an extra-judicial declaration should be obtained from the arbitrators on the subject of the direct claims. On the 19th of June Count Sclopis intimated on behalf of all his colleagues that, without intending to express any opinion upon the interpretation of the treaty, they had arrived at the conclusion that "the indirect claims did not constitute upon the principles of international law applicable to such cases a good foundation for an award or computation of damages between nations." In consequence of this intimation Mr Bancroft Davis informed the tribunal on the 25th of June that he was instructed not to press those claims; and accordingly on the 27th of June Lord Tenterden withdrew his application for an adjournment, and the arbitration was allowed to proceed. The discussion turned mainly on the question of the measure of "due diligence." The United States contended that it must be a diligence commensurate with the emergency or with the magnitude of the results of negligence. The British government maintained that while the measure of care which a government is bound to use in such cases must be dependent more or less upon circumstances, it would be unreasonable to require that it should exceed that which the governments of civilized states were accustomed to employ in matters concerning their own security or that of their citizens.

The tribunal adopted the view suggested by the United States. It found that Great Britain was legally responsible for all the depredations of the "Alabama" and "Florida" and for those committed by the "Shenandoah" after she left Melbourne. In the case of the "Alabama" the court was unanimous; in the case of the "Florida" Sir A. Cockburn alone, in that of the "Shenandoah" he and Baron d'Itajuba, dissented from the majority. In the cases of the other vessels the judgment was in favour of Great Britain. The tribunal decided to award a sum in gross, and (Sir A. Cockburn again dissenting) fixed the damages at $15,500,000 in gold. On the 14th of September the award was formally published, and signed by all the arbitrators except Sir A. Cockburn, who filed a lengthy statement of his reasons.

The stipulation that the three rules should be jointly submitted by the two powers to foreign nations has never been carried out. For this the British government has been blamed by some. But the general view of continental publicists is, that the language of the rules was not sufficiently precise to admit of their being generally accepted as a canon of neutral obligations. (M. H. C.)

ALABAMA RIVER, a river of Alabama, U.S.A., formed by the Tallapoosa and Coosa rivers, which unite about 6 m. above Montgomery. It flows W. as far as Selma, then S.W. until, about 45 m. from Mobile, it unites with the Tombigbee to form the Mobile and Tensas rivers, which discharge into Mobile Bay. The course of the Alabama is tortuous; its width varies from 200 to 300 yds., its depth from 3 to 7 ft.; its length by the United States Survey is 312 m., by steamboat measurement, 420 m. The river crosses the richest agricultural and timber districts of the state, and railways connect it with the mineral regions of north central Alabama. The principal tributary of the Alabama is the Cahaba (about 200 m. long), which enters it about 10 m. below Selma. Of the rivers which form the Alabama, the Coosa crosses the mineral region of Alabama, and is navigable for light-draft boats from Rome, Georgia (where it is formed by the junction of the Oostenaula and Etowah rivers), to about 117 m. above Wetumpka (about 192 m. below Rome and 26 m. below Greensport), and from Wetumpka to its junction with the Tallapoosa; the channel of the river has been considerably improved by the Federal government. The navigation of the Tallapoosa river (which has its source in Paulding county, Georgia, and is about 250 m. long) is prevented by shoals and a 60-ft. fall at Tallassee, a few miles N. of its junction with the Coosa. The Alabama is navigable throughout the year. In 1878 the Federal government undertook to make a channel the length of the Alabama 200 ft. wide and 4 ft. deep; an amendment in 1891 provided for a 6-ft. channel at low water, and in June 1907 this work was reported as "10% completed" at an expenditure of $303,659. The Mobile river is navigable for vessels of about 14 ft. draft. The Alabama is an important carrier of cotton, cotton seed, fertilizer, cereals, lumber, naval stores, &c.; and in the fiscal year 1906–1907 the freight tonnage was 417,041 tons.

ALABASTER, or **ARBLASTIER, WILLIAM** (1567–1640), English Latin poet and scholar, was born at Hadleigh, Suffolk, in 1567. He was, so Fuller states, a nephew by marriage of Dr John Still, bishop of Bath and Wells. His surname, sometimes written Arblastier, is one of the many variants of *arbalester*, a cross-bowman. Alabaster was educated at Westminster school, and entered Trinity College, Cambridge, in 1583. He became a fellow, and in 1592 was incorporated of the university of Oxford. About 1592 he produced at Trinity College his Latin tragedy of *Roxana*.[1] It is modelled on the tragedies of Seneca, and is a stiff and spiritless work. Fuller and Anthony à Wood bestowed exaggerated praise on it, while Samuel Johnson regarded it as the only Latin verse worthy of notice produced in England before Milton's elegies. *Roxana* is founded on the *La Dalida* (Venice, 1567) of Luigi Groto, known as Cieco di Hadria, and Hallam asserts that it is a plagiarism (*Literature of Europe*, iii. 54). A surreptitious edition in 1632 was followed by an authorized version *a plagiarii unguibus vindicata, aucta et agnita ab Authore, Gulielmo Alabastro*. One book of an epic poem in Latin hexameters, in honour of Queen Elizabeth, is preserved in MS. in the library of Emmanuel College, Cambridge. This poem, *Elisaeis, Apotheosis poetica*, Spenser highly esteemed. "Who lives that can match that heroick song?" he says in *Colin Clout's come home againe*, and begs "Cynthia" to withdraw the poet from his obscurity. In June 1596 Alabaster sailed with Robert Devereux, earl of Essex, on the expedition to Cadiz in the capacity of chaplain, and, while he was in Spain, he became a Roman Catholic. An account of his change of faith is given in an obscurely worded sonnet contained in a MS. copy of *Divine Meditations, by Mr Alabaster* (see J. P. Collier, *Hist. of Eng. Dram. Poetry*, ii. 341). He defended his conversion in a pamphlet, *Seven Motives*, of which no copy is extant. The proof of its publication only remains in two tracts, *A Booke of the Seuen Planets, or Seuen wandring motives of William Alablaster's* (*sic*) *wit* . . . , by John Racster (1598), and *An Answer to William Alabaster, his Motives*, by Roger Fenton (1599). From these it appears that Alabaster was imprisoned for his change of faith in the Tower of London during 1598 and 1599. In 1607 he published at Antwerp *Apparatus in Revelationem Jesu Christi*, in which his study of the Kabbalah was turned to account in a mystical interpretation of scripture which drew down the censure alike of Protestants and Catholics. The book was placed on the *Index librorum prohibitorum* at Rome early in 1610. Alabaster says in the preface to his *Ecce sponsus venit* (1633), a treatise on the time of the second advent of Christ, that he went to Rome and was there imprisoned by the Inquisition, but succeeded in escaping to England and again embraced the Protestant faith. He received a prebend in St Paul's cathedral, London, and the living of Therfield, Hertfordshire. He died in 1640. Alabaster's other cabalistic writings are *Commentarius de Bestia Apocalyptica* (1621) and *Spiraculum tubarum* . . . . (1633), a mystical interpretation of the Pentateuch. It was by these theological writings that he won the praise of Robert Herrick, who calls him "the triumph of the day" and the "one only glory of a million" ("To Doctor Alabaster" in *Hesperides*, 1648). He also published (1637) *Lexicon Pentaglotton, Hebraicum, Chaldaicum, Syriacum, Talmudico-Rabbinicon et Arabicum*.

See T. Fuller, *Worthies of England* (ii. 343); J. P. Collier, *Bibl. and Crit. Account of the Rarest Books in the English Language* (vol. i. 1865); Pierre Bayle, *Dictionary, Historical and Critical* (ed. London, 1734); also the *Athenaeum* (December 26, 1903), where Mr Bertram Dobell describes a MS. in his possession containing forty-three sonnets by Alabaster.

ALABASTER, a name applied to two distinct mineral substances, the one a hydrous sulphate of lime and the other a carbonate of lime. The former is the alabaster of the present day, the latter is generally the alabaster of the ancients. The two kinds are readily distinguished from each other by their relative hardness. The modern alabaster is so soft as to be readily scratched even by the finger-nail (hardness = 1·5 to 2), whilst the stone called alabaster by the ancients is too hard to be scratched in this way (hardness = 3), though it yields readily to a knife. Moreover, the ancient alabaster, being a carbonate, effervesces on being touched with hydrochloric acid, whereas the modern alabaster when so treated remains practically unaffected.

Ancient Alabaster.—This substance, the "alabaster" of scripture, is often termed Oriental alabaster, since the early examples came from the East. The Greek name ἀλαβαστρίτης is said to be derived from the town of Alabastron, in Egypt, where the stone was quarried, but the locality probably owed its name to the mineral; the origin of the mineral-name is obscure, and it has been suggested that it may have had an Arabic origin. The Oriental alabaster was highly esteemed for making small perfume-bottles or ointment vases called *alabastra*; and this has been conjectured to be a possible source of the name. Alabaster was also employed in Egypt for Canopic jars and various other sacred and sepulchral objects. A splendid sarcophagus, sculptured in a single block of translucent Oriental alabaster from Alabastron, is in the Soane Museum, London. This was discovered by Giovanni Belzoni, in 1817, in the tomb of Seti I., near Thebes, and was purchased by Sir John Soane, having previously been offered to the British Museum for £2000.

Oriental alabaster is either a stalagmitic deposit, from the floor and walls of limestone-caverns, or a kind of travertine, deposited from springs of calcareous water. Its deposition in successive layers gives rise to the banded appearance which the marble often shows on cross-section, whence it is known as onyx-marble or alabaster-onyx, or sometimes simply as onyx—a term which should, however, be restricted to a siliceous mineral. The Egyptian alabaster has been extensively worked near Suef and near Assiut; there are many ancient quarries in the hills overlooking the plain of Tell el Amarna. The Algerian onyx-marble has been largely quarried in the province of Oran. In Mexico there are famous deposits of a delicate green variety at La Pedrara, in the district of Tecali, near Puebla. Onyx-marble occurs also in the district of Tehuacan and at several localities in California, Arizona, Utah, Colorado and Virginia.

Modern Alabaster.—When the term "alabaster" is used without any qualification it invariably means, at the present day, a finely granular variety of gypsum (*q.v.*). This mineral, or alabaster proper, occurs in England in the Keuper marls of the Midlands, especially at Chellaston in Derbyshire, at Fauld in Staffordshire and near Newark in Nottinghamshire. At all these localities it has been extensively worked. It is also found, though in subordinate quantity, at Watchet in Somersetshire, near Penarth in Glamorganshire, and elsewhere. In Cumberland and Westmorland it occurs largely in the New Red rocks, but at a lower geological horizon. The alabaster of Nottinghamshire and Derbyshire is found in thick nodular beds or "floors," in spheroidal masses known as "balls" or "bowls," and in smaller lenticular masses termed "cakes." At Chellaston, where the alabaster is known as "Patrick," it has been worked into ornaments under the name of "Derbyshire spar"—a term applied also to fluor-spar. The finer kinds of alabaster are largely employed as an ornamental stone, especially for ecclesiastical decoration, and for the walls of staircases and halls. Its softness enables it to be readily carved into elaborate forms, but its solubility in water renders it inapplicable to outdoor work. The purest alabaster is a snow-white material of fine uniform grain, but it is often associated with oxide of iron, which produces brown clouding and veining in the stone. The coarser varieties of alabaster are converted by calcination into plaster of Paris, whence they are sometimes known as "plaster stone."

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[1] For an analysis of the play see an article on the Latin university plays in the *Jahrbuch der Deutschen Shakespeare Gesellschaft* (Weimar. 1898).

On the continent of Europe the centre of the alabaster trade is Florence. The Tuscan alabaster occurs in nodular masses, embedded in limestone, interstratified with marls of Miocene and Pliocene age. The mineral is largely worked, by means of underground galleries, in the district of Volterra. Several varieties are recognized—veined, spotted, clouded, agatiform, &c. The finest kind, obtained principally from Castellina, is sent to Florence for figure-sculpture, whilst the common kinds are carved locally, at a very cheap rate, into vases, clock-cases and various ornamental objects, in which a large trade is carried on, especially in Florence, Pisa and Leghorn. In order to diminish the translucency of the alabaster and to produce an opacity suggestive of true marble, the statues are immersed in a bath of water and gradually heated nearly to the boiling-point—an operation requiring great care, for if the temperature be not carefully regulated, the stone acquires a dead-white chalky appearance. The effect of heating appears to be a partial dehydration of the gypsum. If properly treated, it very closely resembles true marble, and is known as *marmo di Castellina*. It should be noted that sulphate of lime (gypsum) was used also by the ancients, and was employed, for instance, in Assyrian sculpture, so that some of the ancient alabaster is identical with the modern stone.

Alabaster may be stained by digesting it, after being heated, in various pigmentary solutions; and in this way a good imitation of coral has been produced (alabaster coral).

See M. Carmichael, *Report on the Volterra Alabaster Industry*, Foreign Office, Miscellaneous Series, No. 352 (London, 1895); A. T. Metcalfe, "The Gypsum Deposits of Nottingham and Derbyshire," *Transactions of the Federated Institution*, vol. xii. (1896), p. 107; J. G. Goodchild, "The Natural History of Gypsum," *Proceedings of the Geologists' Association*, vol. x. (1888), p. 425; George P. Merrill, "The Onyx Marbles," *Report of the U. S. National Museum for* 1893, p. 539. (F. W. R.*)

ALACOQUE, or AL COQ, **MARGUERITE MARIE** (1647–1690), French nun and mystic, was born at Lauthecourt, a village in the diocese of Autun, on the 22nd of July 1647. She would seem to have been from the first of a morbid and unhealthy temperament, and before the age of thirteen was the subject of a paralytic seizure. Having been cured of this, as she believed, by the intercession of the Holy Virgin, she changed her name to Marie and vowed to devote her life to her service. In May 1671 she entered the Visitation convent at Paray-le-Monial, in the diocese of Autun, and took the final vows in November 1672. Though her reading was confined to the lives of the saints, she taught in the school kept by the nuns for the girls of the neighbourhood, to whom she endeared herself by her kindly disposition. The appalling austerities, however, to which she was allowed to subject herself quickly affected her mental and bodily health. Hallucinations, to which she had been always subject, became more and more frequent. She conceived herself to be specially favoured by Christ, who appeared to her in the most extravagant forms. At last, by dint of fasting and lacerating her flesh, she succeeded in reducing herself to such a state of ecstatic suffering that she believed herself to be undergoing in her own person the Passion of the Lord. Her reward was the supreme vision in which Christ revealed to her His heart burning with divine love, and even, so she affirmed, exchanged it with hers, at the same time bidding her establish, on the Friday following, the feast of Corpus Christi, a festival in honour of His Sacred Heart. It was not till ten years later, in 1685, that the festival was first celebrated at Paray, and not till after the death of Marguerite, on the 17th of October 1690, that the cult of the Sacred Heart, fostered by the Jesuits and the subject of violent controversies within the church, spread throughout France and Christendom. (See SACRED HEART.)

Marguerite Alacoque was beatified by Pius IX. in 1864. Her short devotional writing, *La Dévotion au Sacré-Cœur de Jésus*, was published by J. Croiset in 1698, and is now very popular among Roman Catholics.

See Bishop Languet, *Vie de la vénérable Marguerite-Marie* (Paris, 1724), translated and edited by F. W. Faber (1847); Mgr. Bougaud, *Histoire de la bienheureuse Marguerite-Marie* (Paris, 1874); G. Tickell, S.J., *The Life of Blessed Margaret Mary Alacoque, with some account of the devotion to the Sacred Heart* (London, 1869); J. B. H. R. Capefigue, *Marie Marguerite Al-Coq* (Paris, 1866).

ALAGOAS, a maritime state of Brazil, bounded N. and W. by the state of Pernambuco, S. and W. by the state of Sergipe, and E. by the Atlantic. It has an area of 22,584 sq. m. A dry, semi-barren plateau, fit for grazing only, extends across the W. part of the state, breaking down into long fertile valleys and wooded ridges towards the coast, giving the country a mountainous character. The coastal plain is filled with lakes (*lagoas*), in some cases formed by the blocking up of river outlets by beach sands. The valleys and slopes are highly fertile and produce sugar, cotton, tobacco, Indian corn, rice, mandioca and fruits. Hides and skins, mangabeira rubber, cabinet woods, castor beans and rum are also exported. Cattle-raising was formerly a prominent industry, but it has greatly declined. Manufactures have been developed to a limited extent only, though protective tariff laws have been adopted for their encouragement. The climate is hot and humid, and fevers are prevalent in the hot season. The capital, Maceio, is the chief commercial city of the state, and its port (Jaragua) has a large foreign and coastwise trade. The principal towns are Alagoas, formerly the capital, picturesquely situated on Lake Manguaba, 15 m. S.W. of Maceio, and Penedo, a small port on the lower São Francisco, 26 m. above the river's mouth. Before 1817 Alagoas formed part of the capitania of Pernambuco, but in that year the district was rewarded with a separate government for refusing to join a revolution, and in 1823 became a province of the empire. The advent of the republic in 1889 changed the province into a state.

ALAIN DE LILLE [*Alanus de Insulis*] (*c.* 1128–1202), French theologian and poet, was born, probably at Lille, some years before 1128. Little is known of his life. He seems to have taught in the schools of Paris, and he attended the Lateran Council in 1179. He afterwards inhabited Montpellier (he is sometimes called *Alanus de Montepessulano*), lived for a time outside the walls of any cloister, and finally retired to Cîteaux, where he died in 1202. He had a very widespread reputation during his lifetime and his knowledge, more varied than profound, caused him to be called *Doctor universalis*. Among his very numerous works two poems entitle him to a distinguished place in the Latin literature of the middle ages; one of these, the *De planctu naturae*, is an ingenious satire on the vices of humanity; the other, the *Anticlaudianus*, a treatise on morals, the form of which recalls the pamphlet of Claudian against Rufinus, is agreeably versified and relatively pure in its latinity. As a theologian Alain de Lille shared in the mystic reaction of the second half of the 12th century against the scholastic philosophy. His mysticism, however, is far from being as absolute as that of the Victorines. In the *Anticlaudianus* he sums up as follows: Reason, guided by prudence, can unaided discover most of the truths of the physical order; for the apprehension of religious truths it must trust to faith. This rule is completed in his treatise, *Ars catholicae fidei*, as follows: Theology itself may be demonstrated by reason. Alain even ventures an immediate application of this principle, and tries to prove geometrically the dogmas defined in the Creed. This bold attempt is entirely factitious and verbal, and it is only his employment of various terms not generally used in such a connexion (axiom, theorem, corollary, etc.) that gives his treatise its apparent originality. Alain de Lille has often been confounded with other persons named Alain, in particular with Alain, archbishop of Auxerre, Alan, abbot of Tewkesbury, Alain de Podio, etc. Certain facts of their lives have been attributed to him, as well as some of their works: thus the *Life of St Bernard* should be ascribed to Alain of Auxerre and the *Commentary upon Merlin* to Alan of Tewkesbury. Neither is the philosopher of Lille the author of a *Memoriale rerum difficilium*, published under his name; and it is exceedingly doubtful whether the *Dicta*

Alani de lapide philosophico really issued from his pen. On the other hand, it now seems practically demonstrated that Alain de Lille was the author of the *Ars catholicae fidei* and the treatise *Contra haereticos*.

The works of Alain de Lille have been published by Migne, *Patrologia latina*, vol. ccx. A critical edition of the *Anticlaudianus* and of the *De planctu naturae* is given by Th. Wright in vol. ii. of the *Anglo-Latin Satirical Poets and Epigrammatists of the Twelfth Century* (London, 1872). See Hauréau, *Mémoire sur la vie et quelques œuvres d'Alain de Lille* (Paris, 1885); M. Baumgartner, *Die Philosophie des Alanus de Insulis* (Münster, 1896). (P. A.)

ALAIS, a town of southern France, capital of an arrondissement in the department of Gard, 25 m. N.N.W. of Nîmes on the Paris-Lyon railway, on which it is an important junction. Pop. (1906) 18,987. The town is situated at the foot of the Cévennes, on the left bank of the Gardon, which half surrounds it. The streets are wide and its promenades and fine plane-trees make the town attractive; but the public buildings, the chief of which are the church of St Jean, a heavy building of the 18th century, and the citadel, which serves as barracks and prison, are of small interest. Pasteur prosecuted his investigations into the silkworm disease at Alais, and the town has dedicated a bust to his memory. There is also a statue of the chemist J. B. Dumas. Alais has tribunals of first instance and of commerce, a board of trade-arbitrators, a lycée and a school of mines. The town is one of the most important markets for raw silk and cocoons in the south of France, and the Gardon supplies power to numerous silk-mills. It is also the centre of a mineral field, which yields large quantities of coal, iron, zinc and lead; its blast-furnaces, foundries, glass-works and engineering works afford employment to many workmen.

In the 16th century Alais was an important Huguenot centre. In 1629 the town was taken by Louis XIII., and by the peace of Alais the Huguenots gave up their right to *places de sûreté* (garrison towns) and other privileges. A bishopric was established there in 1694 but suppressed in 1790.

ALAJUELA, the capital of the province of Alajuela, in Costa Rica, Central America, on the transcontinental railway, 15 m. W. of San José. Pop. (1904) 4860. Alajuela is built at the southern base of the volcano of Poas (8895 ft.) and overlooks the fertile plateau of San José. Its central square, adorned with a handsome bronze fountain, contains the municipal buildings, and a large but unattractive cathedral. The town covers a considerable area; the detached white houses of its suburbs are surrounded by trees and flowering shrubs. Alajuela is the centre of the Costa Rican sugar trade, and an important market for coffee. Its products are exported from Puntarenas, on the Pacific Ocean, 32 m. W. The province of Alajuela includes the territory of the Guatusos Indians, along the northern frontier; the towns of Atenas, Grecia, Naranjo and San Ramon (all with less than 5000 inhabitants), and the gold-mines of Aguacate, a little north of Atenas.

ALAMANNI, or Allemanni, a German tribe, first mentioned by Dio Cassius, under the year 213. They apparently dwelt in the basin of the Maine, to the south of the Chatti. According to Asinius Quadratus their name indicates that they were a conglomeration of various tribes. There can be little doubt, however, that the ancient Hermunduri formed the preponderating element in the nation. Among the other elements may be mentioned the Juthungi, Bucinobantes, Lentienses, and perhaps the Armalausi. From the 4th century onwards we hear also of the Suebi or Suabi. The Hermunduri had apparently belonged to the Suebi, but it is likely enough that reinforcements from new Suebic tribes had now moved westward. In later times the names Alamanni and Suebi seem to be synonymous. The tribe was continually engaged in conflicts with the Romans, the most famous encounter being that at Strassburg, in which they were defeated by Julian, afterwards emperor, in the year 357, when their king Chonodomarius was taken prisoner. Early in the 5th century the Alamanni appear to have crossed the Rhine and conquered and settled Alsace and a large part of Switzerland. Their kingdom lasted until the year 495, when they were conquered by Clovis, from which time they formed part of the Frankish dominions. The Alamannic and Swabian dialects are now spoken in German Switzerland, the southern parts of Baden and Alsace, Württemberg and a small portion of Bavaria.

See Dio Cassius lxvii. ff.; Ammianus Marcellinus, *passim*; Gregory of Tours, *Historia Francorum*, book ii.; C. Zeuss, *Die Deutschen und die Nachbarstämme* (Munich, 1837), pp. 303 ff.; O. Bremer in H. Paul, *Grundriss der germanischen Philologie* (2nd ed., Strassburg, 1900), vol. iii. pp. 930 ff. (F. G. M. B.)

ALAMANNI, or Alemanni, **LUIGI** (1495–1556), Italian statesman and poet, was born at Florence. His father was a devoted adherent of the Medici party, but Luigi, smarting under a supposed injustice, joined with others in an unsuccessful conspiracy against Giulio de' Medici, afterwards Pope Clement VII. He was obliged in consequence to take refuge in Venice, and, on the accession of Clement, to flee to France. When Florence shook off the papal yoke in 1527, Alamanni returned, and took a prominent part in the management of the affairs of the republic. On the restoration of the Medici in 1530 he had again to take refuge in France, where he composed the greater part of his works. He was a favourite with Francis I., who sent him as ambassador to Charles V. after the peace of Crépy in 1544. As an instance of his tact in this capacity, it is related that, when Charles interrupted a complimentary address by quoting from a satirical poem of Alamanni's the words—

> "l' aquila grifagna,
> Che per più devorar, duoi rostri porta"
> (Two crooked bills the ravenous eagle bears,
> The better to devour),

the latter at once replied that he spoke them as a poet, who was permitted to use fictions, but that he spoke now as an ambassador, who was obliged to tell the truth. The ready reply pleased Charles, who added some complimentary words. After the death of Francis, Alamanni enjoyed the confidence of his successor Henry II., and in 1551 was sent by him as his ambassador to Genoa. He died at Amboise on the 18th of April 1556. He wrote a large number of poems, distinguished by the purity and excellence of their style. The best is a didactic poem, *La Coltivazione* (Paris, 1546), written in imitation of Virgil's *Georgics*. His *Opere Toscane* (Lyons, 1532) consists of satirical pieces written in blank verse. An unfinished poem, *Avarchide*, in imitation of the *Iliad*, was the work of his old age and has little merit. It has been said by some that Alamanni was the first to use blank verse in Italian poetry, but the distinction belongs rather to his contemporary Giangiorgio Trissino. He also wrote a poetical romance, *Girone il Cortese* (Paris, 1548); a tragedy, *Antigone*; a comedy, *Flora*; and other poems. His works were published, with a biography by P. Raffaelli, as *Versi e prose di Luigi Alamanni* (Florence, 1859).

See G. Naro, *Luigi Alamanni e la coltivazione* (Syracuse, 1897), and C. Corso, *Un decennio di patriottismo di Luigi Alamanni* (Palermo, 1898).

ALAMBAGH, or Alumbagh, the name of a large park or walled enclosure, containing a palace, a mosque and other buildings, as well as a beautiful garden, situated about 4 m. from Lucknow, near the Cawnpore road, in the United Provinces of India. It was converted into a fort by the mutineers in 1857, and after its capture by the British was of importance in connexion with the military operations around Lucknow. (See Indian Mutiny and Outram, Sir James.)

ALAMEDA, a residential city of Alameda county, California, U.S.A., on an artificial island about 5 m. long and 1 m. wide, on the E. side of San Francisco bay, opposite to and about 6 m. from San Francisco, and directly S. of Oakland, from which it is separated by a drainage canal, spanned by bridges. Included within the limits of the city is Bay Farm island, with an area of about 3 sq. m. Pop. (1870) 1557; (1880) 5708; (1890) 11,165; (1900) 16,464, of whom 4175 were foreign-born; (1910, census) 23,383. Alameda is served by the Southern Pacific railway, and is connected by an electric line with Oakland and Berkeley. Its site is low and level and its plan fairly regular. Among the city's manufactures are terra-cotta tiles, pottery, rugs, refrigerators and salt. The city owns and operates the electric-lighting plant; the water-works system is privately owned, and the water supply is obtained from deep wells at San Leandro. A settlement existed here before the end of the Mexican period. In 1854 it was incorporated as a town and in 1885 was chartered as a city. In 1906 the city adopted a freehold charter, centralizing power in the mayor and providing for a referendum. The county was organized in 1853.

ALAMOS DE BARRIENTOS, BALTASAR (1555–1640), Spanish scholar, was born at Medina del Campo in 1555. His friendship with Antonio Perez caused him to be arrested in 1590 and imprisoned for nearly thirteen years. His *Tácito español ilustrado con aforismos* (Madrid, 1614) is the only work which bears his name, but he is probably the author of the *Discurso del gobierno* ascribed to Perez. Through the influence of Lerma (to whom the *Tácito* is dedicated) and of Olivares, he subsequently attained high official position.

See *L'Art de gouverner*, ed. J. M. Guardia (Paris, 1867); P. J. Pidal, *Historia de las alteraciones de Aragon en el reinado de Felipe II.* (Madrid, 1862), vol. iii. pp. 29-30; A. Perez, *Relaciones* (Geneva, 1654), pp. 86-88.

ÅLAND ISLANDS, an archipelago at the entrance to the Gulf of Bothnia, about 25 m. from the coast of Sweden, and 15 from that of Finland. The group, which forms part of the Finnish province of Åbo-Björneborg, consists of nearly three hundred islands, of which about eighty are inhabited, the remainder being desolate rocks. These islands form a continuation of a dangerous granite reef extending along the south coast of Finland. They formerly belonged to Sweden, and in the neighbourhood the first victory of the Russian fleet over the Swedes was gained by Peter the Great in 1714. They were ceded to Russia in 1809. They occupy a total area of 1426 sq. km., and their present population is estimated at about 19,000. The majority of these occupy the island of Åland, upon which is situated the town of Mariehamn with a population of 1171. The inhabitants are mostly of Swedish descent, and are hardy seamen and fishermen. The surface of the islands is generally sandy, the soil thin and the climate keen; yet Scotch fir, spruce and birch are grown; and rye, barley, flax and vegetables are produced in sufficient quantity for the wants of the people. Great numbers of cattle are reared; and cheese, butter and hides, as well as salted meat and fish, are exported. There are several excellent harbours (notably that of Ytternäs), which were at one time of great importance to Russia from the fact that they are frozen up for a much briefer period than those on the coast of Finland.

The Åland Islands occupy a position of the greatest strategic importance, commanding as they do both the entrance to the port of Stockholm and the approaches to the Gulf of Bothnia, through which the greater part of the trade of Sweden is carried on. When, by the 4th article of the treaty of Fredrikshavn (Friedrichshamn), 5/17 September 1809, the islands were ceded to Russia, together with the territories forming the grand-duchy of Finland on the mainland, the Swedes were unable to secure a provision that the islands should not be fortified. The question was, however, a vital one not only for Sweden but for Great Britain, whose trade in the Baltic was threatened. In 1854, accordingly, during the Crimean War, an Anglo-French force attacked and destroyed the fortress of Bomarsund, against the erection of which Palmerston had protested without effect some twenty years previously. By the "Åland Convention," concluded between Great Britain, France and Russia on the 30th of March 1856, it was stipulated that "the Åland Islands shall not be fortified, and that no military or naval establishments shall be maintained or created on them." By the 33rd article of the treaty of Paris (1856) this convention, annexed to the final act, was given "the same force and validity as if it formed part thereof," Palmerston declaring in the House of Commons (May 6) that it had "placed a barrier between Russia and the north of Europe." Some attention was attracted to this arrangement when in 1906 it was asserted that Russia, under pretext of stopping the smuggling of arms into Finland, was massing considerable naval and military forces at the islands. The question of the Åland Islands created some discussion in 1907 and 1908 in connexion with the new North Sea agreements, and undoubtedly Russia considered the convention of 1856 as rather humiliating. But it was plainly shown by other powers that they did not propose to regard it as modified or open to question, and the point was not definitely and officially raised.

See the article by Dr Verner Soderberg in the *National Review*, No. 392, for April 1908.

ALANI (Gr. ’Αλανοί, ’Αλαυνοί; Chinese *'O-lan-na*; since the 9th century A.D. they have been called *As*, Russ. *Jasy*, Georgian *Ossi*), the easternmost division of the Sarmatians (see SCYTHIA), Iranian nomads with some Altaic admixture. First met with north of the Caspian, and later (*c.* 1st century A.D.) spreading into the steppes of Russia, the Alans made incursions into both the Danubian and the Caucasian provinces of the Roman empire. By the Huns they were cut into two portions, of which the western joined the Germanic nations in their invasion of southern Europe, and, following the fortunes of the Vandals, disappeared in North Africa. Those of the eastern division, though dispersed about the steppes until late medieval times, were by fresh invading hordes forced into the Caucasus, where they remain as the Ossetes. At one time partially Christianized by Byzantine missionaries, they had almost relapsed into heathenism, but are now under Russian influence returning to Christianity. (E. H. M.)

ALARCÓN, HERNANDO DE, Spanish navigator of the 16th century, is known only in connexion with the expedition to the coast of California, of which he was leader. He set sail on the 9th of May 1540 with orders from the Spanish court to await at a certain point on the coast the arrival of an expedition by land under the command of Vasquez de Coronado. The junction was not effected, though Alarcón reached the appointed place and left letters, which were afterwards found by Diaz, another explorer. Alarcón was the first to determine with certainty that California was a peninsula and not an island, as had been supposed. He made a careful survey of the coast, ascended the Rio del Tizon or Rio de Buena Guia (Colorado) for 85 Spanish m., and was thus able on his return to New Spain in 1541 to construct an excellent map of California.

See Herrera, Decade VI. book ix. ch. 15; vol. vi. fol. 212 of Madrid edition of 1730.

ALARCÓN, JUAN RUIZ DE (1518?–1639), Spanish dramatist, was born about 1581 at Tlacho (Mexico), where his father was superintendent of mines. He came to Europe in 1600, studied law at Salamanca, and in 1608 went back to Mexico to compete for a professorial chair. Returning to Spain in 1611, he entered the household of the marquis de Salinas, became a successful dramatist, and was nominated a member of the council of the Indies in 1623. He died at Madrid on the 4th of August 1639. His plays were published in 1628 and 1634; the most famous of these is *La Verdad sospechosa*, which was adapted by Corneille as the *Menteur*. Alarcón had the misfortune to be a hunchback, to be embittered by his deformity, and to be constantly engaged in personal quarrels with his rivals; but his attitude in these polemics is always dignified, and his crushing retort to Lope de Vega in *Los pechos privilegiados* is an unsurpassable example of cold, scornful invective. More than any other Spanish dramatist, Alarcón is preoccupied with ethical aims, and his gift of dramatic presentation is as brilliant as his dialogue is natural and vivacious. It has been alleged that his foreign origin is noticeable in his plays, and there is some foundation for the criticism; but his workmanship is exceptionally conscientious, and in *El Tejedor de Segovia* he had produced a masterpiece of national art, national sentiment and national expression. (J. F.-K.)

ALARCÓN, PEDRO ANTONIO DE (1833–1891), Spanish writer, was born on the 10th of March 1833 at Guadix. He graduated at the university of Granada, studied law and theology privately, and made his first appearance as a dramatist before he was of age. Deciding to follow literature as a profession, he joined with Torcuato Tárrago y Mateos in editing a Cadiz newspaper entitled *El Eco de Occidente*. In 1853 he travelled to

Madrid in the hope of finding a publisher for his continuation of Espronceda's celebrated poem, *El Diablo Mundo*. Disappointed in his object, and finding no opening at the capital, he settled at Granada, became a radical journalist in that city, and showed so much ability that in 1854 he was appointed editor of a republican journal, *El Látigo*, published at Madrid. The extreme violence of his polemics led to a duel between him and the Byronic poet, José Heriberto Garcia Quevedo. The earliest of his novels, *El Final de Norma*, was published in 1855, and though its construction is feeble it brought the writer into notice as a master of elegant prose. A small anthology, called *Mañanas de Abril y Mayo* (1856), proves that Alarcón was recognized as a leader by young men of promise, for among the contributors were Castelar, Manuel del Palacio and Lopez de Ayala. A dramatic piece, *El Hijo prodigo*, was hissed off the stage in 1857, and the failure so stung Alarcón that he enlisted under O'Donnell's command as a volunteer for the war in Morocco. His *Diario de un testigo de la guerra de Africa* (1859) is a brilliant account of the expedition. The first edition, amounting to fifty thousand copies, was sold within a fortnight, and Alarcón's name became famous throughout the peninsula. The book is not in any sense a formal history; it is a series of picturesque impressions rendered with remarkable force. On his return from Africa Alarcón did the Liberal party much good service as editor of *La Politica*, but after his marriage in 1866 to a devout lady, Paulina Contrera y Reyes, he modified his political views considerably. On the overthrow of the monarchy in 1868, Alarcón advocated the claims of the duc de Montpensier, was neutral during the period of the republic, and declared himself a Conservative upon the restoration of the dynasty in December 1874. These political variations alienated Alarcón's old allies and failed to conciliate the royalists. But though his political influence was ruined, his success as a writer was greater than ever. The publication in the *Revista Europea* (1874) of a short story, *El Sombrero de tres picos*, a most ingenious resetting of an old popular tale, made him almost as well known out of Spain as in it. This remarkable triumph in the picturesque vein encouraged him to produce other works of the same kind; yet though his *Cuentos amatorios* (1881), his *Historietas nacionales* (1881) and his *Narraciones inverosimiles* (1882) are pleasing, they have not the delightful gaiety and charm of their predecessor. In a longer novel, *El Escándalo* (1875), Alarcón had appeared as a partisan of the neo-Catholic reaction, and this change of opinion brought upon him many attacks, mostly unjust. His usual bad fortune followed him, for while the Radicals denounced him as an apostate, the neo-Catholics alleged that *El Escándalo* was tainted with Jansenism. Of his later volumes, written in failing health and spirits, it is only necessary to mention *El Capitan Veneno* and the *Historia de mis libros*, both issued in 1881. Alarcón was elected a member of the Spanish Academy in 1875. He died at Madrid on the 20th of July 1891. His later novels and tales are disfigured by their didactic tendency, by feeble drawing of character, and even by certain gallicisms of style. But, at his best, Alarcón may be read with great pleasure. The *Diario de un testigo* is still unsurpassed as a picture of campaigning life, while *El Sombrero de tres picos* is a very perfect example of malicious wit and minute observation. (J. F.-K.)

ALARD, JEAN DELPHIN (1815–1888), French violinist and teacher, was born at Bayonne on the 8th of May 1815. From 1827 he was a pupil of F. A. Habeneck at the Paris Conservatoire, where he succeeded P. de Sales Baillot as professor in 1843, retaining the post till 1875. His playing was full of fire and point, and his compositions had a great success in France, while his violin school had a wider vogue and considerably greater value. Mention should also be made of his edition in 40 parts of a selection of violin compositions by the most eminent masters of the 18th century, *Les Maîtres classiques du violon* (Schott). Alard died in Paris on the 22nd of February 1888.

ALARIC (*Ala-reiks*, "All-ruler"), (*c.* 370–410), Gothic conqueror, the first Teutonic leader who stood as a conqueror in the city of Rome, was probably born about 370 in an island named Peucè (the Fir) at the mouth of the Danube. He was of noble descent, his father being a scion of the family of the Balthi or Bold-men, next in dignity among Gothic warriors to the Amals. He was a Goth and belonged to the western branch of that nation—sometimes called the Visigoths—who at the time of his birth were quartered in the region now known as Bulgaria, having taken refuge on the southern shore of the Danube from the pursuit of their enemies the Huns.

In the year 394 he served as a general of *foederati* (Gothic irregulars) under the emperor Theodosius in the campaign in which he crushed the usurper Eugenius. As the battle which terminated this campaign, the battle of the Frigidus, was fought near the passes of the Julian Alps, Alaric probably learnt at this time the weakness of the natural defences of Italy on her north-eastern frontier. The employment of barbarians as *foederati*, which became a common practice with the emperors in the 4th century, was both a symptom of disease in the body politic of the empire and a hastener of its impending ruin. The provincial population, crushed under a load of unjust taxation, could no longer furnish soldiers in the numbers required for the defence of the empire; and on the other hand, the emperors, ever fearful that a brilliantly successful general of Roman extraction might be proclaimed Augustus by his followers, preferred that high military command should be in the hands of a man to whom such an accession of dignity was as yet impossible. But there was obviously a danger that one day a barbarian leader of barbarian troops in the service of the empire might turn his armed force and the skill in war, which he had acquired in that service, against his trembling masters, and without caring to assume the title of Augustus might ravage and ruin the countries which he had undertaken to defend. This danger became a reality when in the year 395 the able and valiant Theodosius died, leaving the empire to be divided between his imbecile sons Arcadius and Honorius, the former taking the eastern and the latter the western portion, and each under the control of a minister who bitterly hated the minister of the other.

In the shifting of offices which took place at the beginning of the new reigns, Alaric apparently hoped that he would receive one of the great war ministries of the empire, and thus instead of being a mere commander of irregulars would have under his orders a large part of the imperial legions. This, however, was denied him, and he found that he was doomed to remain an officer of *foederati*. His disappointed ambition prompted him to take the step for which his countrymen were longing, for they too were grumbling at the withdrawal of the "presents," in other words the veiled ransom-money, which for many years they had been accustomed to receive. They raised him on a shield and acclaimed him as a king; leader and followers both resolving (says Jordanes the Gothic historian) "rather to seek new kingdoms by their own labour, than to slumber in peaceful subjection to the rule of others."

Alaric struck first at the eastern empire. He marched to the neighbourhood of Constantinople, but finding himself unable to undertake the siege of that superbly strong city, he retraced his steps westward and then marched southward through Thessaly and the unguarded pass of Thermopylae into Greece. The details of his campaign are not very clearly stated, and the story is further complicated by the plots and counterplots of Rufinus, chief minister of the eastern, and Stilicho, the virtual regent of the western empire, and the murder of the former by his rebellious soldiers. With these we have no present concern; it is sufficient to say that Alaric's invasion of Greece lasted two years (305–396), that he ravaged Attica but spared Athens, which at once capitulated to the conqueror, that he penetrated into Peloponnesus and captured its most famous cities, Corinth, Argos and Sparta, selling many of their inhabitants into slavery. Here, however, his victorious career ended. Stilicho, who had come a second time to the assistance of Arcadius and who was undoubtedly a skilful general, succeeded in shutting up the Goths in the mountains of Pholoe on the borders of Elis and Arcadia. From thence Alaric escaped with difficulty, and not without some suspicion of connivance on the part of Stilicho. He crossed the

Corinthian Gulf and marched with the plunder of Greece northwards to Epirus. Next came an astounding transformation. For some mysterious reason, probably connected with the increasing estrangement between the two sections of the empire, the ministers of Arcadius conferred upon Alaric the government of some part—it can hardly have been the whole—of the important prefecture of Illyricum. Here, ruling the Danubian provinces, he was on the confines of the two empires, and, in the words of the poet Claudian, he "sold his alternate oaths to either throne," and made the imperial arsenals prepare the weapons with which to arm his Gothic followers for the next campaign. It was probably in the year 400 (but the dates of these events are rather uncertain) that Alaric made his first invasion of Italy, co-operating with another Gothic chieftain named Radagaisus. Supernatural influences were not wanting to urge him to this great enterprise. Some lines of the Roman poet inform us that he heard a voice proceeding from a sacred grove, "Break off all delays, Alaric. This very year thou shalt force the Alpine barrier of Italy; thou shalt penetrate to the city." The prophecy was not at this time fulfilled. After spreading desolation through North Italy and striking terror into the citizens of Rome, Alaric was met by Stilicho at Pollentia (a Roman municipality in what is now Piedmont), and the battle which then followed on the 6th of April 402 (Easter-day) was a victory, though a costly one for Rome, and effectually barred the further progress of the barbarians. Alaric was an Arian Christian who trusted to the sanctity of Easter for immunity from attack, and the enemies of Stilicho reproached him for having gained his victory by taking an unfair advantage of the great Christian festival. The wife of Alaric is said to have been taken prisoner after this battle; and there is some reason to suppose that he was hampered in his movements by the presence with his forces of large numbers of women and children, having given to his invasion of Italy the character of a national migration. After another defeat before Verona, Alaric quitted Italy, probably in 403. He had not indeed "penetrated to the city," but his invasion of Italy had produced important results; it had caused the imperial residence to be transferred from Milan to Ravenna, it had necessitated the withdrawal of the Twentieth Legion from Britain, and it had probably facilitated the great invasion of Vandals, Suevi and Alani into Gaul, by which that province and Spain were lost to the empire. We next hear of Alaric as the friend and ally of his late opponent Stilicho. The estrangement between the eastern and western courts had in 407 become so bitter as to threaten civil war, and Stilicho was actually proposing to use the arms of Alaric in order to enforce the claims of Honorius to the prefecture of Illyricum. The death of Arcadius in May 408 caused milder counsels to prevail in the western cabinet, but Alaric, who had actually entered Epirus, demanded in a somewhat threatening manner that if he were thus suddenly bidden to desist from war, he should be paid handsomely for what in modern language would be called the expenses of mobilization. The sum which he named was a large one, 4000 pounds of gold (about £160,000 sterling), but under strong pressure from Stilicho the Roman senate consented to promise its payment.

Three months later Stilicho himself and the chief ministers of his party were treacherously slain in pursuance of an order extracted from the timid and jealous Honorius; and in the disturbances which followed the wives and children of the barbarian *foederati* throughout Italy were slain. The natural consequence was that these men to the number of 30,000 flocked to the camp of Alaric, clamouring to be led against their cowardly enemies. He accordingly crossed the Julian Alps, and in September 408 stood before the walls of Rome (now with no capable general like Stilicho to defend her) and began a strict blockade.

No blood was shed this time; hunger was the weapon on which Alaric relied. When the ambassadors of the senate in treating for peace tried to terrify him with their hints of what the despairing citizens might accomplish, he gave with a laugh his celebrated answer, "The thicker the hay, the easier mowed!" After much bargaining, the famine-stricken citizens agreed to pay a ransom of more than a quarter of a million sterling, besides precious garments of silk and leather and three thousand pounds of pepper. Thus ended Alaric's first siege of Rome.

At this time, and indeed throughout his career, the one dominant idea of Alaric was not to pull down the fabric of the empire but to secure for himself, by negotiation with its rulers, a regular and recognized position within its borders. His demands were certainly large—the concession of a block of territory 200 m. long by 150 wide between the Danube and the Gulf of Venice (to be held probably on some terms of nominal dependence on the empire), and the title of commander-in-chief of the imperial army. Yet large as the terms were, the emperor would probably have been well advised to grant them; but Honorius was one of those timid and feeble folk who are equally unable to make war or peace, and refused to look beyond the question of his own personal safety, guaranteed as it was by the dikes and marshes of Ravenna. As all attempts to conduct a satisfactory negotiation with this emperor failed before his impenetrable stupidity, Alaric, after instituting a second siege and blockade of Rome in 409, came to terms with the senate, and with their consent set up a rival emperor and invested the prefect of the city, a Greek named Attalus, with the diadem and the purple robe. He, however, proved quite unfit for his high position; he rejected the advice of Alaric and lost in consequence the province of Africa, the granary of Rome, which was defended by the partisans of Honorius. The weapon of famine, formerly in the hand of Alaric, was thus turned against him, and loud in consequence were the murmurs of the Roman populace. Honorius was also greatly strengthened by the arrival of six legions sent from Constantinople to his assistance by his nephew Theodosius II. Alaric therefore cashiered his puppet emperor Attalus after eleven months of ineffectual rule, and once more tried to reopen negotiations with Honorius. These negotiations would probably have succeeded but for the malign influence of another Goth, Sarus, the hereditary enemy of Alaric and his house. When Alaric found himself once more outwitted by the machinations of such a foe, he marched southward and began in deadly earnest his third, his ever-memorable siege of Rome. No defence apparently was possible; there are hints, not well substantiated, of treachery; there is greater probability of surprise. However this may be—for our information at this point of the story is miserably meagre—on the 24th of August 410 Alaric and his Goths burst in by the Salarian gate on the north-east of the city, and she who was of late the mistress of the world lay at the feet of the barbarians. The Goths showed themselves not absolutely ruthless conquerors. The contemporary ecclesiastics recorded with wonder many instances of their clemency: the Christian churches saved from ravage; protection granted to vast multitudes both of pagans and Christians who took refuge therein; vessels of gold and silver which were found in a private dwelling, spared because they "belonged to St. Peter"; at least one case in which a beautiful Roman matron appealed, not in vain, to the better feelings of the Gothic soldier who attempted her dishonour; but even these exceptional instances show that Rome was not entirely spared those scenes of horror which usually accompany the storming of a besieged city. We do not, however, hear of any damage wrought by fire, save in the case of Sallust's palace, which was situated close to the gate by which the Goths had made their entrance; nor is there any reason to attribute any extensive destruction of the buildings of the city to Alaric and his followers.

His work being done, his fated task, and Alaric having penetrated to the city, nothing remained for him but to die. He marched southwards into Calabria. He desired to invade Africa, which on account of its corn crops was now the key of the position; but his ships were dashed to pieces by a storm in which many of his soldiers perished. He died soon after, probably of fever, and his body was buried under the river-bed of the Busento, the stream being temporarily turned aside from its course while the grave was dug wherein the Gothic chief and some of his most precious spoils were interred. When the work was finished the river was turned back into its usual channel, and the captives by whose hands the labour had been accomplished were put to death that none might learn their secret. He was succeeded in the command of the Gothic army by his brother-in-law, Ataulphus.

Our chief authorities for the career of Alaric are the historian Orosius and the poet Claudian, both strictly contemporary; Zosimus, a somewhat prejudiced heathen historian, who lived probably about half a century after the death of Alaric; and Jordanes, a Goth who wrote the history of his nation in the year 551, basing his work on the earlier history of Cassiodorus (now lost), which was written about 520. (T. H.)

ALARIC II. (d. 507), eighth king of the Goths in Spain, succeeded his father Euric or Evaric in 485. His dominions not only included the whole of Spain except its north-western corner, but also Aquitaine and the greater part of Provence. In religion Alaric was an Arian, but he greatly mitigated the persecuting policy of his father Euric towards the Catholics and authorized them to hold in 506 the council of Agde. He displayed similar wisdom and liberality in political affairs by appointing a commission to prepare an abstract of the Roman laws and imperial decrees, which should form the authoritative code for his Roman subjects. This is generally known as the *Breviarium Alaricianum*, or *Breviary of Alaric* (*q.v.*). Alaric was of a peaceful disposition, and endeavoured strictly to maintain the treaty which his father had concluded with the Franks, whose king Clovis, however, desiring to obtain the Gothic province in Gaul, found a pretext for war in the Arianism of Alaric. The intervention of Theodoric, king of the Ostrogoths and father-in-law of Alaric, proved unavailing. The two armies met in 507 at the Campus Vogladensis, near Poitiers, where the Goths were defeated, and their king, who took to flight, was overtaken and slain, it is said, by Clovis himself.

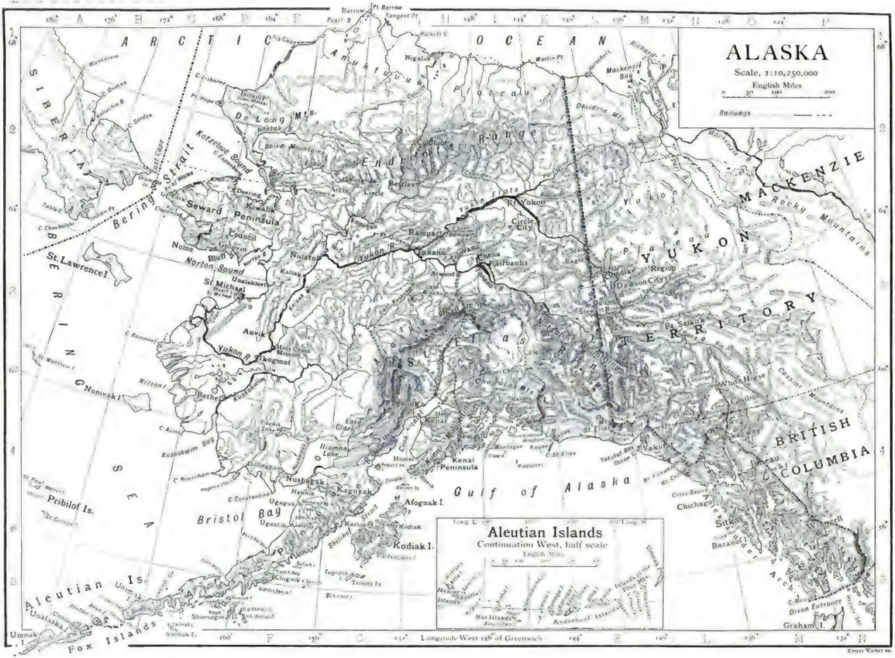
ALA-SHEHR (anc. *Philadelphia*), a town of Asia Minor, in the Aidin vilayet, situated in the valley of the Kuzu Chai (*Cogamus*), at the foot of the Boz Dagh (Mt. Tmolus) 83 m. E. of Smyrna (105 by railway). Pop. 22,000 (Moslems, 17,000; Christians, 5000). Philadelphia was founded by Attalus II. of Pergamum about 150 B.C., became one of the "Seven Churches" of Asia, and was called "Little Athens" on account of its festivals and temples. It was subject to frequent earthquakes. Philadelphia was an independent neutral city, under the influence of the Latin Knights of Rhodes, when taken in 1390 by Sultan Bayezid I. and an auxiliary Christian force under the emperor Manuel II. after a prolonged resistance, when all the other cities of Asia Minor had surrendered. Twelve years later it was captured by Timur, who built a wall with the corpses of his prisoners. A fragment of the ghastly structure is in the library of Lincoln cathedral. The town is connected by railway with Afium-Kara-Hissar and Smyrna. It is dirty and ill-built; but, standing on elevated ground and commanding the extensive and fertile plain of the Hermus, presents at a distance an imposing appearance. It is the seat of an archbishop and has several mosques and Christian churches. There are small industries and a fair trade. From one of the mineral springs comes a heavily charged water known in commerce as "Eau de Vals," and in great request in Smyrna.

See W. M. Ramsay, *Letters to the Seven Churches* (1904).

ALASKA, formerly called RUSSIAN AMERICA, a district of the United States of America, occupying the extreme north-western part of North America and the adjacent islands. The name is a corruption of a native word possibly meaning "mainland" or "peninsula." The district of Alaska comprises, first, all that part of the continent W. of the 141st meridian of W. longitude from Greenwich; secondly, the eastern Diomede island in Bering Strait, and all islands in Bering Sea and the Aleutian chain lying E. of a line drawn from the Diomedes to pass midway between Copper Island, off Kamchatka, and Attu Island of the Aleutians; thirdly, a narrow strip of coast and adjacent islands N. of a line drawn from Cape Muzon, in lat. 54° 40′ N., E. and N. up Portland Canal to its head, and thence, as defined in the treaty of cession to the United States, quoting a boundary treaty of 1825 between Great Britain and Russia, following "the summit of the mountains situated parallel to the coast" to the 141st meridian, provided that when such line runs more than ten marine leagues from the ocean the limit "shall be formed by a line parallel to the windings of the coast and which shall never exceed the distance of ten marine leagues therefrom." The international disputes connected with this description are referred to below.

Physical Features.—Alaska is bounded on the N. by the Arctic Ocean, on the W. by the Arctic Ocean and Bering Strait, on the S. and S.W. by the Gulf of Alaska and the Pacific Ocean, and on the E. by Yukon Territory and British Columbia. It consists of a compact central mass and two straggling appendages running from its S.W. and S.E. corners, and sweeping in a vast arc over 6 degrees of latitude and 58 degrees of longitude. These three parts will be referred to hereafter respectively, as Continental Alaska, Aleutian Alaska and the "Panhandle." The range of latitude from Point Barrow in the Arctic Ocean to Cape Muzon is almost 17 degrees—as great as from New Orleans to Duluth; the range of longitude from Attu Island to the head of Portland Canal is 58 degrees—considerably greater than from New York to San Francisco. The total area is about 586,400 sq. m. The general ocean-coast line is about 4750 m., and, including the islands, bays, inlets and rivers to the head of tide water, is about 26,000 m. in length (U.S. Coast Survey 1889). The entire southern coast is very irregular in outline; it is precipitous, with only very slight stretches of beach or plain. Its elevation gradually decreases as one travels W. toward the Aleutians. A great submarine platform extends throughout a large part of Bering Sea. The western and northern coasts are regular in outline with long straight beaches; and shallows are common in the seas that wash them. On the Arctic there is a broad coastal plain. Of the islands of Alaska the more important are: at the S.E. extremity and lying close inland, the Alexander Archipelago, whose principal islands from N.W. to S.E. are Chicagof, Baranof, Admiralty, Kupreanof, Kuiu, Prince of Wales (the largest of the archipelago and of all the islands about Alaska, measuring about 140 m. in length and 40 m. in width), Etolin and Revillagigedo; S.W. of the mainland, two groups—(1) Kodiak, whose largest island, of the same name, is 40 m. by 100 m., and may be considered a continuation of the Kenai Peninsula, and whose W. continuation, S. of Alaska Peninsula, consists of the Semidi, Shumagin and Sannak clusters; (2) the Aleutian Islands (*q.v.*) sweeping 1200 m. W.S.W. from the end of Alaska Peninsula, W. of the mainland, in Bering Sea, the Pribilof Islands, about 500 m. S. of Cape Prince of Wales, the small Hall and St Matthew Islands, about 170 m. S.W. of the same cape, St Lawrence Island (100 m. and 10 to 30 m. wide), which is about half way between the last mentioned pair of islets and Cape Prince of Wales and Nunivak Island, near the mainland and due E. of St Matthew; and in the middle of Bering Strait the Diomede Islands, which belong in part to Russia.

Very little was known about Alaska previous to 1896, when the gold discoveries in the Klondike stimulated public interest regarding it. Since 1895, however, the explorations of the United States Geological Survey and the Department of War and other departments of the government, have fully established the main features of its physiography. It has mountains, plateaus and lowlands on a grand scale. "In a broad way, the larger features of topography correspond with those of the western states. There is a Pacific Mountain system, a Central Plateau region, a Rocky Mountain system, and a Great Plains region. These four divisions are well marked, and show the close geographic relation of this area to the southern part of the continent." The orographic features of the Pacific Mountain system trend parallel to the coast-line of the Gulf of Alaska, changing with this at the great bend beyond the N., and of the Panhandle from S.E. and N.W. to N.E. and S.W. and running through the Alaska Peninsula. The Pacific Mountain system includes four ranges. The Coast Range of the Panhandle attains a width of 100 m., but has no well-defined crest line. The range is characterized by the uniformity of summit levels between 5000 and 6000 ft. Continuing the Coast Range, with

ALASKA
Scale, 1:10,250,000
English Miles
0
50
100
200
Railways
ARCTIC OCEAN
BERING SEA
SIBERIA
Bering Strait
St. Lawrence I.
Nunivak I.
Pribilof Is.
St. George I.
St. Matthew I.
Kotzebue Sound
Seward Peninsula
Norton Sound
Nome
Bluff
Council
Golovin
Deering
Kiwalik
St. Michael
Unalakleet
De Long Mts.
Baird Mountains
Endicott Range
Anuktuvuk Plateau
Point Barrow
Barrow
Point Hope
C. Lisburne
Nigaluk
Martin Pt.
Herschell I.
Mackenzie Bay
Richards I.
Davidson Mts.
Bettles
Coldfoot
Arctic Circle
Yukon Flats
Ft. Yukon
Circle City
Rampart
Tanana
Tolovana
Chena
Fairbanks
Nulato
Kaltag
Anvik
Holy Cross Mission
Ikogmut
Yukon R.
Bethel
Kuskokwim R.
Kuskokwim Bay
C. Romanof
C. Newenham
Dillingham
Nushagak
Naknek
Ugashik
Bristol Bay
C. Constantine
Iliamna Lake
Lake Clark
Kaguyak
Shelikof Strait
Afognak I.
Kodiak
Kodiak I.
Trinity Is.
Shumagin Is.
Chignik
Aleutian Is.
Unimak I.
Unalaska
Umnak
Fox Islands
Cook Inlet
Homer
Kenai
Kenai Peninsula
Kenai Mountains
Seward
Valdez
Chugach Mts.
Copper Center
Gulf of Alaska
C. St. Elias
Kayak I.
Mt. St. Elias
Yakutat Bay
Yakutat
Cross Sound
Chichagof I.
Sitka
Baranof I.
Alexander Arch.
Juneau
Wrangell
Dixon Entrance
Graham I.
C. Muzon
Hecate Str.
Alaska Range
White Horse
Cassiar Mountains
Ft. Selkirk
Dawson City
Klondike Region
Eagle
Stewart River
YUKON TERRITORY
Yukon Plateau
MACKENZIE
Rocky Mountains
BRITISH COLUMBIA
Aleutian Islands
Continuation West, half scale
English Miles
Near Islands
Attu I.
Rat Islands
Andreanof Islands
Islands of the Four Mts.
Umnak
Longitude West 148° of Greenwich
180°
176°
172°
168°
164°
160°
156°
152°
148°
144°
140°
136°
132°
128°
124°
68°
64°
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Emery Walker sc.

which it is closely associated—the Chilkat river lies between them—is the St Elias Range (a term now used to include not only the mountains between Cross Sound and Mt. St Elias, but the Chugach, Kenai, Skolai and Nutzotin mountains); among its peaks are: Mt. Crillon (15,900 ft.), Mt. Fairweather (15,290 ft.), Mt. Vancouver (15,666 ft.), Mt. Wrangell (17,500 ft., an active volcano) in the Nutzotin Mountains, Mt. St Elias (18,024 ft.) and, in Canadian territory, Mt. Logan (19,539 ft.). The Aleutian Range, of whose crest the Aleutian Islands are remnants, fills out the system near the coast. The Alaskan Range, connecting with the Nutzotin and Skolai branches of the St Elias Range, lies a little farther inland; it is splendidly marked by many snowy peaks, including Mt. Foraker (17,000 ft.) and Mt. McKinley. The latter, which on the W. rises abruptly out of a marshy country, offers the obstacles of magnificent, inaccessible granite cliffs and large glaciers to the mountaineer; it is the loftiest peak in North America (ca. 20,300 ft.). In the Alaskan Range and the Aleutian Range there are more than a dozen live volcanoes, several of them remarkable; the latter range is composed largely of volcanic material. Evidences of very recent volcanic activity are abundant about Cook Inlet. The Rocky Mountain system extends from Canada (the Yukon territory) into N.E. Alaska, which it crosses near the Arctic coast in a broad belt composed of several ranges about 6000 ft. in altitude. There is no well-defined crest line; the axis of the system is roughly parallel to the Pacific Mountain system, but runs more nearly E. and W. in Alaska. Between the Pacific Mountain and the Rocky Mountain systems lies the vast Central Plateau region, or Yukon plateau. Finally, between the Rocky Mountains and the Arctic Ocean is the Arctic Slope region, a sloping plain corresponding to the interior plains of the United States.

First Physiographic Region.—The Panhandle is remarkably picturesque. The maze of islands, hundreds in number, of the Alexander Archipelago (area about 13,000 sq. m.) are remnants of a submerged mountain system; the islands rise 3000 to 5000 ft. above the sea, with luxuriantly wooded tops and bald, sheer sides scarred with marks of glacial action; the beachless coast is only a narrow ledge between the mountains and the sea, and unlike the coast of Norway, to which in outline it is not dissimilar, is bold, steep and craggy. Through the inner channels, sheltered from the Pacific by the island rampart, runs the "inland passage," the tourist route northward from Seattle, Washington. The inter-insular straits are carried up into the shore as fjords heading in rivers and glaciers. Thus the Stikine river continues Sumner Strait and the Taku continues Cross Sound. The Stikine, Taku and Alsek rivers all cross the mountains in deep-cut canyons. Everywhere the evidences of glacial action abound. Most remarkable are the inlets known as Portland Canal and Lynn Canal (continuing Chatham Strait). The first is very deep, with precipitous shores and bordering mountains 5000 to 6000 ft. high; the second is a noble fjord 100 m. long and on an average 6 m. wide, with magnificent Alpine scenery. It is subject in winter to storms of extraordinary violence, but is never closed by ice. Both Portland Canal and Lynn Canal are of historical importance, as the question of the true location of the first and the commercial importance to Canada or to the United States of the possession of the second, were the crucial contentions in the disputes over the Alaska-Canadian boundary. At the head of Lynn Canal, the only place on the whole extent of the south-eastern Alaskan coast where a clear-cut water-parting is exhibited between the sea-board and interior drainage, the summits of the highest peaks in the Coast Range are 8000 to 9000 ft. above the sea. White Pass (2888 ft.) and Chilkoot Pass (3500 ft.), at the head of the Lynn Canal, are the gateway to the mining country of the Klondike and Upper Yukon. They are the highest points that one meets in travelling from Skagway along the course of the Yukon to Bering Sea.

Prior to the opening (in August 1900) of the railway between Skagway and White Horse, Canada (110 m.), by way of the White Pass, all transportation to the interior was effected by men and pack-animals (and for a time by a system of telpherage) over these passes and the Chilkat or Dalton trail; the building of the railway reduced carriage rates to less than a tenth of their former value, and the Chilkat and Chilkoot Passes were no longer used. The coast region above the Panhandle shows on a smaller and diminishing scale the same characteristic features, gradually running into those of the Aleutians. Out of the Alaska and Nutzotin mountains two great rivers flow southward: the Copper, practically unnavigable except for small boats, because of its turbulence and the discharge of glaciers into its waters; and the Susitna, also practically unnavigable. Both of these rivers have their sources in lofty mountain masses, and are swift and powerful streams carrying with them much silt; their passes over the water-parting N. of the Kenai Peninsula are through gorges from 4000 to 10,000 ft. in depth. The Copper, the Susitna and its tributary, the Yentna, as well as the Skwentna, a tributary of the Yentna from the west, all run through picturesque canyons, and their upper courses are characterized by glacial and torrential feeders. Their valleys are well timbered.

The glaciers of the Panhandle and throughout the rest of the Pacific region are most remarkable—extraordinary alike for their number and their size. They lie mainly between 56° and 61° N. lat., in a belt 1000 m. long, of which the central part, some 350 or 500 m. long and 80 m. to 100 m. wide, has been described as one great confluent névé field. Thousands of Alpine glaciers from one to fifteen miles long fill the upper valleys and canyons of the mountains. More than a hundred almost reach the sea, from which they are separated by detrital lowland or terminal moraines. Other glaciers are of the Piedmont type. Greatest of these and of Alaskan glaciers is the Malaspina, a vast elevated plateau of wasting ice, 1500 sq. m. in area (nearly a tenth the area of all Switzerland), touching the sea at only one point, though fronting it for 50 m. behind a fringing foreland of glacial debris. It is fed by Alpine glaciers, among them one of the grandest in Alaska, the Seward, which descends from Mt. Logan. It is more than 50 m. long, and more than 3 m. broad at its narrowest point, and several times in its course flows over cascades, falling hundreds of feet. Of tide-water glaciers the most remarkable is probably the Muir. It has an area of 350 sq. m.; the main trunk, which is 30 to 40 m. broad, is fed by 26 tributaries, 20 of which are each greater than the Mer de Glace, and pushes its bergs into the sea from ice cliffs almost 2 m. wide, standing 100 to 200 ft. above the water, and extending probably 700 to 1000 ft. beneath its surface. It has been calculated that the average daily discharge of the Muir in summer is 30,000,000 cubic ft. Its course, which is only about 13 m., has a slope of 100 ft. per mile, and the main current moves 7 ft. daily. The character of the Muir was greatly altered by an earthquake in 1899. There are some 30 tide-water glaciers—a considerable number of them very noteworthy. The Valdez is 30 m. long and 5000 ft. in altitude. Most of the Alaskan glaciers are receding, but not all of them; and at times there is a general advance. The Muir receded 1·6 m. from 1879–1890, the Childs about 600 yards in 17 years; others over 4, 7 or 10 m. in 20 years.

The Aleutian Islands (*q.v.*), like the Alexander Archipelago, are remnants of a submerged mountain system. Their only remarkable features are the volcanoes on the easterly islands, already mentioned.

Continental Alaska.—Continental Alaska in the interior is essentially a vast plateau. "The traveller between the main drainage areas of the interior is struck by the uniform elevation of the interfluminal areas. Rounded hills, level meads and persistent flat-topped ridges, composed of rocks of varying structure, rise to about the same level and give the impression that they are the remnants of a former continuous surface. Occasional limited areas of rugged mountains rise above this level, and innumerable stream valleys have been incised below it; but from the northern base of the St Elias and Alaskan ranges to the southern foothills of the Rocky Mountain system, and throughout their length, the remnants of this ancient level are to be seen. In height it varies from about 5000 ft. close to the bases of the mountain systems to less than 3000 ft. in the vicinity of the main lines of drainage, and slopes gradually towards the north." The Seward Peninsula is particularly rugged. This great plateau drains westward through broad, gently flowing streams, the network of whose tributary waters penetrates every corner of the interior and offers easy means of communication. Both the main streams and the smaller tributaries often flow through deep canyons. The Yukon is one of the great drainage systems of the world. The Yukon itself has a length of more than 2000 m. and bisects the country from E. to W. Behind the bluffs that form in large part its immediate border its basin is a rolling country, at times sinking into great dead levels like the Yukon flats between Circle City and the Lower Ramparts, some 30,000 sq. m. in area. Of the two great affluents of the Yukon, the Tanana is for the most part unnavigable, while the Koyukuk is navigable for more than 450 m. by river steamers, and for more than 500 m. above its mouth shows no appreciable diminution in volume. A low water-parting divides the Yukon valley from the Kuskokwim, the second river of Alaska in size, navigable by steamers for 600 m. Torrential near its source, it is already a broad, sluggish stream at its confluence with the East Kuskokwim. The tides rise 50 ft. near its mouth and the tide-head is 100 m. above the mouth.

Rocky Mountains.—The Rocky Mountain system in Alaska is higher and more complex than in Canada. About 100 m. wide at the international boundary, where the peaks of the British Mountains on the N. and of the Davidson Mountains on the S. are 7000 to 8000 ft. high, the system runs W.S.W. as the Endicott Mountains, two contiguous ranges of about 5000 to 6000 ft., and as these ranges separate, the northern becomes the De Long, the southern the Baird Mountains, whose elevation rapidly decreases toward the coast-line. The system is sharply defined on the north and less so on the south.

Arctic Slope Region.—The Arctic Slope region is divided into the Anuktuvuk Plateau about 80 m. wide, with a maximum altitude to the S. of 2500 ft., and between the plateau and the Arctic Ocean the Coastal Plain. Very little is known of either part of the region.

Climate.—From the foregoing description of the country it is evident that the range of climate must be considerable. That of the coast and that of the Yukon plateau are quite distinct. The Panhandle, along with the *lisière* (foreland), westward to Cook Inlet might be called temperate Alaska, its climate being similar to that of the N.W. coast of the United States; while to the westward and northward the winters become longer and more severe. The cause of the mild climate of the Panhandle, formerly supposed to be the Japanese current, or Kuro Shiwo, is now held to be the general eastward drift of the waters of the North Pacific in the direction of the prevalent winds. To the warmth and moisture brought by this means the coastal region owes its high equable temperature, its heavy rainfall (80–110 in.) and its superb vegetation. The mean annual temperature is from 54° to 60° F. Winter sets in about the 1st of December and the snow is gone save in the mountains by the 1st of May. The thermometer rarely registers below zero F. or above 75° F.; the difference between the midwinter and midsummer averages is seldom more than 25°. The summer is relatively dry, the autumn and winter wet. The vapour-laden sea air blowing landward against the girdle of snow and glaciers on the mountain barriers a few miles inland drains its moisture in excessive rain and snow upon the *lisière*, shrouding it in well-nigh unbroken fog and cloud-bank. Only some 60 to 100 days in the year are clear. In passing from the Sitkan district westward toward Kodiak and the Aleutians (*q.v.*) the climate becomes even more equable, the temperature a little lower and the rainfall somewhat less;[1] the fogs at first less dense, especially near Cook Inlet, where the climate is extremely local, but more and more persistent along the Aleutians. The clear days of a year at Unalaska can be counted on the fingers; five days in seven it actually rains or snows. Bering Sea is covered with almost eternal fog. Along the coast N. of Alaska Peninsula the rainfall diminishes to 10 in. or less within the Arctic circle; the summer temperature is quite endurable but the winters are exceedingly rigorous.[2] East of the mountains in south-eastern Alaska the atmosphere is dry and bracing, the temperature ranging from −14° to 92° F. In the farther interior, in the valleys of the Yukon, the Tanana, the Copper and the Sushitna the summers are much the same in character, the winters much more severe. On the Yukon at the international boundary the mean of the warmest month is higher than that of the warmest month at Sitka, 500 m. southward. At some points in the Upper Yukon valley the range of extreme temperatures is as great as from −75° to 90° F.[3] The mean heat of summer in the upper valley is about 60° to 70° F., and at some points in the middle and lower valley even higher.[4] By the middle of September snow flurries have announced the imminence of winter, the smaller streams congeal, the earth freezes, the miner perforce abandons his diggings, and navigation ceases even on the Yukon in October. All winter snows fall heavily. The air is dry and quiet, and the cold relatively uniform. In midwinter in the upper valley the sun rises only a few degrees above the horizon for from four to six hours a day, though very often quite obscured. In December, January, February and March the thermometer often registers lower than −50° F., and the mean temperature is −20°. In May the rivers open, the cleared land thaws out, and by June the miner is again at work. Summer is quickly in full ascendancy. In May and June the sun shines from eighteen to twenty hours and diffused twilight fills the rest of the day. The rainfall is light, from 10 to 25 in. according to the year or the locality. Dull weather is unknown. All nature responds in rich and rapid growth to the garish light and intense heat of the long, splendid days. But the Alaska summer is the uncertain season; at times the nights are cold into July, at times snow falls and there are frosts in mid-August; sometimes rain is heavy, or again there is a veritable drought. In the great river valleys S. of the Yukon basin climatic conditions are much less uniform.

Fauna and Flora.—The fauna of Alaska is very rich and surprisingly varied. The lists of insects, birds and mammals are especially noteworthy.[5] Of these three classes, and of other than purely zoological interest, are mosquitoes, which swarm in summer in the interior in vast numbers; sea fowl, which are remarkably abundant near the Aleutians; moose, and especially caribou, which in the past were very numerous in the interior and of extreme economic importance to the natives. The destruction of the wild caribou has threatened to expose the Indians to wholesale starvation, hence the effort which the United States government has made to stock the country with domestic reindeer from Siberia. This effort made under the direction of the Bureau of Education has been eminently successful, and in the future the reindeer seems certain to contribute very greatly to the food, clothing, means of shelter and miscellaneous industries of the natives; and not less to the solution of the problems of communication and transportation throughout the interior. It is, however, the fish and the fur-bearing animals of its rivers and surrounding seas that are economically most distinctive of and important to Alaska. The fishing grounds extend along the coast from the extreme south-east past the Aleutians into Bristol Bay. Herring are abundant, and cod especially so. There are probably more than 100,000 sq. m. of cod-banks from 22 to 90 fathoms deep in Bering Sea and E. of the Alaska Peninsula. Salmon are to be found in almost incredible numbers. Of marine mammals, whales are hunted far to the N. in Bering Sea and the Arctic Ocean, but are much less common than formerly, as are also the walrus, the sea otter and the fur seal. All these are disappearing before commercial greed. The walrus is now found mainly far N.; the sea otter, once fairly common throughout the Aleutian district, is now rarely found even on the remoter islands; the fur seal, whose habitat is the Pribilof Islands in Bering Sea, has been considerably reduced in numbers by pelagic hunting. There are half-a-dozen species of hair seals and sea-lions. The number of fur-bearing land animals is equally large. Sables, ermine, wolverines, minks, land otters, beavers and musk-rats have always been important items in the fur trade. There are black, grizzly and polar bears, and also two exclusively Alaskan species, the Kodiak and the glacier bear. The grey wolf is common; it is the basal stock of the Alaskan sledge-dog. The red fox is widely distributed, and the white or Arctic fox is very common along the eastern coast of Bering Sea; a blue fox, once wild, is now domesticated on Kodiak and the Aleutians, and on the southern continental coast, and a black fox, very rare, occurs in south-eastern Alaska; the silver fox is very rare.

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[1] At Kodiak, the monthly means range from 28° to 55° with a total range from −10° to 82° F., as against −3° to 87° F. at Sitka; the average temperature is 40·6° F., rainfall 59 in.

[2] At St Michael the mean annual temperature is about 26°, the monthly means run from about −2° to 54°, and the extreme recorded temperatures from about −55° to 77° F.; at Port Clarence the annual mean is 22°, monthly means −7° to 51° F.; extreme range of temperature, −38° to 77° F.; at Point Barrow the annual mean is 7·7° F., monthly means −18·6° to 38·1° F., extreme range of temperature −55° to 65° F.

[3] The mean annual temperature on the Yukon at the international line is about 21° F., the monthly means run from −17° to 60° F., the range of extreme temperatures from −80° to 90° F.

[4] At Fort Yukon five years' records showed mean seasonal temperatures of 14°, 60°, 17°, and −23·8° F. for spring, summer, autumn and winter respectively; at Holy Cross Mission 20°, 59°, 36° and 0·95°, at Nulato 29°, 60°, 36° and −14°.

[5] The Harriman expedition collected in two months 1000 species of insects, of which 344 species (and 6 genera) were new to science.

The Alaskan flora is less varied than the fauna. The forests of the coastal region eastward from Cook Inlet, and particularly in south-eastern Alaska, are of fair variety, and of great richness and value. The balsam fir and in the south the red cedar occur in scant quantities; more widely distributed, but growing only under marked local conditions, is the yellow or Alaska cedar, a very hard and durable wood of fine grain and pleasant odour. The Oregon alder is fairly common. Far the most abundant are coast and Alpine hemlocks and the tide-land or Sitka spruce. The last is not confined to this part of Alaska, but is the characteristic and universal tree. It is of primary economic importance to the natives, who use it for the most various purposes. On the islands of the Alexander Archipelago and on Prince William Sound it grows to gigantic size; even on the Koyukuk and the middle Yukon it attains in places a diameter of 2 ft. In 1902 a forest reservation comprising the largest part of the Alexander Archipelago was created by the United States government. The separation of the coast and interior floras is almost complete; only along the mountain passes and river valleys, and rarely there, is there an exchange of species. Timber, however, is fairly abundant along the entire course of the Yukon above Anvik (about 400 m. from the mouth), along the great tributaries of the Yukon, and, so far as explorations have revealed, along every stream in central Alaska; and the woods of the interior consist almost entirely of spruce. On the Yukon flats it grows in a vast forest impenetrably dense.[1] The timber line, which in the Panhandle and along the southern coast of the continental mass runs from 1800 to 2400 ft., frequently rises in the interior plateau even to 4000 ft. Next in importance after spruce, in the interior, is birch, and then balsam poplar. Thickets of alders and willows in wet places and new-made land, aspens and large cottonwoods west of the characteristic spruce area (as on Seward Peninsula), are also common. Toward the Arctic circle, the timber becomes, of course, sparse, low, gnarled and distorted. The willows in the Arctic drainage basin shrink to shrubs scarcely knee-high. Bushes are common in western Alaska, but undergrowth is very scanty in the forests. Grasses grow luxuriantly in the river bottoms and wherever the tundra moss is destroyed to give them footing. Most distinctive is the ubiquitous carpeting of mosses, varying in colours from the pure white and cream of the reindeer moss to the deep green and brown of the peat moss, all conspicuously spangled in the brief summer with bright flowers of the higher orders, heavy blossoms on stunted stalks. The thick peat moss or tundra of the undrained lowlands covers probably at least a quarter of Alaska; the reindeer moss grows both on the lowlands and the hills.[2] Sedges available for forage grow in the tundra. In August berries are fairly abundant over the interior; one of them, the salmon or cloud berry, preserved in seal oil for the winter, is an important food of the natives. The grasses are killed by the frosts in September. The western timber limit is on Kodiak Island. The Aleutian Islands (*q.v.*) are almost destitute of trees, but are covered with a luxuriant growth of herbage. Climatic differences cannot account for the treeless condition of the country W. of this point, and the true explanation lies probably in the fact that in winter, when the seeds of the coastal forests ripen and are released, the prevalent winds W. of Kodiak are damp and blow from the S. and S.W., while the spread of the seeds requires dry winds blowing from the N. and N.W. Such favourable conditions occur only rarely.

The *Soil* of Alaska seems to be in itself rich, and quite capable of agricultural development; the great impediment to this is in the briefness of the summer. Contrary, however, to the once universal belief, the experiments of the department of agriculture of the United States have definitely proved that hardy vegetables in great variety can readily be produced in the coastal region and at various stations in the Yukon valley; and presumably, therefore, all over the interior S. of the Arctic circle, save along Bering Sea; also that there is little doubt of the practicability of successfully cultivating buckwheat, barley and oats, and possibly also rye and wheat; that grasses for grazing grow generally and often in abundance; and in general that the possibilities of interior Alaska as a live-stock country are very considerable. It is calculated that a twentieth of south-eastern Alaska is available for agriculture, and that of the entire country 100,000 sq. m. are pasturable or tillable.

Industry.—The fur and fish resources of Alaska have until recently held first place in her industries. Herrings furnish oil and guano, and the young fish are packed as "sardines" at Juneau. Cod can be taken with comparatively little danger or hardship. During the Russian occupation a small amount was shipped to California and the Sandwich Islands. The take since 1879 has been practically constant. The take of halibut is increasing steadily. The salmon industry dates from 1878. The total output (in 1901, 100,000,000 lb; in 1906, about 72,000,000 lb), which since 1900 has been more than half the total salmon product of the United States, is more than ten times the product of all other fish.[3] On the Karluk river, Kodiak Island, is the greatest salmon fishery in the world. More than 3,000,000 salmon have been canned here in one season. The second salmon stream is the Nushagak, flowing into Bristol Bay; this bay is the richest fishing field of Alaska, furnishing in 1901, 35 % of the total production. The recklessly wasteful manner in which these fisheries are conducted, and the inadequate measures taken by the United States government for their protection, threaten the entire industry with destruction. From 1867 to 1902 the value of the total fishery product was estimated at $60,000,000. The fur-seal industry has been better protected but still unavailingly. (See SEAL FISHERIES and BERING SEA ARBITRATION.) The value of the fur seals taken from 1868 to 1902 was estimated at $35,000,000 and that of other furs at $17,000,000. The walrus, hunted for its ivory tusks, and the sea otter, rarest and most valuable of Alaskan fur animals, are near extermination; the blue fox is now bred for its pelt on the Aleutians and the southern continental coast; the skins of the black and silver fox are extremely rare, and in general the whole fur industry is discouragingly decadent. The whale fishery also has greatly fallen off; there is no profit on the oil and the whales are sought for the baleen alone; they are much less numerous too than they once were, and have to be sought farther and farther north.

Minerals.—The timber resources of Alaska are untouched and the serious exploitation of her minerals is very recent. As early as 1861 gold discoveries were made on the Stikine river; repeated discoveries, culminating in the Cassiar district "boom," were made in British Columbia from 1857 to 1874; colourings along the Yukon were reported in 1866–1867 and systematic prospecting of the upper river began about 1873. Juneau was founded in 1880; the same year the opposition of the Indians was withdrawn that had prevented the crossing of the mountain passes to the interior, and after 1880 repeated and scattered discoveries were made on the Lewes, Pelly, Stewart and other streams of the Upper Yukon country in Canada. As early as 1883–1885 there was a considerable mining excitement due to these discoveries, and a much greater one in 1887 after the discovery of coarse gold on Forty Mile Creek in American territory; but these were as nothing to the picturesque and feverish rush that followed the location of the first Klondike claim in Canadian territory in August 1896. (SEE KLONDIKE.) The mines in American territory were temporarily deserted for the new diggings. Other gold districts are scattered over the whole interior of Alaska. Nome (*q.v.*) was the scene of a great gold mining stampede in 1900. The quartz mines near Juneau are among the greatest stamp mills of the world (SEE JUNEAU). The product of gold and silver (of the latter some 1.3 % of the total) from 1895 to 1901 was more than $32,000,000 from Alaska proper (not including that from the Canadian Yukon fields) as against a production of $5,000,000 in 1880–1896. The gold product of the Canadian Yukon territory from 1896–1903 was about $96,000,000, as estimated by the Canadian Geological Survey. In 1905 the product of gold from Alaska was valued at $15,630,000 (mines report); and from 1880 to 1906 the production of gold, according to the estimate of A. H. Brooks, was more than $100,000,000. The gravest problem of mining in the interior country, even graver than that presented by the climate, is transportation; in 1900 the Tanana fields, for example, were provisioned from Circle City, about 125 m. distant, at the rate of a cent per lb mile (*i.e.* $2000 for moving a ton 100 m.). Even higher rates prevailed in the copper country in 1902. Various other minerals in addition to gold have been discovered, and several of them, notably copper and silver (the latter appearing with the gold deposits), may probably be profitably exploited. In 1905 the product of copper was valued at $759,634, that of silver at $80,165 (mines report). Coal, and in much larger quantities lignite, have been found in many parts of Alaska. Most important, because of their location, are deposits along the Alaska Peninsula and between Circle City and Dawson. The latter furnishes fuel to the river steamboats, and it is hoped may eventually supply the surrounding mining region. There are valuable deposits of gypsum on Chicagof Island, and marble quarries are being developed on Prince of Wales Island.

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[1] The trees here grow as large as 10 in. in diameter and 40 or 50 ft. high; the branches do not spread, even where there is room, so that the tallest tree has a top only four or five feet broad; the roots, which cannot penetrate the shaded and frozen soil, spread over the ice or shallowly into the tundra carpeting, and often only by their matted network prevent the fall of the trees.

[2] 280 species of mosses proper, of which 46 were new to science, and 16 varieties of peat moss (*Sphagnum*) were listed by the Harriman expedition; and 74 species or varieties of ferns.

[3] The value of the total product of Alaska's fish canneries was in 1905 $7,735,782, or 29·3 % of the total for the United States; in 1900 it was 17·4 % of the country's total.

As against $7,200,000 paid for Alaska in 1867, the revenues returned to the United States in the years 1867–1903 totalled $9,555,909 (namely, rental for the Fox and Pribilof Islands, $999,200; special revenue tax on seal-skins, $7,597,351; Alaskan customs, $528,558; public lands, $28,928; other sources $401,872). It has been estimated that in the same period the United States drew from Alaska fish, furs and gold to the value of about $150,000,000; that up to 1903 the imports from the states aggregated $100,000,000; and that $25,000,000 of United States capital was invested in Alaska.

Since 1896 communication with the outer world has been greatly increased. Alaskan mails leave the states daily, many post-offices are maintained, mail is regularly delivered beyond the Arctic circle, all the more important towns have telegraphic communication with the states,[1] there is one railway in the interior through Canadian territory from Skagway, and other railways are planned. The total mileage in 1906 was 136 m. In that year the Alaskan Central Railroad (from Seward to Fairbanks, 463 m.) was chartered; 45 m. of this road were in operation in 1905. One long military road as an "All American" route from Valdez has long been built.

Population.—The population in 1867 at the time of the cession from Russia is estimated at 30,000, of which two-thirds were Eskimo and other Indians. Population returned in 1880, 33,426; in 1890, 32,052; in 1900, 63,592, of whom approximately 48 % were whites, 46 % natives and 6 % Japanese and Chinese (with a few negroes). The Asiatics are employed in the salmon canneries. The natives of Alaska fall under four ethnologic races: the Eskimo or Innuit—of these the Aleuts are an offshoot; the Haidas or Kaigani, found principally on Prince of Wales Island and thereabouts; the Thlinkits, rather widely distributed in the "Panhandle"; and the Tinnehs or Athapascans, the stock race of the great interior country. In 1890 the pure-blooded natives numbered 23,531, of whom 6000 were Haidas, Thlinkits or other natives of the coastal region, 1000 Aleuts, 3400 Athapascans and 13,100 Eskimo. The natives have adopted many customs of white civilization, and on the Aleutians, and in coastal Alaska, and in scattered regions in the interior acknowledge Christianity under the forms of the Orthodox Greek or other churches. The rapid exhaustion in late years of the caribou, seals and other animals, once the food or stock-in-trade of the Aleuts and other races, threatens more and more the swift depletion of the natives. They have also felt the fatal influence of the liquor traffic. From 1893 to 1895 the United States expended $55,000 to support the natives of the Fur Seal Islands. This policy threatens to become a continued necessity throughout much of Alaska. There is a small government Indian reservation on Afognak Island, near Kodiak. The white population is extremely mobile, and few towns have an assured or definite future. The prosperity of the mining towns of the interior is dependent on the fickle fortune of the gold-fields, for which they are the distributing points. Sitka, Juneau (the capital) and Douglas, both centres of a rich mining district, Skagway, shipping point for freight for the Klondike country (see these titles), and St Michael, the ocean port for freighting up the Yukon, are the only towns apparently assured of a prosperous future. Wrangell (formerly Fort St Dionysius, Fort Stikine and Fort Wrangell), founded in 1833, is a dilapidated and torpid little village, of some interest in Alaskan history, and of temporary importance from 1874 to 1877 as the gateway to the Cassiar mines in British Columbia. Its inhabitants are chiefly Thlinkit Indians.

Government.—Alaska, by an act of Congress approved the 7th of May 1906, received the power to elect a delegate to Congress. Before this act and the elections of August 1906 Alaska was a governmental district of the United States without a delegate in Congress. Its administration rests in the hands of the various executive departments, and is partly exercised by a governor and other resident officials appointed by the president. It is a military district, a customs district (since 1868), is organized into a land district, and constitutes three judicial divisions. In 1867–1877 the government was in the hands of the department of war, although the customs were from the beginning collected by the department of the treasury, with which the effective control rested from 1877 until the passage of the so-called Organic Act of 17th May 1884. This act extended over Alaska the laws of the state of Oregon so far as they should be applicable, created the judicial district and a land district, put in force the mining laws of the United States, and in general gave the administrative system the organization it retained up to the reforms of 1899–1900. The history of government and political agitation has centred since then in the demand for general land legislation and for an adequate civil and criminal law, in protests against the enforcement of a liquor prohibition law, and in agitation for an efficiently centralized administration. As the general land laws of the United States were not extended to Alaska in 1884, there was no means, generally speaking, of gaining title to any land other than a mining claim, and so far as any method did exist its cost was absolutely prohibitive. After partial and inadequate legislation in 1891 and 1898, the regular system of land surveys was made applicable to Alaska in 1899, and a generous homestead law was provided in 1903. An adequate code of civil and criminal law and provisions for civil government under improved conditions were provided by Congress in 1899 and 1900. The agitation over prohibition dates from 1868; the act of that year organizing a customs district forbade the importation and sale of firearms, ammunition and distilled spirits; the Organic Act of 1884 extended this prohibition to all intoxicating liquors. The coast of Alaska offers exceptional facilities for smuggling, and liquor has always been very plentiful; juries have steadily refused to convict offenders, and treasury officials have regularly collected revenue from saloons existing in defiance of law. The prohibition law is still upon the statute-books. The chief weaknesses in the colonial administration of the territory, particularly prior to 1900—but only to a slightly less extent since—have been decentralization and a lax civil service. The concomitants of these have been irresponsibility and inefficiency. The governor has represented the president without possessing much power; the department of war has had ill-defined duties; the department of justice has, in theory, had charge of the general law; the department of the interior has administered the land law; the agents of the bureau of education have superintended the stocking of Alaska with reindeer; the United States Fish Commission has investigated the condition of marine life without having powers to protect it. The treasury department has chartered the coasts, sought to enforce the prohibition law, controlled and protected the fur seals and fisheries, and incidentally collected the customs. Since the creation of the department of commerce and labour (1903), it has taken over from other departments some of these scattered functions. All in all, the government has proved itself without power to protect the most valuable industries of the district, and for many years there has been talk of a regular territorial government. The paucity of permanent residents and the poverty of the local treasury seem to make such a solution an impossible one.

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[1] Seattle, Sitka and Valdez are connected by cable; telegraph lines run from the Panhandle inland to the Yukon and down its valley to Fort St Michael.

History.—The region now known as Alaska was first explored by the Russian officers Captain Vitus Bering and Chirikov in 1741. They visited parts of the coast between Dixon Entrance and Cape St Elias, and returned along the line of the Aleutians. Their expedition was followed by many private vessels manned by traders and trappers. Kodiak was discovered in 1763 and a settlement effected in 1784. Spanish expeditions in 1774 and 1775 visited the south-eastern coast and laid a foundation for subsequent territorial claims, one incident of which were the Nootka Sound seizures of 1789. Captain James Cook in 1778 made surveys from which the first approximately accurate chart of the coast was published; but it was reserved for Vancouver in 1793–1794 to make the first charts in the modern sense of the intricate south-eastern coast, which only in recent years have been superseded by new surveys. Owing to excesses committed by private traders and companies, who robbed, massacred and hideously abused the native Indians, the trade and regulation of the Russian possessions were in 1799 confided to a semi-official corporation called the Russian-American Company for a term of twenty years, afterwards twice renewed for similar periods. A monopoly of the American trade had previously been granted in 1788 to another private company, the Sholikof. Alexander Baranov (1747–1819); chief resident director of the American companies (1790–1819), one of the early administrators of the new company, became famous through the successes he achieved as governor. He founded Sitka (*q.v.*) in 1804 after the massacre by the natives of the inhabitants of an earlier settlement (1799) at an adjacent point. The headquarters of the company were at Kodiak until 1805, and thereafter at Sitka. In 1821 Russia attempted by *ukase* to exclude navigators from Bering Sea and the Pacific coast of her possessions, which led to immediate protest from the United States and Great Britain. This led to a treaty with the United States in 1824 and one with Great Britain in 1825, by which the excessive demands of Russia were relinquished and the boundaries of the Russian possessions were permanently fixed. The last charter of the Russian-American Company expired on the 31st of December 1861, and Prince Maksutov, an imperial governor, was appointed to administer the affairs of the territory. In 1864 authority was granted to an American company to make explorations for a proposed Russo-American company's telegraph line overland from the Amur river in Siberia to Bering Strait, and through Alaska to British Columbia. Work was begun on this scheme in 1865 and continued for nearly three years, when the success of the Atlantic cable rendered the construction of the line unnecessary and it was given up, but not until important explorations had been made. In 1854 a Californian company began importing ice from Alaska. Very soon thereafter the first official overtures by the United States for the purchase of Russian America were made during the presidency of James Buchanan. In 1867, by a treaty signed on the 30th of March, the purchase was consummated for the sum of $7,200,000, and on the 18th of October 1867 the formal transfer of the territory was made at Sitka.

Since its acquisition by the United States the history of Alaska has been mainly that of the evolution of its administrative system described above, and the varying fortunes of its fisheries and sealing industries. Since the gold discoveries a wonderful advance has been made in the exploration of the country. A military reservation has been created with Fort Michael as a centre. The two events of greatest general interest have been the Fur Seal Arbitration of 1893 (see Bering Sea Arbitration), and the Alaska-Canadian boundary dispute, settled by an international tribunal of British and American jurists in London in 1903. The boundary dispute involved the interpretation of the words, quoted above, in the treaties of 1825 and 1867 defining the boundary of the Russian (later American) possessions, and also the determining of the location of Portland Canal, and the question whether the coastal girdle should cross or pass around the heads of the fjords of the coast. The tribunal was an adjudication board and not an actual court of arbitration, since its function was not to decide the boundary but to settle the meaning of the Anglo-Russian treaty, which provided for an ideal (and not a physical) boundary. This boundary did not fit in with geographical facts; hence the adjudication was based upon the motive of the treaty and not upon the literal interpretation of such elastic terms as "ocean," "shore" and "coast-line." The award of the tribunal made in October 1903 was arrived at by the favourable vote of the three commissioners of the United States and of Lord Alverstone, whose action was bitterly resented by the two Canadian commissioners; it sustained in the main the claims of the United States.

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ALASSIO, a town of Liguria, Italy, on the N.W. coast of the Gulf of Genoa, in the province of Genoa, 57 m. S.W. of the town of the same name by rail. Pop. (1901) 5630. It is mainly noticeable as a health resort in winter and a bathing-place in summer, and has many hotels. The anchorage is safe, and the bay full of fish; the harbour has a certain amount of trade. The old town contains one or two interesting churches, and commands a fine view.

ALASTOR, in Greek mythology, the spirit of revenge, which prompts the members of a family to commit fresh crimes to obtain satisfaction. These crimes necessitate further acts of vengeance, and the curse is thus transmitted from generation to generation. The word is also used for a man's evil genius, which drives him to sin without any provocation; a man so driven is sometimes called *Alastor*. The epithet is applied to Zeus and the Erinyes as the deities of revenge and punishment.

ALA-TAU (*"Variegated Mountains"*), the name of six mountain ranges in Asiatic Russia. Three of these are in the government of Semiryechensk in Central Asia, all belonging to the Tian-shan system:—(1) the Terskei Ala-tau, south of and parallel to the lake of Issyk-kul; (2) the Kunghei Ala-tau, and (3) the Trans-Ili Ala-tau, both N. of and parallel to the same lake; and (4) the Dzungarian Ala-tau, lying N. of the Ili depression. The first three link together the Tian-shan and the Alexander Range. Their mean elevation is 6000–7000 ft.; their culminating point, Talgar, on a transverse ridge between (2) and (3), reaches 15,000 ft.; the limits of perpetual snow run at 11,000–11,700 ft. The Dzungarian Ala-tau reach a maximum altitude of 11,000 ft. and have a mean altitude of 6250 ft. From the middle of the Alexander Range another range (5) called Ala-tau, or Talastau, strikes west by south. The name Ala-tau also enters into the designation of (6), a range between the upper Yenisei and the upper Ob, in the government of Tomsk, namely, the Kuznetsk Ala-tau, forming an outlier of the Altai Mountains, and reaching 6000–7000 ft. in altitude.

ALAUNA, ALAUNUS, the Celtic names of two rivers, &c., in Roman Britain. Hence the modern Allan Water, river Alyn, &c.

ÁLAVA, DON MIGUEL RICARDO DE (1770–1843), Spanish general and statesman, was born at Vittoria in 1770. He served first in the navy, and had risen to be captain of a frigate when he exchanged into the army, receiving corresponding rank. He was present as a marine at the battle of Trafalgar on board the flagship of his uncle Admiral Álava. In politics he followed a very devious course. At the assembly of Bayonne in 1808 he was one of the most prominent of those who accepted the new constitution from Joseph Bonaparte as king of Spain. After the national rising against French aggression, and the defeat of General Dupont at Bailen in 1808, Álava joined the national independent party, who were fighting in alliance with the English. The Spanish Cortes appointed him commissary at the English headquarters, and the duke of Wellington, who regarded him with great favour, made him one of his aides-de-camp. Before the close of the campaign he had risen to the rank of brigadier-general. On the restoration of Ferdinand, Álava was cast into prison, but the influence of his uncle Ethenard, the inquisitor, and of Wellington secured his speedy release. He soon contrived to gain the favour of the king, who appointed him in 1815 ambassador to the Hague. It was therefore his remarkable fortune to be present at the battle of Waterloo with Wellington's staff. He is supposed to have been the only man who was present at both Waterloo and Trafalgar. Four years later he was recalled owing, it is said, to the marked kindness he had shown to his banished fellow-countrymen. On the breaking out of the revolution of 1820 he was chosen by the province of Álava to represent it in the Cortes, where he became conspicuous in the party of the *Exaltados*, and in 1822 was made president. In the latter year he fought with the militia under Francisco Ballesteros and Pablo Murillo to maintain the authority of the Cortes against the rebels. When the French invested Cadiz, Álava was commissioned by the Cortes to treat with the duc d'Angoulême, and the negotiations resulted in the restoration of Ferdinand, who pledged himself to a liberal policy. No sooner had he regained power, however, than he ceased to hold himself bound by his promises, and Álava found it necessary to retire first to Gibraltar and then to England. On the death of Ferdinand he returned to Spain, and espousing the cause of Maria Christina against Don Carlos was appointed ambassador to London in 1834 and to Paris in 1835. After the insurrection of La Granja he refused to sign the constitution of 1812, declaring himself tired of taking new oaths, and was consequently obliged to retire to France, where he died at Barèges in 1843.

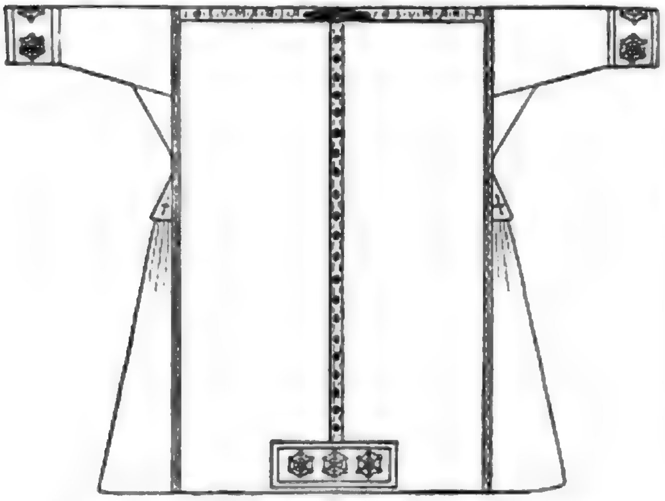
Frequent and honourable mention of Álava is made in Napier's *History of the Peninsular War*, and his name is often met both in lives of the duke of Wellington and in his correspondence.

ÁLAVA, one of the Basque Provinces of northern Spain; bounded on the N. by Biscay and Guipúzcoa, E. by Navarre, S. by Logroño, and W. by Burgos. Pop. (1900) 96,385; area 1175 sq. m. The countship of Trevino (190 sq. m.) in the centre of Álava belongs to the province of Burgos. The surface of Álava is very mountainous, especially on the north, where a part of the Pyrenees forms its natural boundary. It is separated from Logroño by the river Ebro, and its other rivers are the Zadorra and the Ayuda. The climate is mild in summer, fitful in autumn and spring, and very cold in winter, as even the plains are high and shut in on three sides by mountains snow-clad during several months. The soil in the valleys is fertile, yielding wheat, barley, maize, flax, hemp and fruits. Oil and a poor kind of wine called *chacoli* are also produced. Many of the mountains are clothed with forests of oak, chestnuts, beeches and other trees, and contain iron, copper, lead and marble. Salt is also found in large quantities; but mining and quarrying are not practised on a large scale; only lead, lignite and asphalt being worked. There are mineral waters in many places. Other local industries of some importance include smelting, and manufactures of beds, furniture, railway carriages, matches, paper, sweets and woollen and cotton goods. Bread-stuffs, colonial products and machinery are largely imported. Few provinces in Spain are inhabited by so laborious, active and well-to-do a population. The primary schools are numerously attended, and there are very good normal schools for teachers of both sexes, and a model agricultural farm. The public roads and other works of the province are excellent, and, like those of the rest of the Basque provinces, entirely kept up by local initiative and taxes. Railways from Madrid to the French frontier, and from Saragossa to Bilbao, cross the province. The capital is Vitoria (pop. 1900, 30,701), which is the only town with more than 3500 inhabitants.

For a fuller account of the history, people and customs of Álava, see BASQUES and BASQUE PROVINCES, with the works there cited. A very elaborate bibliography is given in the *Cátalogo de las obras referentes ó las provincias de Álava y Navarra*, by A. A. Salazar (Madrid, 1887.) The following books by J. J. Landazuri y Romarate contain much material for a provincial history:—*Historia ecclesiastica, &c.* (Pamplona, 1797); *Historia civil, &c.* (Vitoria, 1798); *Compendios historicos de la ciudad y villas de . . . Álava, &c.* (Pamplona, 1798); *Suplemento ó los cuatro libros de la historia de . . . Álava* (Vitoria, 1799); and *Los varones illustres Álavenses* (Vitoria, 1798). See also M. Risco in vol. 33 of *Hispania Sagrada*, by H. Florez, &c. (Madrid, 1754–1879).

ALB (Lat. *alba*, from *albus*, white), a liturgical vestment of the Catholic Church. It is a sack-like tunic of white linen, with narrow sleeves and a hole for the head to pass through, and when gathered up round the waist by the girdle (*cingulum*) just clears the ground. Albs were originally quite plain, but about the 10th century the custom arose of ornamenting the borders and the cuffs of the sleeves with strips of embroidery, and this became common in the 12th century. These at first encircled the whole border; but soon it became customary to substitute for them square patches of embroidery or precious fabrics. These "parures" "apparels" or "orphreys" (Lat. *parurae*, *grammata*, *aurifrisia*, &c.), were usually four in number, one being sewn on the back and another on the front of the vestment just above the lower hem, and one on each cuff. When, as occasionally happened, a fifth was added, this was placed on the breast just below the neck opening. These "apparelled albs" (*albae paratae*) continued in general use in the Western Church till the 16th century, when a tendency to dispense with the parures began, Rome itself setting the example.

The growth of the lace industry in the 17th century hastened the process by leading to the substitution of broad bands of lace as decoration; occasionally, as in a magnificent specimen preserved at South Kensington, nearly half the vestment is thus composed of lace. At the present time, so far as the Roman Catholic Church is concerned, apparelled albs are only in regular use at Milan (Ambrosian Rite), and, partially, in certain churches in Spain. The decree of the Congregation of Rites (May 18, 1819) says nothing about apparels, but only lays down that the alb must be of white linen or hemp cloth. There is no definite rule as to the material or character of the ornamentation, and attempts have been made, especially in England, to revive the use of the apparelled alb.



Apparelled Alb in the South Kensington Museum.
From Braun's *Liturgische Gewandung*.

In the Roman Church the alb is now reckoned as one of the vestments proper to the sacrifice of the Mass. It is worn by bishops, priests, deacons and subdeacons under the other eucharistic vestments, either at Mass or at functions connected with it. It is sometimes also worn by clerics in minor orders, whose proper vestment is, however, the surplice—itself a modification of the alb (see SURPLICE). The alb is supposed to be symbolical of purity, and the priest, when putting it on, prays: "Make me white and purify my heart, O Lord," &c. In the middle ages the parures, which originally had no mystic intention whatever, were taken to symbolize the wounds of Christ; whence probably is derived the custom surviving at the cathedral of Toledo, of the singers of the Passion on Good Friday being vested in apparelled albs.

In England at the Reformation the alb went out of use with the other "Mass vestments," and remained out of use in the Church of England until the ritual revival of the 19th century. It is now worn in a considerable number of churches not only by the clergy but by acolytes and servers at the Communion. Where the ritual, as in most cases, is a revival of pre-Reformation uses and not modelled on that of modern Rome, these albs are frequently apparelled. For the question of its legality see VESTMENTS.

Both the alb and its name are derived ultimately from the *tunica alba*, the white tunic, which formed part of the ordinary dress of Roman citizens under the Empire. As such it was worn both in and out of church, the few notices remaining which suggest a special tunic for ministers at the Eucharist merely implying that it was not fitting to use for so sacred a function a garment soiled by everyday wear. The date of its definite adoption as a liturgical vestment is uncertain; at Rome—where until the 13th century it was known as the *linea* or *camisia* (cf. the modern Italian *camice* for alb)—it seems to have been thus used as early as the 5th century. But as late as the 9th and 10th centuries the *alba* is still an everyday as well as a liturgical garment, and we find bishops and synods forbidding priests to sing mass in the *alba* worn by them in ordinary life (see Braun, p. 62). Throughout the middle ages, moreover, the word *alba* was somewhat loosely used. In the medieval inventories are sometimes found *albae*, described as red, blue or black; which has led to the belief that albs were sometimes not only made of stuffs other than linen, but were coloured. It is clear, however, from the descriptions of these vestments that in some cases they were actually tunicles, the confusion of terms arising from the similarity of shape (see DALMATIC); in other cases the colour applied to the parures, not to the albs as a whole. Silk albs appear in the inventories, but only very exceptionally.

The equivalent of the alb in the ancient Churches of the East is the sticharion (*στιχάριον*) of the Orthodox Church (Armenian *shapik*, Syrian *Kutina*, Coptic *stoicharion* or *tuniah*). It is worn girdled by bishops and priests in all rites, by subdeacons in the Greek and Coptic rites. By deacons and lectors it is worn ungirdled in all the rites. The colour of the vestment is usually white for bishops and priests (this is the rule in the Coptic Church); for the other orders there is no rule, and all colours, except black, may be used. Its material may be linen, wool, cotton or silk; but silk only is the rule for deacons. In the Armenian and Coptic rites the vestment is often elaborately embroidered; in the other rites the only ornament is a cross high in the middle of the back, save in the case of bishops of the Orthodox Church, whose sticharia are ornamented with two vertical red stripes (*ποταμοί*, "rivers"). In the East as in the West the vestment is specially associated with the ritual of the Eucharist.

The whole subject is exhaustively treated by Father Joseph Braun in *Die liturgische Gewandung* (Freiburg im Breisgau, 1907). See also bibliography to the article VESTMENTS.

ALBA, a town and episcopal see of Piedmont, Italy, on the river Tanaro, in the province of Cuneo. From the town of the same name it is 33 m. N.E. direct; it is 42 m. S.S.E. of Turin by rail. Pop. (1901) 13,000. It contains a fine cathedral, with a Gothic façade, reconstructed in 1486, and is an important commercial centre. It occupies the site of the ancient Alba Pompeia, probably founded by Pompeius Strabo (consul 89 B.C.) when he constructed the road from Aquae Statiellae (Acqui) to Augusta Taurinorum (Turin). Probably this was the road taken by Decimus Brutus when he succeeded, after the raising of the siege of Mutina in 43 B.C., in occupying Pollentia just before Mark Antony's cavalry came in sight. Alba was the birthplace of the emperor Pertinax. It became an episcopal see dependent on Milan in the 4th century. A small museum of local antiquities was established in 1897.

See F. Eusebio in *Atti del Congresso Internazionale di Scienze Storiche* (Rome, 1904), vol. v. p. 485.

ALBACETE, an inland province of south-eastern Spain, formed in 1833 out of the northern half of Murcia, and bounded on the N. by Cuenca, E. by Valencia and Alicante, S. by Murcia, and W. by Granada and Jaén. Pop. (1900) 237,877; area 5737 sq. m. The northern part of Albacete belongs to the high plains of New Castile, the southern is generally mountainous, traversed by low ranges or isolated groups of hills, which culminate in the Sierra de Alcaraz on the borders of Granada, where several summits reach 5000 ft. Besides many smaller streams, two large rivers water the province, the Segura in the south-west, and the Júcar in the north-east; both rising beyond the borders of Albacete, and ultimately flowing into the Mediterranean. The fertile glens of the Alcaraz district are richly wooded, and often, from their multitude of fruit trees, resemble the *huertas* or gardens of Alicante; but broad tracts of land are destitute of trees, and suitable only for pasture. These barren regions are thinly peopled; and for the whole of Albacete the density of population (41·3 per sq. m. in 1900) is lower than in any other Spanish province, except Soria.

The climate is generally mild and healthy, although, among the higher mountains, the snow lies for several months. Wheat and other cereals are cultivated, with fruits of many kinds, olives, and vines which yield a wine of fair quality; while saffron is largely produced, and some attention is given to the keeping of bees and silkworms. Stock-farming, for which the wide plains afford excellent opportunities, employs many of the peasantry; the bulls of Albacete are in demand for bull-fighting, and the horses for mounting the Spanish cavalry. There is also a good breed of mules. Sulphurous and other mineral springs, both hot and cold, exist in several districts, and deposits of silver, iron, copper, sulphur, coal and other minerals have been discovered; but the exploitation of these is retarded by lack of communications, and, apart from building materials, sulphur and salt, the actual output is insignificant. Manufactures are almost confined to the spinning of hemp, and the making of coarse cloth, porcelain, earthenware and cutlery. Brandy distilleries are numerous, and there is some trade in wood; but no local industry can rival agriculture and stock-breeding, which furnish the bulk of the exports. Albacete (pop. 1900, 21,512), the capital, and the other important towns of Almansa (11,180) and Hellín (12,558), are described under separate headings. Alcaraz, which gives its name to the mountain range already mentioned, is a picturesque old town with the ruins of a Moorish castle, and a fine Roman aqueduct; pop. (1900) 4501. Caudete (5913), Chinchilla, or Chinchilla de Monte-Aragon (6680), La Roda (7066), Tobarra (7787), Villarrobledo (10,125) and Yeste (6591) are important markets for the sale of agricultural produce. The railway from Madrid to Albacete passes south-westward to Chinchilla, where it bifurcates, one line going to Murcia, and the other to Alicante. A large part of the province is only accessible by road, and even the main highways maintained by the state are ill kept. Education is very backward even in the towns; many of the inhabitants carry arms; and crimes of violence are not infrequent.

ALBACETE, the capital of the above province, on the Madrid-Alicante railway, and at the confluence of the river Balazote with the canal of Maria Christina, which flows into the river Júcar, 16 m. N. Pop. (1900) 21,512. Albacete comprises the picturesque old upper town and the new or lower town, with law-courts, schools, barracks, hospitals, a council-hall, a bull-ring and other modern buildings, mostly erected after the city became a provincial capital in 1833. It is surrounded by a fertile plain, and has considerable trade in saffron and agricultural produce. A great market, chiefly for the sale of cattle, is held annually in September, and extends over several days. The manufacture of matches is aided by the existence of sulphur workings in the vicinity; and Albacete formerly had an extensive trade in cutlery, from which it was named the Sheffield of Spain. Despite the importation of cutlery from England and Germany, Albacete is still famous for its daggers, which are held in high repute by Spaniards. They are formidable weapons, of coarse manufacture, but with richly ornamented handles; and they frequently bear proverbial inscriptions suitable to their murderous appearance.

ALBA FUCENS (mod. *Albe*), an ancient Italian town occupying a lofty situation (3347 ft.) at the foot of the Monte Velino, 4 m. N. of Avezzano. It was originally a town of the Aequi, though on the frontier of the Marsi, but was occupied by a Roman colony (304 B.C.) owing to its strategic importance. It lay on a hill just to the north of the Via Valeria, which was probably prolonged beyond Tibur at this very period. In the Second Punic war Alba at first remained faithful, but afterwards refused to send contingents and was punished. After this it became a regular place of detention for important state prisoners, such as Syphax of Numidia, Perseus of Macedonia, Bituitus, king of the Arverni. It was attacked by the allies in the Social War, but remained faithful to Rome; and its strong position rendered it a place of some importance in the civil wars. Its prosperity, in the imperial period, can only be inferred from the number of inscriptions found there. It is chiefly remarkable for its finely preserved fortifications. The external walls, which have a circuit of about 2 m., are constructed of polygonal masonry; the blocks are carefully jointed, and the faces smoothed. With our present knowledge of such constructions, their date cannot certainly be determined. They are not preserved to any very considerable height; but the arrangement of the gates is clearly traceable; as a rule they come at the end of a long, straight stretch of wall, and are placed so as to leave the right side of any attacking force exposed. On the north there is, for a length of about 150 yds. a triple line of defences of later date (possibly added by the Roman colonists), inasmuch as both the city wall proper and the double wall thrown out in front of it are partly constructed of concrete, and faced with finer polygonal masonry (in which horizontal joints seem to be purposely avoided). A mile to the north of the city a huge mound with a ditch on each side of it (but at a considerable distance from it) may be traced for a couple of miles. Within the walls there are hardly any buildings of a later date. Excavations have only been made casually, though remains of buildings and of roads can be traced, and also an extensive system of underground passages perhaps connected with the defences of the place. The hill at the western extremity was occupied by a temple of the Tuscan order, into which was built the church of S. Pietro; this contains ancient columns, and some remarkably fine specimens of Cosmatesque work. It is the only monastic church in the Abruzzi in which the nave is separated from the aisles by ancient columns. The collegiate church of S. Nicola in the village contains a remarkable *staurotheca* of the 11th (?) century, and a wooden triptych in imitation of the Byzantine style with enamels of the 13th century.

A very good description of the site, with plans, is given by C. Promis, *L'Antichità di Alba Fucense* (Rome, 1836). (T. As.)

ALBA LONGA, an ancient city of Latium, situated on the western edge of the Albanus Lacus, about 12 m. S.E. of Rome. It was, according to tradition, founded by Ascanius, and was the oldest of all Latin cities—the mother indeed of Rome, by which, however, it was destroyed, it is said under Tullus Hostilius. By this act Rome succeeded to the hegemony of the Latin league. It has by many topographers been placed between the Albanus Mons and the Albanus Lacus, according to the indication given by Dionysius (i. 66), at the monastery of Palazzolo; but the position is quite unsuitable for an ancient city, and does not at all answer to Livy's description, *ab situ porrectae in dorso urbis Alba longa appellata*; and it is much more probable that its site is to be sought on the western side of the lake, where the modern Castel Gandolfo stands, immediately to the north of which the most important part of the archaic necropolis was situated. Confirmation of this may be found in Cicero's description (*Pro Milone*, 85) of the destruction of the shrines and sacred groves of Alba by the construction of Clodius's villa, in the local application of the adjective *Albanus*, and in the position of Castel Gandolfo itself, which exactly suits Livy's description. No traces of the ancient city, except of its necropolis, the tombs of which are overlaid with a stratum of peperino 3 ft. thick, are preserved. The view that the modern Albano occupies the site of Alba Longa was commonly held in the 15th and 16th centuries, but was disproved by P. Cluver (1624). But it is certain that no city took the place of Alba Longa until comparatively late times. The name *Albanum*, from about 150 B.C. till the time of Constantine, meant a villa in the Alban territory. The emperors formed a single estate out of a considerable part of this district, including apparently the whole of the lake, and Domitian was especially fond of residing here. The imperial villa occupied the site of the present Villa Barberini at Castel Gandolfo, and considerable remains of it still exist. To the south was a camp for the imperial bodyguard, with baths, an amphitheatre, a large water reservoir, &c. The first legion known to have been quartered there is the *II. Parthica*, founded by Septimius Severus; but it was probably constructed earlier. In some of the tombs of these legionaries coins of Maxentius have been found, while the *Liber Pontificalis* records that Constantine gave to the church of Albano "omnia scheneca deserta vel domos intra urbem Albanensem," which has generally been taken to refer to the abandoned camp. It was at this period, then, that the *civitas Albanensis* arose. The lapis Albanus is a green grey volcanic stone with black and white grains in it (hence the modern name, peperino), much used for building material.

See T. Ashby in *Journal of Philology*, xxvii., 1901, 37. (T. As.)

ALBAN, SAINT, usually styled the protomartyr of Britain, is said to have been born at Verulamium (the modern St Albans in Hertfordshire) towards the close of the 3rd century, and to have served for seven years in Rome in the army of the emperor Diocletian. On his return to Britain he settled at his native place and was put to death as a Christian during the persecution of Diocletian (*c.* 286–303). According to tradition, when peace was restored, great honours were paid to his tomb. A church was built on the spot, *c.* 793, by King Offa of Mercia. A monastery was subsequently added, and around it the present town of St Albans gradually grew up. Pope Adrian IV., who was born in the neighbourhood, conferred on the abbot of St Alban's the right of precedence over his fellow abbots, a right hitherto attached to the abbey of Glastonbury. St Alban is commemorated in the Roman martyrology on the 22nd of June; but it is impossible to determine with certainty whether he ever existed, as no mention of him occurs till the middle of the 6th century.

See U. Chevalier, *Répertoire des sources historiques* (1905), i. 95; D. Hardy, *Descriptive Catalogue* (1862), I. i. 3-34, ii. 688.

ALBANI, or Albano, **FRANCESCO** (1578–1660), Italian painter, was born at Bologna. His father was a silk merchant, and intended to bring up his son to the same occupation; but Albani was already, at the age of twelve, filled with so strong an inclination for painting, that on the death of his father he devoted himself entirely to art. His first master was Denis Calvert, with whom Guido Reni was at the same time a pupil. He was soon left by Calvert entirely to the care of Guido, and contracted with him a close friendship. He followed Guido to the school of the Caracci; but after this, owing to mutual rivalry, their friendship began gradually to cool. They kept up for a long time a keen competition, and their mutual emulation called forth some of their best productions. Notwithstanding this rivalry, they still spoke of each other with the highest esteem. Albani after having greatly improved himself in the school of the Caracci, went to Rome, where he opened an academy and resided for many years. Here he painted, after the designs of Annibal Caracci, the whole of the frescoes in the chapel of San Diego in the church of San Giacomo degli Spagnuoli. His best frescoes are those on mythological subjects, of which there is a large number in the Verospi, now Torlonia Palace. On the death of his wife he returned to Bologna, where he married a second time and resided till his death. His wife and children were very beautiful and served him for models. The learning displayed in the composition of his pictures, and their minute elaboration and exquisite finish, gave them great celebrity and entitle them to a distinctive place among the products of the Bolognese school. A number of his works are at Bologna, and others at Florence, the Louvre, Dresden and St Petersburg. Among the best of his sacred subjects are a "St Sebastian" and an "Assumption of the Virgin," both in the church of St Sebastian at Rome. He was among the first of the Italian painters to devote himself to the painting of cabinet pictures. A rare etching, the "Death of Dido," is attributed to him.

ALBANI, the stage name of Marie Louise Emma Cecile Lajeunesse (1847–   ), Canadian singer, who was born at Chambly, in the province of Quebec, on the 27th of September 1847. She made her first public appearance in Montreal, at the age of seven, and afterwards studied in the United States, Paris and Italy. In 1870 she made her first appearance at Messina, and after two successful seasons appeared in London in 1872 with the Royal Italian Opera. Later she abandoned opera for oratorio, and sang at all the principal festivals. She has made several tours of Canada and of the United States, and in 1886 sang at the opening of the Colonial and Indian Exhibition in London the ode written by Tennyson for the occasion. She frequently sang before Queen Victoria, the German emperor and others of the crowned heads of Europe, and received numerous marks of their esteem. In 1897 she was awarded the gold Beethoven medal by the London Philharmonic Society, "as a mark of appreciation of her exceptional genius and musical attainments, and of her generous and artistic nature." She married in 1878 Ernest Gye, the theatrical manager. Her stage name of Madame Albani was taken from that of an extinct Italian family.

See Morgan, *Canadian Men and Women of the Time* (1898).

ALBANIA, the ancient name of a district in the eastern Caucasus, consisting, according to Strabo (xi. 4. 1-8), of the valley of the Cyrus (Kur) and the land lying between it and the Caucasus range from Iberia to the Caspian Sea, *i. e.* the modern Shirvan. In reality the Albani inhabited also the mountain valleys and the land to the north towards Sarmatia, the modern Daghestan (Pliny vi. 39). Dionysius of Halicarnassus quotes a tradition that the name arose from the alleged fact that the people were the descendants of emigrants from Alba in Italy, but it would seem that the race was of Lesghian (not Georgian) descent. Strabo describes them as tall, well made, and in character simple and honest; he says that payment was in kind and that the people could not count beyond a hundred. They worshipped the sun, and more particularly the moon, the latter being perhaps identical with the great Nature Goddess of Asia Minor (see Great Mother of the Gods), and believed in soothsaying and the virtue of human sacrifice. Old age was held in high honour, but it was sacrilege to speak, or even to think, of the dead. The race was nomadic, and lived on the abundant natural fruits of the land. In Strabo's time they appear to have been ruled by a single king, though previously there were twenty-six, each one ruling over a community distinct only in point of language. The Albani became known to the Romans during Pompey's pursuit of Mithradates the Great (65 B.C.), against which they are said to have opposed a force of 60,000 foot and 20,000 cavalry. Pompey exacted from them a nominal submission, but their independence was not seriously affected by the Romans. In the reign of Hadrian their territory was invaded by the Alani (Th. Mommsen, *Provinces of the Roman Empire*, Eng. trans., 1886), and later they fell under the Sassanid rule. They were driven finally into Armenia by the Khazars, and ceased to exist as a separate people. The district subsequently suffered under the successive invasions of Huns, Varangians (who captured the chief town Barda in the 10th century) and Mongols. (See Caucasia, *History*; Armenia.)

ALBANIA, a portion of the Turkish empire extending along the western littoral of the Balkan Peninsula from the southern frontier of Montenegro to the northern confines of Greece. Albania is perhaps the least-known region in Europe; and though more than a hundred years have passed since Gibbon described it as "a country within sight of Italy, which is less known than the interior of America," but little progress has yet been made towards a scientific knowledge of this interesting land and its inhabitants. The wild and inaccessible character of the country, the fierce and lawless disposition of the people, the difficulties presented by their language and their complex social institutions, and the inability of the Turkish authorities to afford a safe conduct in the remoter districts, combine to render Albania almost unknown to the foreign traveller, and many of its geographical problems still remain unsolved. A portion of the Mirdite region, the Mat district, the neighbourhood of Dibra, Jakova and Ipek and other localities have never been thoroughly explored. The northern boundary of Albania underwent some alteration in consequence of the enlargement of Montenegro, sanctioned by the Berlin Treaty (July 13, 1878); owing to subsequent arrangements providing for the cession of Dulcigno to Montenegro (November 25, 1880) in exchange for the districts of Plava and Gusinye, restored to Turkey, the frontier-line (finally settled December 1884) now ascends the Boyana from its mouth to Lake Sass (Shas), thence passes northward, and crossing Lake Scutari separates the district of Kutch Kraïna on the N. from the territories of the Gruda, Hot and Klement tribes on the S.; leaving Gusinye and Plava to the S.E., it turns to the N.W. on reaching the Mokra Planina, and then follows the course of the Tara river. On the S., Albanian territory was curtailed owing to the acquisition of the Arta district by Greece (May 1881), the river Arta now forming the frontier. On the E. the chains of Shar, Grammos and Pindus constitute a kind of natural boundary, which does not, however, coincide with ethnical limits nor with the Turkish administrative divisions. North-eastern Albania forms part of the Turkish vilayet of Kossovo; the northern highlands are included in the vilayet of Shkodra (Scutari), the eastern portion of central Albania belongs to the vilayet of Monastir, and the southern districts are comprised in the vilayet of Iannina. The boundaries of the three last-named vilayets meet near Elbassan. The name Albania (in the Tosk dialect *Arberia*, in the Gheg *Arbenia*), like Albania in the Caucasus, Armenia, Albany in Britain, and Auvergne (*Arvenia*) in France, is probably connected with the root *alb*, *alp*, and signifies "the white or snowy uplands."

Physical Features.—The mountain system is extremely complex, especially that of the northern region. On the E. the great Shar range, extending in a south-westerly direction from the neighbourhood of Prishtina to that of Dibra, is continued towards the S. by the ranges of Grammos and Pindus; the entire chain, a prolongation of the Alpine systems of Bosnia and Dalmatia, may be described as the backbone of the peninsula; it forms the watershed between the Aegean and the Adriatic, and culminates in the lofty peak of Liubotrn, near Kalkandele, one of the highest summits in south-eastern Europe (8858 ft.). The country to the west of this natural barrier may be divided geographically into three districts—northern, central and southern Albania. The river Shkumb separates the northern from the central district, the Viossa the central from the southern. The highland region of northern Albania is divided into two portions by the lower course of the Drin; the mountains of the northern portion, the Bieska Malziis, extend in a confused and broken series of ridges from Scutari to the valleys of the Ibar and White Drin; they comprise the rocky group of the Prokletia, or Accursed Mountains, with their numerous ramifications, including Mount Velechik, inhabited by the Kastrat and Shkrel tribes, Bukovik by the Hot, Golesh by the Klement, Skulsen (7533 ft.), Baba Vrkh (about 7306 ft.), Maranay near Scutari, and the Bastrik range to the east. South of the Drin is another complex mountain system, including the highlands inhabited by the Mirdites and the Mat tribe; among the principal summits are Deia Mazzuklit, Mal-i Vels, Kraba, Toli and Mnela. Central Albania differs from the northern and southern regions in the more undulating and less rugged character of its surface; it contains considerable lowland tracts, such as the wide and fertile plain of Musseki, traversed by the river Simen. The principal summit is Tomor (7916 ft.), overhanging the town of Berat. Southern Albania, again, is almost wholly mountainous, with the exception of the plains of Iannina and Arta; the most noteworthy feature is the rugged range of the Tchika, or Khimara mountains, which skirt the sea-coast from south-west to north-east, terminating in the lofty promontory of Glossa (ancient *Acroceraunia*). Farther inland the Mishkeli range to the north-east of Lake Iannina and the Nemertzika mountains run in a parallel direction. In the extreme south, beyond the basin of the Kalamas, the mountains of Suli and Olyzika form a separate group. The rivers, as a rule, flow from east to west; owing to the rapidity of their descent none are navigable except the Boyana and Arta in their lower courses. The principal rivers are the Boyana, issuing from Lake Scutari, and consequently regarded as a continuation of the Montenegrin Moratcha, the Drin, formed by the confluence of the White and Black Drin, which, flowing respectively to the south and north through a long valley at the foot of the Shar range, take a westerly direction after their junction, the Matia, the Arzen, the Shkumb (ancient *Genusos*), the Simen (*Apsos*), formed by the junction of the Devol and Ergene, the Viossa (*Aöus*), which owing to the trend of the Khimara range takes a north-westerly direction, the Kalamas (*Thyamis*) and the Arta (*Arachthos*), flowing south into the Ambracian Gulf. A portion of the stream of the Drin has found its way into the Boyana channel; the result has been a rise in the level of Lake Scutari and the inundation of the adjacent lowlands. A proposal to confine the Drin to its former course by means of a dyke, and to ease the downflow of the Boyana by a canal opening navigation to Lake Scutari, has long been considered by the Turkish authorities. The great lakes of Scutari (135 sq. m.) and Ochrida (107 sq. m.) are among the most beautiful in Europe; the waters of Ochrida, which find an outlet in the Black Drin, are of marvellous clearness. Lake Malik, south by east of Ochrida, is drained by the Devol. The waters of the picturesque Lake Iannina (24 sq. m.) find an issue by *katabothra*, or underground channels, into the Ambracian Gulf. The lake of Butrinto (Buthrotum) is near the sea-coast opposite Corfu.

Climate.—The climate is healthy in the uplands, though subject to violent changes; in the valleys fever is very prevalent, especially in the basins of the Boyana, the lower Drin and the Simen. The winter is short, but exceedingly cold; snow remains on the Prokletia and other mountains till August, and sometimes throughout the year. The summer temperature in the plains is that of southern Italy; in the mountain districts it is high during the day, but falls almost to freezing-point at night. The sea-coast is exposed to the fierce *bora*, or north wind, during the spring.

Natural Products.—The mountains of Albania are said to be rich in minerals, but this source of wealth remains practically unexplored. Iron and coal are probably abundant, and silver-lead, copper and antimony are believed to exist. Gold mines were worked in antiquity in the Drin valley, and silver mines in the Mirdite region were known to the Venetians in the middle ages. At Selinitza, near Avlona, there is a remarkable deposit of mineral pitch which was extensively worked in Roman times; mining operations are still carried on here, but in a somewhat primitive fashion. The splendid forests, of which there are 70,000 acres in the vilayet of Scutari alone, are undergoing a rapid process of destruction, as in other lands under Turkish rule. The principal trees are the oak, the valonia oak, the beech, ash, elm, plane, celtis, poplar and walnut, which give way in the higher regions to the pine and fir. The oak forests near Dibra, where charcoal-making is a considerable industry, and the beech-woods of the Prishtina district, are especially remarkable. The sumach is largely grown in the Mirdite district; its leaves are exported to Trieste for use in tanneries and dyeworks. In 1898 the export of valonia was estimated at £11,200, of sumach at £2400. Of fruit-trees the white mulberry, cherry and wild pear are plentiful; the chestnut and walnut are sometimes met with, and the olive is grown in the lowland and maritime districts. The exportation of olive oil in 1898 was valued at £24,000. The greater part of the country is admirably suited to viticulture, and wine of tolerable quality is produced. Tobacco is grown extensively in southern Albania, especially near Berat and in the upper valley of the Viossa, but the quantity exported is small. The means of subsistence are mainly provided by the cultivation of grain and cattle-rearing. Notwithstanding the primitive condition of agriculture, the deficiency of communications and the damage caused by frequent inundations, Albania furnishes almost the entire corn supply of the Dalmatian coast and islands. Maize is the favourite grain for home consumption, but considerable quantities of this cereal, as well as barley, rye and oats are exported. The total export of cereals in 1898 was valued at £70,800. Sheep and goats form almost the only wealth of the mountaineers of northern Albania; large cattle are found only on the plains. The slopes of Pindus afford excellent pasture for the flocks of the Vlach shepherds. The export of raw hides and wool is considerable; in 1898 these commodities were valued respectively at £90,400 and £24,000. The lakes and rivers of Albania abound in fish. The *scoranse* (Alb. *seraga*), a kind of sardine, is taken in great quantities in Lake Scutari; it is salted and smoked for home consumption and exportation. Sea-fishing is almost wholly neglected. There are salines at Avlona and other places on the coast.

Commerce and Industries.—The exports in 1898 were estimated at £480,000, the imports at £1,360,000, the former comprising agricultural produce, live stock, hides, wool, cheese, eggs, poultry, olive oil, valonia, sumach leaves, timber, skins of wild animals, silk, tobacco and salted fish, the latter manufactured articles, cloth, hardware, furniture, firearms, gunpowder, sugar, coffee, &c. The monopoly of Albanian commerce formerly possessed by Venice has descended to Austria-Hungary; the trade with other countries, except Italy, is inconsiderable. Owing to the poverty of the people, cheap Austrian goods find a readier sale than the more expensive and solid British manufactures. The maritime traffic is largely conducted by the steamers of the subsidized Austrian-Lloyd company, Trieste being the principal commercial centre; the coasting trade is carried on by small Greek and Turkish sailing vessels. The trade of the northern and western districts has to some extent been diverted to Salonica since the opening of the railways from that town to Mitrovitza and Monastir. The development of commerce is retarded by lack of communications; the country possesses no railways and few roads. Several railway lines have been projected, but there is no great probability of their construction under existing political conditions. The Via Egnatia, the great Roman highway to the east, is still used; it runs from Durazzo (*Dyrrhachium*) to Elbassan and Ochrida. Iannina is connected by carriage-roads with Monastir, Agii Saranta and Preveza. As a rule, however, bridle-paths supply the only means of communication. The native industries are inconsiderable, and many of them are in a languishing condition. The manufacture of highly ornate firearms, yataghans and other weapons at Scutari, Jakova and Prizren has declined, owing to the importation of modern rifles and revolvers. Gold and silk embroidery, filigree work, morocco and richly-braided jackets are produced for home use and for sale in Bosnia, Macedonia and Montenegro.

Population.—The population of Albania may be estimated at between 1,600,000 and 1,500,000, of whom 1,200,000 or 1,100,000 are Albanians. Of the other races the Slavs (Serbs and Bulgars) are the most numerous, possibly numbering 250,000. Servian settlements exist in various parts of northern Albania; there is a strong Bulgarian colony in the neighbourhood of Dibra and Ochrida; farther south, Mount Zygos and the Pindus range—the "Great Walachia" of the middle ages—are inhabited by Vlachs or Tzintzars, who possibly number 70,000. Some Turkish colonies are also found in the south-eastern districts. There is a considerable Greek-speaking population in Epiros (including many Mahommedan Albanians), which must, however, be distinguished from the genuine Greeks of Iannina, Preveza and the extreme south; these may be estimated at 100,000. The population of the vilayet of Scutari is given as 237,000, that of the vilayet of Iannina as 552,000. The principal towns are Scutari (Albanian *Shkoder*, with the definite article *Shkodr-a*), the capital of the vilayet of that name, pop. 32,000; Prizren, 30,000; Iannina (often incorrectly written *Ioannina*), capital of the southern vilayet, 22,000; Jakova, 12,000; Dibra, 15,000; Prishtina, 11,000; Ipek (Slav. *Petch*), 15,000; Berat, 15,000; Ochrida, 11,000; Tirana, 12,000; Argyrokastro, 11,000; Kortcha (Slav. *Goritza*), 10,000; Elbassan (perhaps ancient *Albanopolis*), 8000; Metzovo, 7500; Preveza, 6500; Avlona, 6000; Durazzo, 5000; Parga, 5000; Butrinto, 2000; and Kroia, the ancient fortress of Scanderbeg, 5000. All these, except Elbassan, Metzovo and Kroia, are described in separate articles.

The Albanians are apparently the most ancient race in south-eastern Europe. History and legend afford no record of their arrival in the Balkan Peninsula. They are probably the descendants of the earliest Aryan immigrants, who were represented in historical times by the kindred Illyrians, Macedonians and Epirots; the Macedonians and Epirots are believed by Hahn to have formed the core of the pre-Hellenic Tyrrheno-Pelasgian population which inhabited the southern portion of the peninsula and extended its limits to Thrace and Italy. The Illyrians were also "Pelasgian," but in a wider sense. Of these cognate races, which are described by the Greek writers as barbarous or non-Hellenic, the Illyrians and Epirots, he thinks, were respectively the progenitors of the *Ghegs*, or northern, and the *Tosks*, or southern, Albanians. The Via Egnatia, which Strabo (vii. fragment 3) describes as forming the boundary between the Illyrians and Epirots, practically corresponds with the course of the Shkumb, which now separates the Ghegs and the Tosks. The same geographer (v. 2. 221) states that the Epirots were also called Pelasgians; the Pelasgian Zeus was worshipped at Dodona (Homer, *Il.* xvi. 234), and the neighbourhood of the sanctuary was called Pelasgia (Herodotus ii. 56). The meaning of the term "Pelasgian" is, however, too obscure to furnish a basis for ethnographical speculation; in the time of Herodotus it may have already come to denote a period rather than a race. The name *Tosk* is possibly identical with *Tuscus*, *Etruscus*, while the form *Tyrrhenus* perhaps survives in Tirana. The large number of Slavonic local names in Albania, even in districts where no trace of a Slavonic population exists, bears witness to the extensive Servian and Bulgarian immigrations in the early middle ages, but the original inhabitants gradually ousted or assimilated the invaders. The determination with which this remarkable race has maintained its mountain stronghold through a long series of ages has hitherto met with scant appreciation in the outside world. While the heroism of the Montenegrins has been lauded by writers of all countries, the Albanians—if we except Byron's eulogy of the Suloits—still remain unsung. Not less noticeable is the tenacity with which isolated fragments of the nation have preserved their peculiar characteristics, language, customs and traditions. The Albanians in Greece and Italy, though separated for six centuries from the parent stock, have not yet been absorbed by the surrounding populations.

The Albanians, both Ghegs and Tosks, call themselves *Shküpetar*, and their land *Shküpenia* or *Shküperia*, the former being the Gheg, the latter the Tosk form of the word. *Shküpetar* has been variously interpreted. According to Hahn it is a participial from *shkyipoij*, "I understand," signifying "he who knows" the native language; others interpret it with less probability as "the rock-dweller," from *shkep*, *shkip*, N. Alb. *shkamp*, "rock." The designations *Arber* (Gr. Ἀρβανίτης, Turk. *Arnaout*), denoting the people, and *Arbenia* or *Arberia*, the land, are also, though less frequently, used by the Albanians. A district near Kroia is locally known as Arbenia; the Tosk form *Arberia* strictly applies only to the mountain region near Avlona. The region inhabited by a more or less homogeneous Albanian population may be roughly marked out by a line drawn from the Montenegrin frontier at Berane to Mitrovitza and the Servian frontier near Vranya; thence to Usküb, Prilep, Monastir, Florina, Kastoria, Iannina and Parga. These limits, however, are far from including all the members of a widely scattered race. The Albanians in Greece, whose settlements extend over Attica, Boeotia, the district of Corinth and the Argolid peninsula, as well as southern Euboea and the islands of Hydra, Spetzae, Poros and Salamis, descend from Tosk immigrants in the 14th century. They played a brilliant part in the War of Independence (1821–1829), and to-day supply the Greek army with its best soldiers. They were estimated by Leake at 200,000. A large number still speak the Albanian language; many of the older men, and a considerable proportion of the women, even in the neighbourhood of Athens, are ignorant of Greek. The Albanian settlements in southern Italy and Sicily were founded in 1444, 1464 and 1468; minor immigrations followed in the three succeeding centuries. In southern Italy there are 72 Albanian communes, with 154,674 inhabitants; in Sicily 7 communes, with 52,141 inhabitants. The Italian and Sicilian Albanians are of Tosk descent, and many of them still speak a variation of the Tosk dialect. There are also several Albanian settlements in European Turkey and Asia Minor, some founded by military colonists who received grants of land from successive sultans, others owing their origin to enforced migrations after insurrections in Albania. The only genuine division of the Albanian race is that of Ghegs and Tosks; the Liaps, who inhabit the district between the Viossa and the sea, and the Tshăms or Chăms, who occupy the coast-land south of the Kalamas, are subdivisions of the Tosk family. The name Gheg (*Gĕgĕ-a*) is not adopted by the Ghegs themselves, being regarded as a nickname; the designation Tosk (*Toskĕ-a*) is restricted by the Tosks to the inhabitants of a small region north of the lower Viossa (Toskería).

National Characteristics.—While the other primitive populations of the peninsula were either hellenized or latinized, or subsequently absorbed by the Slavonic immigration, the Albanians to a great extent remained unaffected by foreign influences. Retaining their original language and preserving the customs and institutions of remote antiquity, they present a distinct type, and differ in many essential particulars from the other nations of the peninsula. The Ghegs especially, notwithstanding their fierce and lawless character, their superstition, ignorance and predatory propensities, possess some noteworthy qualities rarely found in eastern Europe: simple, brave, faithful, and sometimes capable of devoted attachment, these wild mountaineers make excellent soldiers and trustworthy retainers; they have long furnished a bodyguard to the sultan and, like the Tosks, are much employed as kavasses and attendants at foreign embassies and consulates in the East. The native disposition of the Tosks has been modified by intercourse with the Greeks and Vlachs; while the Gheg devotes his attention exclusively to fighting, robbery and pastoral pursuits, the Tosk occasionally occupies himself with commercial, industrial or agricultural employments; the Gheg is stern, morose and haughty, the Tosk lively, talkative and affable. The natural antipathy between the two sections of the race, though less evident than in former times, is far from extinct. In all parts of Albania the vendetta (*gyăk, jăk*) or blood-feud, the primitive *lex talionis*, is an established usage; the duty of revenge is a sacred tradition handed down to successive generations in the family, the village and the tribe. A single case of homicide often leads to a series of similar crimes or to protracted warfare between neighbouring families and communities; the murderer, as a rule, takes refuge in the mountains from the avenger of blood, or remains for years shut up in his house. It is estimated that in consequence of these feuds scarcely 75% of the population in certain mountainous districts die a natural death. A truce (*bessa*, literally "faith," "pledge"), either temporary or permanent, is sometimes arranged by mediation, or among the Ghegs, by the intervention of the clergy; a general *bessa* has occasionally been proclaimed by special iradé of the sultan, the restoration of peace being celebrated with elaborate ceremonies. So stringent are the obligations of hospitality that a household is bound to exact reparation for any injury done to a guest as though he were a member of the family. No traveller can venture into the mountain districts without the *bessa* of one of the inhabitants; once this has been obtained he will be hospitably welcomed. In some districts there is a fixed price of blood; at Argyrokastro, for instance, the compensation paid by the homicide to the relatives of his victim is 1200 piastres (about £10), at Khimara 2000 piastres; once the debt has been acquitted amicable relations are restored. Notwithstanding their complete subjection, women are treated with a certain respect, and are often employed as intermediaries in the settlement of feuds; a woman may traverse a hostile district without fear of injury, and her *bessa* will protect the traveller or the stranger. Women accompany their male relatives to the battlefield for the purpose of tending the wounded and carrying away the dead. The bride brings no dowry to her husband; she is purchased at a stipulated price, and earnest-money is paid at the betrothal, which usually takes place while the contracting parties are still children. It is customary for young men who are attached to each other to swear eternal brotherhood (compare the Slavonic *pobratimstvo*); the contract is regarded as sacred, and no instance has been known of its violation. The costume of the Tosks differs from that of the Ghegs; its distinctive feature is the white plaited linen fustanella or petticoat, which has been adopted by the Greeks; the Ghegs wear trews of white or crimson native cloth adorned with black braid, and a short, close-fitting jacket, which in the case of wealthy persons is embellished with gold lace. The fez is worn by both races, and in the northern highlands yataghans and firearms are almost invariably carried. The costume of the Mirdite and Mat tribes is peculiar. It consists of a white felt cap, a long white tunic bound with a red girdle, white linen trousers and opinki, or sandals.

Tribal System.—The tribal organization in northern Albania is an interesting survival of the earliest form of social combination; it may be compared in many respects with that which existed in the Scottish highlands in the time of the Stuart kings. The practical autonomy which the Gheg mountaineers enjoy has been won by a prolonged and successful resistance to Turkish domination; as a rule they pay no taxes, they are exempt from the conscription, they know nothing of the Ottoman law, and the few Turkish officials established amongst them possess no real authority. Their only obligation to the Turkish government is to furnish a contingent in time of war; the only law they recognize is either traditional custom(*adĕt*) or the unwritten *Kanun-i Leks Dukajinit*, a civil and criminal code, so called from its author, Leka Dukajini, who is supposed to have lived in the 13th or 14th century. The tribe or *mal* (" mountain ") is often composed of several clans (*phis-i*, *phărea*)or *baryaks* (literally " standards ") each under a chief or *baryaktar* (standard-bearer), who is, strictly speaking, a military leader; there are in each clan a certain number of elders or voïvodes (Albanian *kru-ye*, pl. *krene-te*) who form a council and, like the baryaktar, hold their office by hereditary right; they preside over the assemblies of the tribesmen, which exercise the supreme legislative power. The clan is generally subdivided into smaller communities (*mahale*), each administered by a local notable or *jobar*. The jobars superintend the execution of the laws, collect fines and administer capital punishment; they are in contact with the *buluk-bashi*, or resident representative of the tribe at Scutari, who forms the only link between the mountaineers and the Turkish government. He communicates to the tribesmen the orders of the vali, which must be framed in accordance with their customs and institutions. The tribes of northern Albania, or Ghegería, may be classified in seven groups as follows:—(1) The Mirdites, who inhabit the alpine region around Orosh to the south-east of Scutari—the most important of all in respect of numbers (about 17,000) and political independence. A Roman Catholic tribe, occupying an inaccessible district, they have hitherto defeated every effort of the Turks to encroach on their autonomy. Their hereditary chiefs, or *capidans*, belong to the family known as *Dera e Jon Markut* (the house of John Marco), which has ruled for 200 years and is supposed to be descended from Scanderbeg. In 1868 the reigning chief, Bib Doda, died, and his son and successor Prenk was detained as a hostage by the Turks. The Mirdites consequently refused to contribute their customary contingent to the Turkish army, and eventually Prenk was restored. His ambiguous conduct, however, led to the despatch of two expeditions against the Mirdites and the devastation of their territory. In 1880 Prenk was kidnapped by the Turkish authorities and exiled to Anatolia; another member of the ruling family was appointed kaimakam, but the Mirdites refused to obey him, and their district has ever since been in a state of anarchy. No Moslem is allowed to remain in Mirdite territory. (2) The Mi-shkodrak (Upper Scutari) group or confederation, also known as the Malsia-Madhé (Great Highlands), is composed of the Klement, Grud-a, Hot, Kastrat and Shkrel tribes, which occupy the mountainous district north-east of Scutari. Owing to the proximity of the capital this group is comparatively subject to the Turkish power, and pays a small annual tribute; the chiefs, who assess and collect the tribute, form a kind of administrative council; the confederation has also an official representative council at Scutari, called the *Jibal*, under the presidency of a *Serkardé* or Moslem official. (3) The Dukajin, whose territory lies between that of the last-named group and the district of Jakova, include the Pulati, Shalla, Shoshi and other tribes; they are more independent and more savage than the Mi-shkodrak, and have never paid tribute from time immemorial. (4) The Puka group, known as "the Seven Baryaks of Puka," dwell on the south side of the river Drin; they are nominally administered by a Turkish kaimakam, who is a mere spectator of their proceedings. (5) The Malsia Jakovs, a group of two Catholic and three Moslem tribes, extend in the direction of Jakova, where they maintain an official representative; they are entirely exempt from taxation. (6,7) The Malsia-Lezhs, who occupy the Alessio highlands, and the Malsia Krues, who inhabit the region north of Kroïa, live in a state of extreme poverty and pay no tribute; the Malsia Krues are much addicted to brigandage. To these seven groups, which are included under the general appellation of *Malissori*, or "highlanders," may be added the Malsia of Dibra, who extend to the west and north of that town, and form a large separate group; they are notorious for their fierce lawless character, and maintain themselves by plundering the Bulgarian peasants in their neighbourhood. In general the attitude of the Albanians in the north-eastern districts towards the Slavonic peasantry may be compared with that of the Kurds towards the Armenians. In the region east of Kroïa the Mat tribe, which occupies the upper valley of the Matia, presents an entirely different organization; their district is governed by four wealthy families, possessing hereditary rank and influence. Towards the south the tribal organization becomes looser and is gradually supplanted by a kind of feudal system; among the powerful aristocratic houses may be mentioned the Vliores at Avlona, who are stated to own over 150 sq. m. of land, and the Toptans at Tirana. The principal landowners, who reside in fortified houses, are all Moslems; their estates are cultivated on the *métayer* system. Since the time of Ali Pasha, who broke the power of the local chieftains, southern Albania has been subject to the central Turkish power; before that period the mountaineers of Suli and Khimara enjoyed an independence similar to that of the Gheg tribes.

Religions.—The great majority of the Albanians, probably more than three-fifths, are Moslems. The conversion of the Christian population to Islam appears to have taken place during the 16th and 17th centuries. Like the Cretan Moslems and the Bulgarian Pomaks, the Albanian Mahommedans retain many Christian traditions and customs; it is said that many thousands of them secretly adhere to their original faith. In the vilayet of Scutari they form about 55% of the population; central Albania is almost entirely Moslem; in southern Albania, however, there is a considerable Christian population, whose limits practically coincide with those of the Greek-speaking districts. Of the Christian population (about 600,000), some 110,000 are Roman Catholic Ghegs, some 90,000 are Orthodox Tosks, and some 400,000 are Orthodox Slavs, Greeks and Vlachs. The Roman Catholic Ghegs appear to have abandoned the Eastern for the Western Church in the middle of the 13th century. Their bishops and priests, who wear the moustache in deference to popular prejudice, are typical specimens of the church militant. Some of the Gheg tribes, such as the Puka, Malsia Jakovs and Malsia Krues, are partly Roman Catholic, partly Moslem; among fellow-tribesmen the difference of religion counts for little. The Mirdites are exclusively Roman Catholic, the Mat-i exclusively Moslem. At the head of the Roman Catholic hierarchy are the archbishops of Scutari (with three suffragans), Prizren and Durazzo; the mitred abbot of St Alexander is the spiritual chief of the Mirdites. The Orthodox Church has metropolitans at Prizren, Durazzo, Berat, Iannina and Kortcha; the Bulgarian exarchate maintains a bishop at Dibra. Of the Albanians in Sicily the great majority (44,791) remain faithful to the Greek Church; in Italy 116,482 follow the Latin ritual, and 38,192 the Greek. All the Albanians in Greece belong to the Orthodox Church.

Education.—Education is almost non-existent, and the vast majority of the population, both Christian and Moslem, are totally illiterate. Instruction in the Albanian language is prohibited by the Turkish government for political reasons; a single exception has been made in the case of an American school for girls at Kortcha. There are Turkish primary and secondary schools in some of the towns; in the village mosques instruction in the Koran is given by the *imâms*, but neither reading nor writing is taught. The aristocratic Moslem families send their sons to be educated in Constantinople or Vienna. At Scutari a college and a seminary are maintained by the Jesuits, with the aid of the Austrian government; the Franciscans have several primary schools, and three lay schools are supported by the Italian government; in all these institutions Italian is the language of instruction. There are two Servian seminaries at Prizren. In southern Albania there are Greek schools in the towns and a large Greek gymnasium at Iannina. The priests of the Greek Church, on whom the rural population depend for instruction, are often deplorably ignorant. The merchant families of Iannina are well educated; the dialect spoken in that town is the purest specimen of colloquial Greek.

Language.—Albanian is peculiarly interesting as the only surviving representative of the so-called Thraco-Illyrian group of languages which formed the primitive speech of the peninsula. It has afforded an attractive study to philologists, amongst whom may be mentioned Malte-Brun, Leake, Xylander, Hahn, Miklosich and G. Meyer. The analysis of the language presents great difficulties, as, owing to the absence of literary monuments, no certainty can be arrived at with regard to its earlier forms and later development. The groundwork, so far as it can be ascertained, and the grammar are Indo-European, but a large number of words have been borrowed from the Latin or Italian and Greek, and it is not always easy to decide whether the mutilated and curtailed forms now in use represent adopted words or belong to the original vocabulary. There is also a considerable admixture of Turkish and Slavonic words. Notwithstanding certain points of resemblance in structure and phonetics, Albanian is entirely distinct from the neighbouring languages; in its relation to early Latin and Greek it may be regarded as a co-ordinate member of the Aryan stock. It possesses seven vowels; among the consonants are the aspirated *d* and *t*, as in Greek, and many other sounds, such as *b*, *d*, *sh*, *zh* (French *j*), and hard *g*, which are wanting in Greek, but exist in the Slavonic languages. There are three declensions, each with a definite and indefinite form; the genitive, dative and ablative are usually represented by a single termination; the vocative is formed by a final *o*, as *memmo* from *memme*, "mother." The neuter gender is absent. There are two conjugations; the passive formation, now wanting in most Indo-European languages, has been retained, as in Greek; thus *kerko-iy*, "I seek," forms *kerko-n-em*, "I am sought." The infinitive is not found; as in Greek, Rumanian and Bulgarian, it is replaced by the subjunctive with a particle. The two auxiliary verbs are *kăm*, "I have," and *yăm*, "I am." An interesting and characteristic feature of the language is the definite article, which is attached to the end of the word: *e.g. mik* ("friend," *amicus*), *mik-u* ("the friend"); *kien* ("dog"), *kien-i; Shkumb, Shkumb-i.* The suffix-article likewise appears in Rumanian and Bulgarian, but in no other Latin or Slavonic language; it is in each case a form of the demonstrative pronoun. Another remarkable analogy between the Albanian and the neighbouring languages is found in the formation of the future; the Albanian *do* (3rd pers. sing. of *dova*, "I will"), like the Greek *θὰ*, is prefixed without change to all persons of the verb: a similar usage in Servian and Bulgarian, as well as in Rumanian (especially the Macedonian dialect), is peculiar to these languages in the Slavonic and Latin groups. These and other points of similarity, possibly only accidental, have led to the conjecture that the primitive Illyrian language may have exerted some kind of influence on the other idioms of the peninsula. In the absence of literary culture the Albanian dialects, as might be expected, are widely divergent; the limits of the two principal dialects correspond with the racial boundaries of the Ghegs and Tosks, who understand each other with difficulty; the Albanians in Greece and Italy have also separate dialects. In writing Albanian the Latin character is employed by the Ghegs, the Greek by the Tosks; neither alphabet suffices to represent the manifold sounds of the language, and various supplementary letters or distinguishing signs are necessary. In the use of these no uniform system has yet been adopted. An alphabet of fifty-two letters, some presenting ancient Phoenician and Cretan forms, was found by Hahn in partial use at Elbassan and Tirana; its antiquity, however, has not been established. The Tosks generally use the Greek language for written communications. The native folklore and poetry of the Albanians can hardly compare with that of the neighbouring nations in originality and beauty. The earliest printed works in Albanian are those of the Catholic missionaries; the first book containing specimens of the language was the *Dictionarium Latino-Epiroticum* of Bianchi, printed in 1635. The literature of the last two centuries consists mainly of translations and religious works written by ecclesiastics, some of whom were natives of the Albanian colonies in Italy. The most noteworthy Albanian writer was Girolamo di Rada (b. 1815), a poet, philologist and collector of national folklore. Among his successors may be mentioned Vincenzo Dorsa and Demetrio Camarda.

Antiquities.—Albania abounds in ancient remains, which as yet have been little explored. Fragments of "Cyclopean" structures were discovered by Hahn at Kretzunista, Arinista, and other sites in the district of Argyrokastro; the walls, partly "Cyclopean," of an ancient city (perhaps *Bullis*) are visible at Gradisti on the Viossa. Masonry of this type, however, occurring in Illyria and Dalmatia (*e.g.* at Spalato and on the island of Lesina) has been shown by modern archaeologists to belong to the Roman period. In general, the remains of the classical epoch attest the influence of Roman rather than of Greek civilization. At Pollina, the ancient *Apollonia*, are the remnants of a Doric temple, of which a single column is still standing. A little north of Preveza are the considerable ruins of Nikopolis, founded by Octavian to commemorate the victory of Actium. At Khimara (anc. *Chimaera*) the remains of an old Greek city may still be seen; at Santi Quaranta (anc. *Onchesmos*) the walls and towers of a later town are in good preservation. Few traces remain of the once celebrated Dyrrhachium. The ruins of Pandosia, Ephyra, Elatea, Phoeniké, Buthrotum, Akrolissos and other towns may be identified. The most important and interesting remains, however, are those of Dodona (*q.v.*). Of the medieval ruins those of Kroïa, the stronghold of Scanderbeg, are the most interesting.

Medieval History.—After the division of the Roman empire, the lands inhabited by the Albanian race became provinces of the Byzantine empire; northern Albania from Scutari to Berat formed the *thema* or province of Dyrrachium (*Durazzo*, Albanian *Dourtz*), southern Albania and Epirus the *thema* of Nikopolis. The country was overrun by the Goths in the 4th and 5th centuries, but reconquered by Justinian in 535. In 640 northern Albania was invaded by the Serbo-Croats; it continued with interruptions under Servian rule till 1360. In 861 the Bulgarians conquered the southern portion of the country and Epirus as far as Khimara; under their powerful tsar Simeon (893–927), who defeated the Servians, they established their rule on the Adriatic littoral, except at Durazzo, which remained Byzantine, and colonized these regions in great numbers. A new Bulgarian dynasty, that of Shishman, was founded at Ochrida after the death of Simeon. Shishman's son Samuel (976–1014) captured Durazzo; he extended his sway over a great part of the Balkan Peninsula, but was eventually defeated in 1014 by the emperor Basil II., who put out the eyes of 15,000 Bulgarian prisoners. Southern Albania and Epirus fell once more under Byzantine rule, which, however, was shaken by numerous revolts. In 1081 the Normans under Robert Guiscard possessed themselves of Durazzo; Guiscard's son Bohemund defeated the Greeks in several battles and again (1107) laid siege to Durazzo, which had been surrendered to them by treachery; failing to take the city, he retired to Italy in 1109. Southern Albania and Epirus remained under Byzantine domination till 1204, when, after the capture of Constantinople by the crusaders, Michael Comnenus, a member of the imperial family, withdrew to Epirus and founded an independent sovereignty known as the *Despotate of Epirus* at Iannina; his realm included the whole of southern Albania, Acarnania and Aetolia. The despotate of Epirus was held by the Comnenus family till 1318, and by princes of the house of Orsini till 1358. Meanwhile Durazzo, with Berat and Central Albania, had passed into the hands of the Sicilian kings of the house of Anjou, who ruled these regions, which they styled the "Kingdom of Albania," from 1271 to 1368, maintaining a constant warfare with the Byzantine emperors. The Servians again installed themselves in Upper Albania about 1180, and the provinces of Scutari and Prizren were ruled by kings of the house of Nemanya till 1360; Stefan Dushan (1331–1358), the greatest of these monarchs, included all Albania in his extensive but short-lived empire, and took the title of *Imperator Romaniae Slavoniae et Albaniae* (emperor of the Greeks, Slavs and Albanians).

Period of Native Rule.—After the death of Dushan and the break-up of the Servian empire, a new epoch began when Albania fell under the rule of chieftains more or less of native origin. A portion of Upper Albania was ruled by the Balsha dynasty (1366–1421), which, though apparently Servian by descent, assimilated itself with its Albanian subjects and embraced the faith of Rome. Alessio and a tract of the interior in the direction of Ipek was governed by the Dukajin. The northern portion of the "kingdom of Albania," including Durazzo and Kroïa, was ruled by the family of Thopia (1359–1392) and afterwards by that of Kastriota, to which Scanderbeg belonged; the southern portion with Berat, by the Musaki (1368–1476). In the middle of the 14th century a great migration of Albanians from the mountainous districts of the north took place, under the chiefs Jin Bua Spata and Peter Liosha; they advanced southwards as far as Acarnania and Aetolia (1358), occupied the greater portion of the despotate of Epirus, and took Iannina and Arta. In the latter half of the century large colonies of Tosks were planted in the Morea by the despots of Mistra, and in Attica and Boeotia by Duke Nerio of Athens. As the power of the Balshas declined, the Venetians towards the close of the 14th century established themselves at Scutari, Budua, Antivari and elsewhere in northern Albania.

Period of Turkish Rule.—The advance of the Turks into Albania began with the capture of Iannina in 1431. For once in the history of the country the Albanian chiefs combined against the invader under a single leader, the celebrated George Kastriota (see SCANDERBEG), who fought thirteen campaigns in the period 1444–1466. In 1478 Kroïa, which the Venetians had occupied after Scanderbeg's death, surrendered to Mahommed II., and in 1479 Scutari, after a memorable defence by the Venetians and their Montenegrin allies, was reduced by blockade. Many of its native Christian defenders emigrated to Dalmatia and Italy; others took refuge in the mountains with the Roman Catholic Ghegs. In 1502 the Turks captured Durazzo, and in 1571 Antivari and Dulcigno, the last Venetian possessions in Albania. Notwithstanding the abandonment of Christianity by a large section of the population after the Turkish conquest, the authority of the sultans was never effectively established, and succeeding centuries present a record of interminable conflicts between the tribesmen and the Turks, between the Christians and the converts to Islam, or between all combined and the traditional Montenegrin enemy. The decline of the Ottoman power, which began towards the end of the 17th century, was marked by increasing anarchy and lawlessness in the outlying portions of the empire. About 1760 a Moslem chieftain, Mehemet of Bushat, after obtaining the pashalik of Scutari from the Porte, succeeded in establishing an almost independent sovereignty in Upper Albania, which remained hereditary in his family for some generations. In southern

Albania Ali Pasha of Tepelen (b. about 1750), an able, cruel and unscrupulous man, subdued the neighbouring pashas and chiefs, crushed the Suliotes and Khimarrhotes, and exercised a practically independent sovereignty from the Adriatic to the Aegean. He introduced comparative civilization at Iannina, his capital, and maintained direct relations with foreign powers. Eventually he renounced his allegiance to the sultan, but was overthrown by a Turkish army in 1822. Shortly afterwards the dynasty of Scutari came to an end with the surrender of Mustafa Pasha, the last of the house of Bushat, to the grand vizier Reshid Pasha, in 1831.

The opposition of the Albanians, Christian as well as Moslem, to the reforms introduced by the sultan Mahmūd II. led to the devastation of the country and the expatriation of thousands of its inhabitants. During the next half-century several local revolts occurred, but no movement of a strictly political character took place till after the Berlin Treaty (July 13, 1878), when some of the Moslems and Catholics combined to resist the stipulated transference of Albanian territory to Austria-Hungary, Servia and Montenegro, and the *Albanian League* was formed by an assemblage of chiefs at Prizren. The movement, which was instigated by the Porte with the object of evading the provisions of the treaty, was so far successful that the restoration of Plava and Gusinye to Albania was sanctioned by the powers, Montenegro receiving in exchange the town and district of Dulcigno. The Albanian leaders, however, soon displayed a spirit of independence, which proved embarrassing to Turkish diplomacy and caused alarm at Constantinople; their forces came into conflict with a Turkish army under Dervish Pasha near Dulcigno (November 1880), and eventually the league was suppressed. A similar agitation on a smaller scale was organized in southern Albania to resist the territorial concessions awarded by the powers to Greece. In the spring of 1903 serious disturbances took place in north-western Albania, but the Turks succeeded in pacifying the revolted tribesmen, partly by force and partly by concessions. These movements were far from displaying a genuinely national character. In recent years attempts have been made by Albanians resident abroad to propagate the national idea among their compatriots at home; committees have been formed at Brussels, Bucharest, Athens and elsewhere, and books, pamphlets and newspapers are surreptitiously sent into the country. Unity of aim and effort, however, seems foreign to the Albanians, except in defence of local or tribal privileges. The growth of a wider patriotic sentiment must depend on the spread of popular education; certainly up to 1908 no appreciable progress had been made in this direction.

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ALBANUS LACUS (mod. *Lago di Albano*), a lake about 12 m. S.E. of Rome. It is generally considered to have been formed by a volcanic explosion at the margin of the great crater of the Albanus Mons; it has the shape of a crater, the banks of which are over 400 ft. in height from the water-level, while the water is as much as 560 ft. deep in the S. portion. It is fed by subterranean springs. According to the legend, the *emissarium* (outlet) which still drains it was made in 398–397 B.C., the Delphic oracle having declared that Veii could only be taken when th of the lake reached the sea. It is over a mile in length, the rock, and about 6 ft. high and 4 ft. broad; it has vertical shafts at intervals, and a sluice chamber at its egress from the lake. In the time of Domitian the whole lake belonged to the imperial domain. (See ALBA LONGA.)

ALBANUS MONS (mod. *Monte Cavo*, from an early city of the name of Cabum? [1]), the highest point of the volcanic Alban hills, about 13 m. S.E. of Rome, 3115 ft. above sea-level. It is upon the line of the rim of the inner crater of the great volcano, while Tusculum and Algidus Mons mark the edge of the earlier outer crater, which was about 7 m. wide. The lakes of Albano and Nemi were probably formed by volcanic explosions at the margin of the great crater; though a view has also been expressed that the basins are the result of subsidence. The name Albanus Mons is also used generally of the Alban group of hills in which there seem to have been some remains of volcanic activity in early Roman times, which covered the early necropolis of Alba Longa, and occasionally produced showers of stones, *e.g.* in the time of Tullus Hostilius (Liv. i. 31), and perhaps much later. In 193 B.C. it is recorded (*ib.* xxxv. 9) that such a shower occurred at Aricia, Lanuvium and on the Aventine. Upon the Mons Albanus stood the temple of Jupiter Latiaris, where the annual festival of the Latin League was held. The foundations and some of the architectural fragments of the temple were still in existence until 1777, when they were used to build the Passionist monastery by Cardinal York. The road which ascended to the temple from the rim of the lake is still well preserved.

ALBANY, DUKES OF. The territorial designation of Albany was formerly given to those parts of Scotland to the north of the firths of Clyde and Forth. The title of duke of Albany was first bestowed in 1398 by King Robert III. on his brother, Robert Stewart, earl of Fife (see I. below); but in 1425 it became extinct. The dukedom was re-created, *c.* 1458, in favour of Alexander Stewart, "lord of Annandale and earl of March" (see II. below), whose son and successor (see III. below) left no legitimate heir. The title of duke of Albany was next bestowed upon Henry Stuart, commonly known as Lord Darnley, by Mary, queen of Scots, in 1565. From him the title passed to his son, James VI. of Scotland and I. of England. The title was by him given, at his birth, to Charles, his second son, afterwards King Charles I. By Charles II. it was again bestowed, in 1660, on James, duke of York, afterwards King James II. On the 5th of July 1716 Ernest Augustus, bishop of Osnaburgh [Osnabrück] (1715–1728), youngest brother of King George I., was created duke of York and Albany, the title becoming extinct on his death without heirs in 1728. On the 1st of April 1760 Prince Edward Augustus, younger brother of King George III., was created duke of York and Albany; he died without heirs on the 17th of September 1767. On the 29th of November 1784 the title of duke of York and Albany was again created in favour of Frederick, second son of George III., who died without heirs on the 5th of January 1827. The title of duke of Albany was bestowed on the 24th of May 1881 on Prince Leopold, youngest son of Queen Victoria (see IV. below).

I. ROBERT STEWART, duke of Albany (*c.* 1345–1420), regent of Scotland, was a son of King Robert II. by his mistress, Elizabeth Mure, and was legitimatized when his parents were married about 1349. In 1361 he married Margaret, countess of Menteith, and after his widowed sister-in-law, Isabel, countess of Fife, had recognized him as her heir, he was known as the earl of Fife and Menteith. Taking an active part in the government of the kingdom, the earl was made high chamberlain of Scotland in 1382, and gained military reputation by leading several plundering expeditions into England. In 1389 after his elder brother John, earl of Carrick, had been incapacitated by an accident, and when his father the king was old and infirm, he was chosen governor of Scotland by the estates; and he retained the control of affairs after his brother John became king as Robert III. in 1390. In April 1398 he was created duke of Albany;

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[1] See Th. Mommsen in *Bulletino dell' Istituto* (1861), 206; *Corpus Inscrip. Lat.* (Berlin, 1887), xiv. 2228.

but in the following year his nephew David, duke of Rothesay, the heir to the crown, succeeded him as governor, although the duke himself was a prominent member of the advising council. Uncle and nephew soon differed, and in March 1402 the latter died in prison at Falkland. It is not certain that Albany was responsible for the imprisonment and death of Rothesay, whom the parliament declared to have died from natural causes; but the scanty evidence points in the direction of his guilt. Restored to the office of governor, the duke was chosen regent of the kingdom after the death of Robert III. in 1406, as the new king, James I., was a prisoner in London; and he took vigorous steps to prosecute the war with England, which had been renewed a few years before. He was unable, or as some say unwilling, to effect the release of his royal nephew, and was soon faced by a formidable revolt led by Donald Macdonald, second lord of the Isles, who claimed the earldom of Ross and was in alliance with Henry IV. of England; but the defeat of Donald at Harlaw near Aberdeen in July 1411 freed him from this danger. Continuing alternately to fight and to negotiate with England, the duke died at Stirling Castle in September 1420, and was buried in Dunfermline Abbey. Albany, who was the ablest prince of his house, left by his first wife one son, Murdac (or Murdoch) Stewart, who succeeded him as duke of Albany and regent, but at whose execution in 1425 the dukedom became extinct.

See Andrew of Wyntoun, *The Orygynale Cronykil of Scotland*, edited by D. Laing (Edinburgh, 1872–1879); John of Fordun, *Scotichronicon*, continued by Walter Bower, edited by T. Hearne (Oxford, 1722); and P. F. Tytler, *History of Scotland* (Edinburgh, 1850). See also Sir W. Scott's *Fair Maid of Perth*.

II. **Alexander Stewart**, duke of Albany (*c.* 1454–1485), was the second son of James II., king of Scotland, by his wife, Mary, daughter of Arnold, duke of Gelderland. Created duke of Albany before 1458, he also received the lordship of the Isle of Man, and was afterwards captured by an English ship when journeying to Gelderland in 1468. He was soon released, and as he grew to manhood began to take part in the government and defence of Scotland, being appointed in quick succession high admiral, warden of the marches, governor of Berwick and lieutenant of the kingdom. Soon, however, he quarrelled with his brother, King James III. Some of his actions on the marches aroused suspicion, and in 1479 he was seized and imprisoned in Edinburgh Castle; but he soon made his escape, and reaching Paris in September 1479 was welcomed by King Louis XI. Louis, however, would not assist him to attack his brother the king, and crossing to England he made a treaty with King Edward IV. at Fotheringhay in June 1482. Like Edward Baliol, he promised to hold Scotland under English suzerainty in return for Edward's assistance, and with Richard, duke of Gloucester, afterwards King Richard III., he marched at the head of the English forces to Edinburgh. Meanwhile his supporters in Scotland had seized James, and professed their readiness to recognize Albany, declaring at the same time their distrust of Gloucester. A compromise, however, was arranged, and the restoration of his lands and offices was promised to Albany, who in turn agreed to be faithful to James; but about the same time the duke with remarkable duplicity had sworn he would keep the treaty with Edward. Again he was appointed lieutenant of the kingdom, a truce was made with the English, and James, released from custody, restored his brother and created him earl of Mar and Garioch. The fraternal peace was soon disturbed. Failing to obtain possession of the king's person, Albany renewed negotiations with Edward, and in February 1483 made a new treaty at Westminster on the lines of that of Fotheringhay. A fresh reconciliation followed between the brothers, but in July 1483, during Albany's absence in England, he was sentenced to death for treason. After making a raid on Lochmaben he went to France, where in 1485 he was accidentally killed. Albany's first wife was Catherine, daughter of William, third earl of Orkney and first earl of Caithness, who bore him three sons and a daughter. This marriage was dissolved in 1478, and as its issue was regarded as illegitimate the title of duke of Albany descended to John (see below), his only son by his second wife, Anne de la Tour d'Auvergne, daughter of Bertrand II., count of Auvergne and of Bouillon, whom he married in 1480.

III. **John Stewart**, duke of Albany (*c.* 1481–1536), regent of Scotland, was born about 1481. He was brought up in France, where he owned large estates, and held the office of admiral of France. In 1515, at the request of the Scottish parliament, and in spite of Henry VIII.'s efforts to prevent him, Albany came to Scotland, was inaugurated regent in July, and proceeded to organize resistance to the influence of England and of Margaret Tudor, the queen dowager, sister of Henry VIII. In August he seized the latter and her children at Stirling, and subsequently was occupied in suppressing the rebellion of the Homes, Angus (the second husband of Margaret), and James Hamilton, earl of Arran; Alexander, third Lord Home, being beheaded in October 1516. Albany was declared on the 12th of November heir to the throne, and on the 6th of June 1517 he returned to France. In August he concluded the treaty of Rouen, by which the alliance between France and Scotland was renewed and a daughter of Francis I. was to marry James V., and next year he obtained the relaxation of certain dues on Scottish imports into France. Meanwhile Margaret had returned immediately on Albany's departure, and disorders had broken out owing to the rivalry between Angus and Arran. Francis I. had secretly engaged himself to Henry VIII. not to allow Albany's departure from France, but he returned at the close of 1521 and immediately became the object of Henry VIII.'s and Wolsey's attacks. He reconciled himself temporarily with Margaret, supported her divorce from Angus, and was now accused by the English government, in all probability unjustly, of having seduced her and of harbouring schemes of marrying her himself, together with designs against the life of the young king. These accusations were repudiated by the Scots, and Henry's demand for the regent's dismissal refused. War broke out in 1522, and in September Albany advanced to within four miles of Carlisle with a large army. The Scots, however, showed unwillingness to fight outside their own frontiers, and Albany agreed to a truce and disbanded his troops. On the 25th of October he departed hastily to France, leaving the borders exposed to the enemy. On the 25th of September 1523 he once more landed in Scotland, bringing with him supplies from France and a considerable body of troops, and on the 3rd of November, after an unsuccessful attack on Wark, retreated hastily, and quitted Scotland finally on the 20th of May 1524. On the 30th of July his regency was terminated by the declaration of James V. as king. He accompanied Francis I. in his disastrous Italian campaign of 1525, being detached to make a diversion in Naples against the Spanish. Between 1530 and 1535 he acted as French ambassador in Rome, conducted Catherine de' Medici, his wife's niece, to Paris on her marriage to Henry (afterwards Henry II.) in 1534, and negotiated the marriage of James V.

The regent Albany was a singularly unfortunate commander in the field, but a successful ruler and administrator, and the Scottish court of session owed to him its institution. But he regarded himself more the subject of the king of France than of the king of Scotland, subordinated the interests of the latter state to the former, and disliked his official duties in Scotland, where the benefits of his administration were largely diminished by his want of perseverance and frequent absence. He appears to have been a man of honourable and straightforward conduct, whose character must be cleared from the aspersions of Wolsey and the English authorities. He married his cousin Anne de la Tour d'Auvergne, but left no legal issue, and all his honours became extinct at his death.

IV. **Leopold George Duncan Albert**, duke of Albany, eighth child and youngest son of Queen Victoria, was born on the 7th of April 1853. The delicacy of his health seemed to mark him out for a life of retirement, and as he grew older he evinced much of the love of knowledge, the capacity for study and the interest in philanthropic and ecclesiastical movements which had characterized his father, the prince consort. He matriculated at Christ Church, Oxford, in November 1872, living with his tutor at Wykeham House, St Giles's, and diligently pursued his favourite studies of science, art and the modern languages. In 1876 he left the university with the honorary degree of D.C.L., and resided at Boyton House, Wiltshire, and afterwards at Claremont. On coming of age in 1874, he had been made a privy councillor and granted an annuity of £15,000. He travelled on the continent, and in 1880 visited the United States and Canada. He was a trustee of the British Museum, a bencher of Lincoln's Inn, and continued to take an active part in the promotion of education and knowledge generally. Like his father and other members of his family he was an excellent public speaker. On the 24th of May 1881 he was created duke of Albany, earl of Clarence and Baron Arklow. On the 27th of April 1882 he married Hélène Frederica Augusta, princess of Waldeck-Pyrmont, and his income was raised by parliament to £25,000. Having gone to the south of France for his health in the spring of 1884, he was attacked by a fit, the cause or the consequence of a fall in a club-house at Cannes, on the 27th of March, and died very unexpectedly on the following morning. His death was universally regretted, from the gentleness and graciousness of his character, and the desire and ability he had shown to promote intellectual interests of every kind. He left a daughter, born in February 1883, and a posthumous son, Arthur Charles Edward, born on the 19th of July 1884, who succeeded to the dukedom of Albany, and who on the 30th of July 1900 became duke of Saxe-Coburg on the death of his uncle.

ALBANY, LOUISE MAXIMILIENNE CAROLINE, COUNTESS OF (1752–1824), eldest daughter of Prince Gustavus Adolphus of Stolberg-Gedern, was born at Mons on the 20th of September 1752. In her youth she was a canoness of Ste. Wandru at Mons, but in her twentieth year she was affianced, at the instigation of the duke of Berwick and with the secret connivance of the French Court, to Prince Charles Edward Stuart, "the Young Pretender," self-styled count of Albany. She was wedded to the prince at Macerata, near Ancona, on Good Friday 1774, and the married pair for over two years resided in the old Stuart palace at Rome. Pretty, intelligent, charming and witty, Louise fascinated Roman society, wherein she gained the nickname of "Queen of Hearts." The union, however, which was obviously intended to give an heir to the Stuart prince, proved childless, and Louise's married life became far from happy. In 1774 the pair moved to Florence, where in December 1780 Louise, terrified at her husband's violence and fearing for the safety of her life, fled to a neighbouring convent and threw herself on the protection of her brother-in-law, Henry Stuart, Cardinal York, who invited her to Rome. Louise had already in Florence formed the acquaintance of the great Italian tragic poet, Vittorio Alfieri, who had been captivated by her engaging manners, her youthful beauty and her literary powers. The poet now followed her to Rome, but the friendship between Alfieri and his sister-in-law does not seem to have aroused any suspicion in the mind of Cardinal York until 1783, when, after a visit to his brother in Florence, he suddenly requested Pope Pius VI. to banish Alfieri from papal territory. In 1784, however, a legal separation between the count and countess of Albany was arranged, and by Charles's death in 1788 Louise found herself freed from matrimonial bonds. In company with Alfieri (to whom rumour said she had been secretly married) she now visited Paris and London, and was cordially received at the English court, George III. granting her an annual pension of £1600 from the privy purse. Returning to Italy, Alfieri and the countess settled at Florence, where the poet died on the 9th of October 1803, and was buried in the church of Santa Croce beneath Canova's vast monument erected at Louise's expense. The countess continued to reside in the house on the Lung' Arno at Florence, patronising men of science and letters and holding nightly receptions, at which all visitors were expected to treat their hostess with the etiquette due to reigning royalty. She died on the 29th of January 1824 and was buried in Santa Croce, where in the south transept a marble monument by Giovannozzi and Santarelli commemorates her. By her will the countess bequeathed all her property, including many historic objects of art and documents, to the companion of her old age, the French painter, François Xavier Fabre, who ultimately gave the greater part of his legacy to the museum of his native town of Montpellier. Two excellent portraits of the countess of Albany and of Alfieri, painted by this artist, now hang in the Uffizi Gallery at Florence.

See Vernon Lee, *The Countess of Albany* (1884); Marchesa Vitelleschi, *A Court in Exile.* (H. M. V.)

ALBANY, a river of Canada, forming part of the boundary between the province of Ontario and the district of Keewatin. It rises in Lake St Joseph in 91° 25′ W. and 50° 55′ N., and flows E.N.E. into James Bay, its total length being over 400 m. It is navigable for nearly half its length, to Martin's Falls. There are four Hudson's Bay Company's posts on its banks, including Fort Albany at its mouth. The Ogoki and Kenogami rivers are the principal tributaries.

ALBANY, a city and the county-seat of Dougherty county, Georgia, U.S.A., at the mouth of the Kinchafoona Creek, and at the head of navigation on the Flint river, about 100 m. S.S.W. of Macon, about 200 m. S.W. of Savannah and about 203 m. N.E. of Pensacola. Pop. (1890) 4008; (1900) 4606, of whom 2903 were of negro descent. It is served by the Central of Georgia, the Georgia Northern, the Seaboard Air Line, the Albany & Northern and the Atlantic Coast Line railways, and by steamboats connecting it with Apalachicola at the mouth of the Apalachicola river. Its importance is largely due to these transportation facilities and to the resources of the surrounding country, which produces timber, lime, cotton, Indian corn, sugar-cane, wheat, oats, fruit, melons, hay and vegetables. Albany ships much cotton, and has a cotton compress, a cotton mill, cotton-seed oil and guano factories, brick yards, lumber mills and ice factories. It is a summer and winter resort and is the home of the Georgia Chautauqua. The city owns and operates the electric-lighting plant and artesian water-works. It was settled in 1836, was incorporated in 1838 and received its present city charter in 1907.

ALBANY, a city and the county-seat of Albany county, New York, U.S.A., and the capital of the state. It is situated on the W. bank of the Hudson river, just below the mouth of the Mohawk, 145 m. N. of New York City and 165 m. W. of Boston. Pop. (1880) 90,758; (1890) 94,923; (1900) 94,151, of whom 17,718 were foreign-born (6612 being Irish, 5903 German, 1361 English and 740 Russian) and 1178 were negroes; (1910) 100,253. Albany is a terminus of the New York Central & Hudson River, the Delaware & Hudson and the West Shore railways, and is also served by the Boston & Maine railway, by the Erie and Champlain canals (being a terminus of each), by steamboat lines on the Hudson river and by several inter-urban electric railways connecting with neighbouring cities.

Albany is attractively situated on a series of hills rising sharply from the river. The older portions of the city are reminiscent of Dutch colonial days, and some fine specimens of the Dutch and later colonial architecture are still standing. Perhaps the most famous of these is the Schuyler mansion (now St Francis de Sales Orphan Asylum), built in 1760–1761. The Van Rensselaer manor-house, built in 1765, was pulled down in 1893 and was reconstructed on the campus of Williams College, Williamstown, Massachusetts, where it is used as a fraternity club-house. Among the public buildings, the finest is the new State Capitol, one of the largest and most imposing in America. It occupies a commanding position in Capitol Square (7·84 acres), one of the highest points in the city. It is built of white Maine granite, and cost about $25,000,000. Its dimensions are 300×400 ft. The corner-stone was laid in 1871, and the building was completed, with the exception of the central tower and dome, in 1904. The legislature first met in it in 1879. The original designs were by Thomas Fuller, who also designed the parliamentary buildings at Ottawa; but the plans underwent many changes, Isaac Gale Perry, Leopold Eidlitz and H. H. Richardson being associated with the work before its completion.

The beautiful "western staircase" of red sandstone (from plans by Perry) and the senate chamber (designed by Richardson) are perhaps the most notable parts of the structure. The building houses the various executive departments, the legislature and the court of appeals. A large and handsome building of white granite was begun in 1908 directly opposite the Capitol to accommodate the department of education and the magnificent state library (about 450,000 volumes). Other important buildings are the old state hall, a handsome white marble building erected in 1842; the city hall, a beautiful French Gothic building of pink granite trimmed with red sandstone, designed by H. H. Richardson; the Federal Building; the State Museum of Natural History; the galleries of the Albany Institute and Historical and Art Society, in State Street, opposite the Capitol; Harmanus Bleecker Hall, a theatre since 1898; and the Ten Eyck and Kenmore hotels. Among the finest office buildings are the structures of the Albany City Savings Institution, National Commerical Bank, Union Trust Company, Albany Trust Company, the National Savings Bank, First National Bank, the New York State National Bank (1803, probably the oldest building in the United States used continuously for banking purposes) and the Albany Savings Bank. The Fort Orange Club, the Catholic Union, the Albany Club, the University Club, the City Club of Albany, the Country Club, the German Hall Association and the Adelphi Club are the chief social organizations. The principal church buildings are the Cathedral of the Immaculate Conception (Roman Catholic), a fine specimen of Gothic architecture, built of brownstone, with spires 210 ft. high; the cathedral of All Saints (Protestant Episcopal), an English Gothic structure of pink sandstone designed by R. W. Gibson and begun in 1883; St Peter's Episcopal Church (French Gothic), of Hudson River bluestone; Emmanuel Baptist Church, of white granite; the Madison Avenue Reformed Church; and St Joseph's (Roman Catholic), of bluestone and Caen stone with marble trimmings. Among the educational institutions are the Albany Medical College (1839) and the Albany Law School (1851), both incorporated since 1873 with the Union University, the Collegiate Department of which is at Schenectady; the Albany College of Pharmacy (1881), also part of Union University; the Albany Academy (1813), in which Joseph Henry, while a member of the faculty, perfected in 1826–1832 the electro-magnet and began his work on the electric telegraph; the Albany Academy for Girls, founded in 1814 as the Albany Female Academy (name changed in 1906); and a State Normal College (1890), with a Model School. The hospitals and charitable institutions include St Vincent's Orphan Asylum, the Lathrop Memorial (for children of working mothers), Albany City Hospital, the Homeopathic Hospital, St Peter's Hospital, the Albany City Orphan Asylum and the House of the Good Shepherd. There are a county penitentiary and a State armoury. The city has 95 acres of boulevards and avenues under park supervision and several fine parks (17, with 307 acres in 1907), notably Washington (containing Calverley's bronze statue of Robert Burns, and Rhind's "Moses at the Rock of Horeb"), Beaver and Dudley, in which is the old Dudley Observatory—the present Observatory building is in Lake Avenue, south-west of Washington Park, where is also the Albany Hospital. In the beautiful rural cemetery, north of the city, are the tombs of President Chester A. Arthur and General Philip Schuyler. The city owns a fine water-supply and a filtration plant covering 20 acres, with a capacity of 30,000,000 gallons daily and storage reservoirs with a capacity of 227,000,000 gallons.

The first newspaper in Albany was the *Gazette*, founded in 1771. The *Argus*, founded in 1813 by Jesse Buel (1778–1839) and edited from 1824 to 1854 by Edwin Croswell (1797–1871), was long the organ of the coterie of New York politicians known as the "Albany Regency," and was one of the most influential Democratic papers in the United States. Previously to their holding office, Daniel Manning (1831–1887), secretary of the treasury in President Cleveland's cabinet, was president of the *Argus* company, and Daniel Scott Lamont (1851–1005), secretary of war during President Cleveland's second administration, was managing editor of the newspaper. The *Evening Journal*, founded in 1830 as an anti-Masonic organ, and for thirty-five years edited by Thurlow Weed, was equally influential as an organ of the Whig and later of the Republican party.

Albany is an important railway and commercial centre, particularly as a distributing point for New England markets, as a lumber market and—though to a much less extent than formerly—as a depot for transhipment to the south and west. Among the city's manufactories are breweries, iron and brass foundries, stove factories, knitting mills, cotton mills, clothing factories, slaughtering and meat-packing establishments, cigar and cigarette factories, and manufactories of adhesive pastes, court plaster, spring beds, ribbed underwear, aniline dyes, chemicals, gas meters, fire-brick, and glazed paper and cardboard. The value of the total factory product in 1905 was $20,208,715, which was 17 % greater than that for 1900.

History.—Albany was probably the second place to be permanently settled within the borders of the original Thirteen Colonies. It seems likely that French traders ascended the river as far as the site of the present city in the first half of the sixteenth century, and according to some writers a temporary trading post was established here about 1540. Albany's authentic history, however, may be dated from 1614, when Dutch traders built on Castle Island, opposite the city, a post which they named Fort Nassau. Three years later the fort was removed to the mainland, and near here in 1618 the Dutch made their first treaty with the Iroquois. In 1624 arrived eighteen families of Dutch Walloons, the first actual permanent settlers, as distinguished from traders. In that year, on a hill near the site of the present Capitol, Fort Orange was built, and around it, as a centre, the new town grew. At first it was known by the Dutch simply as the "fuyck" (hoop), from the curve in the river at this point, whence was soon derived the name Beverfuyck or Beverwyck. In 1629 the Dutch government granted to Killiaen van Rensselaer, an Amsterdam diamond merchant, a tract of land (24 sq. m.) centring at Fort Orange. Over this tract, the first patroonship granted in the colony, he had the usual powers and rights of a patroon. The grant was named Rensselaerwyck in his honour, became a "manor" in 1685, and remained in the family until 1853. The colonists whom he settled upon his grant (1630) were industrious, and "Beverwyck" became increasingly prosperous. From this time the town, on account of its favourable commercial and strategic position at the gateway of the Iroquois country and at the head of navigation on the Hudson river, was for a century and a half one of the most important places in the colonies. In 1644, with the transfer of New Netherlands to English control, the name "Beverwyck" was changed to "Albany"—one of the titles of the duke of York (afterward James II.). In 1673 the town was again for a short time under Dutch control. In 1686 Governor Dongan granted to Albany a city charter, which provided for an elected council. The first mayor appointed by the governor was Peter Schuyler (1657–1724). In 1689 was held here the first inter-colonial convention in America, when delegates from Massachusetts Bay, Plymouth, Connecticut and New York met to treat with representatives of the Five Nations and to plan a system of colonial defence. During the 18th century there was a great influx of English colonists, and in 1714 the first English church was erected. During the French and Indian wars Albany was a starting-point for expeditions against Canada and the Lake Champlain country. In June 1754, in pursuance of a recommendation of the Lords of Trade, a convention of representatives of Massachusetts, Rhode Island, New Hampshire, Connecticut, New York, Pennsylvania and Maryland met here for the purpose of confirming and establishing a closer league of friendship with the Iroquois and of arranging for a permanent union of the colonies. The Indian affairs having been satisfactorily adjusted, the convention, after considerable debate, in which Benjamin Franklin, Stephen Hopkins and Thomas Hutchinson took a leading part, adopted (July 11) a plan for a union of the colonies, which was in great part similar to one submitted to the convention by Franklin. This plan provided for a representative governing body to be known as the Grand Council, to which each colony should elect delegates (not more than seven or less than two) for a term of three years. This body was to have control of Indian affairs, impose taxes, nominate all civil officers, authorize the opening of new lands to settlement, and in general have charge of colonial defence, and of the enlistment, equipment and maintenance of an army. An executive or viceroy, to be known as the president-general, was to have the veto power over the acts of the Grand Council and the right of appointment of military officers. Finally, it was provided that the acts of the Grand Council should be valid unless vetoed by the crown within a period of three years. Neither the British government nor the growing party in the colonies which was clamouring for colonial rights received the plan with favour — the former holding that it gave the colonies too much independence, and the latter that it gave them too little. The strategic importance of Albany was fully recognized during the War of Independence, and it was against Albany that Burgoyne's expedition was directed. Albany became the permanent state capital in 1797. In 1830 it became the centre of the "Anti-Rent War," which was precipitated by the death of Stephen van Rensselaer (1764–1830), the last of the patroons; the attempt of his heirs to collect overdue rents resulting in disturbances which necessitated the calling out of the militia, spread into several counties where there were large landed estates, and were not entirely settled until 1847.

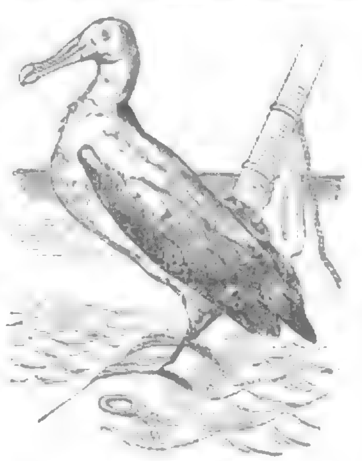
See William Barnes, *The Settlement and Early History of Albany* (Albany, 1864); J. Munsell, *The Annals of Albany* (10 vols., Albany, 1850–1859; 2nd ed., 4 vols., 1869–1871); E. B. O'Callaghan, *Documentary History of the State of New York*, vol. iii. (Albany, 1850); A. J. Weise, *The History of the City of Albany* (Albany, 1884); G. R. Howell and J. Tenney, *Bi-Centennial History of Albany* (New York, 1886); Amasa J. Parker, *Landmarks of Albany County* (Syracuse, 1897); and Cuyler Reynolds, *Albany Chronicles; or Albany Mayors and Contemporaneous Chronology* (Albany, 1907).

ALBANY, a municipal town in the county of Plantagenet, West Australia, on Princess Royal Harbour, a branch of King George Sound, 352 m. by rail and 254 m. directly S.S.E. of Perth. Pop. (1901) 3650. It is the chief health resort of the state, and its climate is one of the finest in Australia; it has a mean annual temperature of 58·6° F., and the summer heat is never excessive. One of the features of the town is the Marine Drive, some 5½ m. in circuit around the hills overlooking the harbour. Albany has several flourishing industries, of which the chief are brewing, coach-building, printing and tanning. In addition it has the finest harbour in West Australia. A pier extends for 1700 ft. into the sea, giving safe accommodation to the large steamers which call at the port. The Great Southern railway has a line to the seaward end of the pier, and affords direct communication with the interior of the colony. The harbour is protected by forts and there is a garrison in the town. King George Sound, of which Albany is the township, was first occupied in 1826 and a penal settlement was established. No attempt was made to colonize the locality until after this settlement was given up in 1831. Albany became a municipality in 1871.

ALBATEGNIUS (*c.* 850–929), an Arab prince and astronomer, correctly designated Mahommed ben Gebir al Batani, his surname being derived from his native town, Batan in Mesopotamia. From his observations at Aracte and Damascus, where he died, he was able to correct some of Ptolemy's results, previously taken on trust. He compiled new tables of the sun and moon, long accepted as authoritative, discovered the movement of the sun's apogee, and assigned to annual precession the improved value of 55″. Perhaps independently of Aryabhatta (born at Pâtaliputra on the Ganges 476 A.D.), he introduced the use of sines in calculation, and partially that of tangents. His principal work, *De Motu Stellarum*, was published at Nuremberg in 1537 by Melanchthon, in a blundering Latin translation by Plato Tiburtinus (fl. 1116), annotated by Regiomontanus. A reprint appeared at Bologna in 1645. The original MS. is preserved at the Vatican; and the Escorial library possesses in MS. a treatise of some value by him on astronomical chronology. Albategnius takes the highest rank among Arab astronomers.

See Houzeau, *Bibliographie astronomique*, i. 467; M. Marie, *Histoire des sciences*, ii. 113; R. Wolf, *Geschichte der Astronomie*, p. 67; Delambre, *Hist. de l'astr. au moyen âge*, ch. ii.; *Phil. Trans.*, 1693 (913), where E. Halley supplies corrections to some of the observations recorded in *De Motu Stellarum*.

ALBATROSS (from the Port. *Alcatraz*, a pelican), the name of a genus of aquatic birds (*Diomedea*), closely allied to the petrels, and belonging, like them, to the order *Tubinares*. In the name *Diomedea*, assigned to them by Linnaeus, there is a reference to the mythical metamorphosis of the companions of the Greek warrior Diomedes into birds. The beak is large, strong and sharp-edged, the upper mandible terminating in a large hook; the wings are narrow and very long; the feet have no hind toe, and the three anterior toes are completely webbed. The best known is the common or wandering albatross (*D. exulans*), which occurs in all parts of the Southern Ocean. It is the largest and strongest of all sea-birds. The length of the body is stated at 4 ft., and the weight at from 15 to 25 lb. It sometimes measures as much as 17 ft. between the tips of the extended wings, averaging probably from 10 to 12 ft. Its strength of wing is very great. It often accompanies a ship for days—not merely following it, but wheeling in wide circles round it—without ever being observed to alight on the water, and continues its flight, apparently untired, in tempestuous as well as in moderate weather. It has even been said to sleep on the wing, and Moore alludes to this fanciful "cloud-rocked slumbering" in his *Fire Worshippers*. It feeds on small fish and on the animal refuse that floats on the sea, eating to such excess at times that it is unable to fly and rests helplessly on the water. The colour of the bird is white, the back being streaked transversely with black or brown bands, and the wings dark. Sailors capture the bird for its long wing-bones, which they manufacture into tobacco-pipe stems. The albatross lays one egg; it is white, with a few spots, and is about 4 in. long. In breeding-time the bird resorts to solitary island groups, like the Crozet Islands and the elevated Tristan da Cunha, where it has its nest—a natural hollow or a circle of earth roughly scraped together—on the open ground. The early explorers of the great Southern Sea cheered themselves with the companionship of the albatross in its dreary solitudes; and the evil hap of him who shot with his cross-bow the bird of good omen is familiar to readers of Coleridge's *Rime of the Ancient Mariner*. Several species of albatross are known; for the smaller forms see MALLEMUCK.



ALBAY, a city and the capital of the province of Albay, Luzon, Philippine Islands, near an inlet on the W. shore of the Gulf of Albay, 215 m. by wagon-road S.E. of Manila. Pop. (1903) 14,049; in October 1907 the towns of Daraga (pop. 1903, 18,695) and Legaspi (pop. 1903, 9206) were merged with Albay, making its total population, on the basis of the 1903 census, 41,950. Albay is one of the most important cities of the Philippine Islands. It is built on level ground near the S. base of Mount Mayón, a beautiful volcanic peak, 7916 ft. high, from which it is sheltered by the Linguin hills. The surrounding country is one of the most important hemp-producing districts in the Philippines; sinamay is woven here, and large quantities of hemp are shipped from here to Manila. Cocoa, copra, sugar and sweet potatoes are other important products of the district. The language is Bicol. The old town, called Cagsaua, which stood a short distance E.N.E. of the new, was completely destroyed by an eruption of the volcano in 1814 (about 1200 people being killed), and the new town was almost entirely destroyed by the insurgents in February 1900, an ancient stone church of much beauty (in what was formerly Daraga) being left standing on an elevated site commanding a view of the surrounding country. The town was rebuilt on a larger scale by Americans.

ALBEDO (from Lat. *albus*, white), "whiteness," a word used principally in astronomy for the degree of reflected light; the light of the sun which is reflected from the moon is called the albedo of the moon.

ALBEMARLE, EARLS AND DUKES OF. The name Albemarle, which now forms the title of the earldom held by the English family of Keppel, is an early variant of the French Aumale (Lat. *Alba Marla*), other forms being Aubemarle and Aumerle, and is described in the patent of nobility granted in 1696–1697 by William III. to Arnold Joost van Keppel as "a town and territory in the dukedom of Normandy."

The fief of Aumale (*q. v.*) was granted by the archbishop of Rouen to Odo of Champagne, brother-in-law of William the Conqueror, who erected it into a countship. On Odo's death his son Stephen succeeded not only to the countship of Aumale, but to the lordships of Holderness, of Bytham in Lincolnshire, &c., which were subsequently known as the "Fee and Honor of Albemarle." Stephen, who as a crusader had fought valiantly at Antioch, died about 1127, leaving by his wife Hawise, daughter of Ralph de Mortimer, a son—William of Blois, known as "le Gros." William, who distinguished himself at the battle of the Standard (1138), and shared with King Stephen in the defeat of Lincoln (1141), married Cicely, daughter of William Fitz-Duncan, grandson of Malcolm, king of Scotland, who as "lady of Harewood" brought him vast estates. He founded abbeys at Meaux in Holderness and at Thornton, and died in 1179. His elder daughter and heiress Hawise married (1) William de Mandeville, 3rd earl of Essex (d. 1189), (2) William de Fortibus (de Fors, de Fortz or des Forts[1]), (3) Baldwin de Betun or Béthune, all of whom bore the title of earls of Albemarle.

Soon after the death of Baldwin (October 13, 1213), William de Fortibus, Hawise's son by her second husband, was established by King John in the territories of the countship of Albemarle, and in 1215 the whole of his mother's estates were formally confirmed to him. He is described by Bishop Stubbs as "a feudal adventurer of the worst type," and for some time was actively engaged in the struggles of the Norman barons against John and Henry III. He was one of the twenty-five executors of the Great Charter; but in the war that followed sided with John, subsequently changing sides as often as it suited his policy. His object was to revive the independent power of the feudal barons, and he co-operated to this end with Falkes de Breauté (*q.v.*) and other foreign adventurers established in the country by John. This brought him into conflict with the great justiciar, Hubert de Burgh, and in 1219 he was declared a rebel and excommunicated for attending a forbidden tournament. In 1220 matters were brought to a crisis by his refusal to surrender the two royal castles of Rockingham and Sauvey of which he had been made constable in 1216. Henry III. marched against them in person, the garrisons fled, and they fell without a blow. In the following year, however, Albemarle, in face of further efforts to reduce his power, rose in revolt. He was now again excommunicated by the legate Pandulph at a solemn council held in St Paul's, and the whole force of the kingdom was set in motion against him, a special scutage—the "scutagium de Bihan"—being voted for this purpose by the Great Council. The capture of his castle of Bytham broke his power; he sought sanctuary and, at Pandulph's intercession, was pardoned on condition of going for six years to the Holy Land. He remained in England, however, and in 1223 was once more in revolt with Falkes de Breauté, the earl of Chester and other turbulent spirits. A reconciliation was once more patched up; but it was not until the fall of Falkes de Breauté that Albemarle finally settled down as an English noble. In 1225 he witnessed Henry's third re-issue of the Great Charter; in 1227 he went as ambassador to Antwerp; and in 1230 he accompanied Henry on his expedition to Brittany. In 1241 he set out for the Holy Land, but died at sea, on his way there, on the 26th of March 1242. By his wife Avelina of Montfichet, William left a son, also named William, who married (1) Christina (d. 1246), daughter and co-heiress of Alan, lord of Galloway, (2) in 1248 Isabella de Redvers (1237–1292-3), daughter of Baldwin de Redvers, earl of Devon and lord of the Isle of Wight. He played a conspicuous part in the reign of Henry III., notably in the Mad Parliament of 1258, and died at Amiens in 1260. His widow, Isabella, on the death of her brother Baldwin, 8th earl of Devon, in 1261, called herself countess of Devon. She had two children, Thomas, who died in 1269 unmarried, and Avelina, who married (1269) Edmund Plantagenet, earl of Lancaster, and died without issue in 1274. The "Honor of Albemarle" was claimed, in 1278, by John de Eston, or Aston, as heir of Amicia, younger daughter of William le Gros; but he released his right to the earldom of Albemarle to the crown in exchange for certain lands in Thornton.

The title of Albemarle, thus extinguished, was several times revived before it became attached to the family of its present holders. In 1385 Thomas of Woodstock, duke of Gloucester, was summoned to parliament as "duke of Albemarle," but he seems never subsequently to have used the title. In any case this creation became extinct with the death of his son Humphrey, duke of Gloucester, in 1399. In 1411 Thomas Plantagenet, second son of Henry IV., was created earl of Albemarle and duke of Clarence, but at his death at the battle of Beaugé (March 22, 1421) these honours became extinct. That of Albemarle was, however, soon revived (*c.* 1423) in favour of Richard de Beauchamp, earl of Warwick, whose title of earl of Aumerle, however, died with him.

In 1660 Charles II. bestowed the title of duke of Albemarle on General Monk (*q.v.*). Monk's hereditary claim to this semi-royal peerage was a very shadowy one, being based—as was also his subordinate style of Baron Beauchamp—on his descent from the youngest of the three co-heiresses of Richard, earl of Warwick, and, with yet more remote applicability, on that from Arthur Plantagenet, a natural son of Edward IV. The title became extinct in 1688, on the death of Christopher, 2nd duke of Albemarle.

Finally, as mentioned above, the title of earl of Albemarle was bestowed by William III., without any shadow of hereditary claim, on his Dutch favourite Arnold Joost van Keppel (see below), by whose descendants it is still held. The motive for choosing this title was probably that, apart from its dignified traditions, it avoided the difficulty created by the fact that the Keppels had as yet no territorial possessions in the British Islands.

ARNOLD JOOST VAN KEPPEL, 1st earl of Albemarle, and lord of Voorst in Gelderland (*c.* 1670–1718), son of Oswald van Keppel and his wife Anna Geertruid van Lintello, was born in Holland about 1670. He became page to William III., accompanied him to England in 1688, and was made groom of the bedchamber and master of the robes in 1695. On the 10th of February 1696/7 he was created earl of Albemarle, Viscount Bury and Baron Ashford. In 1700 William gave him lands of enormous extent in Ireland, but parliament obliged the king to cancel this grant, and William then bestowed on him £50,000. The same year he was made a knight of the Garter. Meanwhile he had served both with the English and Dutch troops, was major-general in 1697, colonel of several regiments and governor of Bois-le-Duc. Of handsome person and engaging disposition, he rivalled Portland, whose jealousy he aroused in the royal favour, possessed William's full confidence and accompanied him everywhere. In February 1702 he was sent by William, then prostrated with his last illness, to Holland to arrange the coming campaign, and only returned in time to receive William's last commissions on his deathbed. After the death of the latter, who bequeathed to him 200,000 guilders and some lands, he returned to Holland, took his seat as a noble in the states-general, and was made a general of horse in the Dutch army. He joined the forces of the allies in 1703, was present at Ramillies in 1706 and at Oudenarde in 1708, and distinguished himself at the siege of Lille. He commanded at the siege of Aire in 1710, led Marlborough's second line in 1711, and was general of the Dutch forces in 1712, being defeated at Denain after the withdrawal of Ormonde and the English forces and taken prisoner. He died on the 30th of May 1718, aged 48. He married Geertruid, daughter of Adam van der Denijn, by whom, besides a daughter, he had a son, William Anne, who succeeded him as 2nd earl of Albemarle.

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[1] The name was derived from Fors, a commune in the canton of Prahecq in Poitou. It is spelt Forz in a deed of 1233, and the best vernacular form is, according to Thomas Stapleton (Preface to the *Liber de Antiquitate*, Camden Soc., 1846, p. xxxiv. note), de Fortz.

Of the later earls mention need only be made of the sixth, GEORGE THOMAS KEPPEL (1799–1891), British general, second son of the fourth earl, born on the 13th of June 1799. Educated at Westminster School he entered the army as ensign, 14th Foot, in 1815. He joined his regiment in Belgium and took part in the Waterloo campaign and the march to Paris, joined the second battalion in Corfu, and was transferred to the 22nd Foot, with which he served in Mauritius and at the Cape, returning home in 1819, when he was appointed equerry to the duke of Sussex. Promoted to a lieutenancy in the 24th Foot, he was transferred to the 20th Foot, and went to India, where he was aide-de-camp to the marquess of Hastings until his resignation in 1823, when Keppel returned to England, travelling overland through Persia, Moscow and St Petersburg. He published in 1825 an account of his travels, entitled *Journey from India to England*. He was aide-de-camp to the Marquess Wellesley, lord-lieutenant of Ireland, for two years, was promoted captain in the 62nd Foot, studied in the senior department of the Royal Military College at Sandhurst, and in 1827 obtained a half-pay unattached majority. He did not again serve on full pay, but rose to be a general. In 1829 he visited the seat of the Russo-Turkish war and was with the British fleet in Turkish waters. In 1832 he was returned in the Whig interest to the first reformed parliament as member for East Norfolk and sat until 1835. He was private secretary to the premier, Lord John Russell, in 1846, and M.P. for Lymington from 1847 to 1849. He succeeded to the title on the death of his brother in 1851. He died in 1891 and was buried at Quidenham, Norfolk. He wrote an account of a *Journey across the Balkans*, *Memoirs of the Marquis of Rockingham*, and an autobiography entitled *Fifty Years of My Life*.

See G. E. C(ockayne), *Complete Peerage*, 8 vols. (London, 1887). For the two Williams de Fortibus, see *s.v.* Prof. T. F. Tout's articles in the *Dict. of Nat. Biog.*

ALBENGA, a town and episcopal see of Liguria, Italy, on the N.W. coast of the Gulf of Genoa, in the province of Genoa, 52½ m. S.W. of Genoa by rail. Pop. (1901) 6248. Albenga is the ancient *Album Ingaunum* or *Albingaunum*, the chief town of the Ingauni, one of the most important of the Ligurian tribes, whose territory reached as far as Genoa. Under the empire it was a *municipium*; an inscription records the restoration of the walls, forum, harbour, &c., by Constantius A.D. 354. A little way outside the town to the E. is a well-preserved Roman bridge nearly 500 ft. long and 11½ ft. wide, with 10 arches, each with a span of 37 ft. It belonged to the coast road and is now known as Ponte Lungo. To the S. of the town is a conspicuous monument, 27 ft. high, in the form of a rectangular pillar, resembling a tomb; but as there is no trace of a door to a sepulchral chamber it may be a shrine. In the town itself there are no Roman remains; but there is a good Gothic cathedral in brick, and an interesting octagonal baptistery, attributed to the 8th or 9th century, the arches being supported by ancient columns, and the vaulting decorated with mosaics. Some of the medieval palaces of Albenga have lofty brick towers.

See A. d'Andrade in *Relazione dell' Ufficio Regionale per la Conservazione dei monumenti del Piemonte e della Liguria* (Turin, 1899), 114 seq.

ALBERONI, GIULIO (1664–1752), Spanish-Italian cardinal and statesman, was born near Piacenza, probably at the village of Fiorenzuola, on the 31st of May 1664. His father was a gardener, and he himself became first connected with the church in the humble position of verger in the cathedral of Piacenza. Having gained the favour of Bishop Barni he took priest's orders, and afterwards accompanied the son of his patron to Rome. During the war of the Spanish succession Alberoni laid the foundation of his political success by the services he rendered to the duke of Vendôme, commander of the French forces in Italy; and when these forces were recalled in 1706 he accompanied the duke to Paris, where he was favourably received by Louis XIV. In 1711 he followed Vendôme into Spain as his secretary. Two years later, the duke having died in the interval, Alberoni was appointed consular agent for Parma at the court of Philip V. of Spain, being raised at the same time to the dignity of count. On his arrival at Madrid he found the princesse des Ursins all but omnipotent with the king, and for a time he judged it expedient to use her influence in carrying out his plans. In concert with her he arranged the king's marriage with Elizabeth Farnese of Parma. The influence of the new queen being actively exerted on Alberoni's behalf, he speedily rose to high position. He was made a member of the king's council, bishop of Malaga, and in 1715 prime minister, and was raised to the dignity of cardinal in 1717. His internal policy was exceedingly vigorous. The main purpose he put before himself was to produce an economic revival in Spain by abolishing internal custom-houses, throwing open the trade of the Indies and reorganizing the finances. With the resources thus gained he undertook to enable King Philip V. to carry out an ambitious policy both in Italy and in France. The impatience of the king and his wife gave the minister no time to mature his plans. By provoking England, France, Holland and the Empire at once it brought a flood of disaster on Spain for which Alberoni was held responsible. On the 5th of December 1719 he was ordered to leave Spain, Elizabeth herself having taken an active part in procuring the decree of banishment. He went to Italy, and there had to take refuge among the Apennines, Pope Clement XI., who was his bitter enemy, having given strict orders for his arrest. On the death of Clement, Alberoni boldly appeared at the Conclave, and took part in the election of Innocent XIII. (1721), after which he was for a short time imprisoned by the pontiff on the demand of Spain. At the next election (1724) he was himself proposed for the papal chair, and secured ten votes at the Conclave which elected Benedict XIII. Benedict's successor, Clement XII. (elected 1730), named him legate of Ravenna, in which capacity he incurred the pope's displeasure by the strong and unwarrantable measures he adopted to reduce the little republic of San Marino to subjection to Rome. He was consequently replaced by another legate in 1740, and soon after he retired to Piacenza. Clement XII. appointed him administrator of the hospital of San Lazzaro at Piacenza in 1730. The hospital was a medieval foundation for the benefit of lepers. The disease having disappeared from Italy, Alberoni obtained the consent of the pope to the suppression of the hospital, which had fallen into great disorder, and replaced it by a college for the education of seventy poor boys for the priesthood, under the name of the Collegio Alberoni, which it still bears. He died on the 16th of June 1752, leaving a sum of 600,000 ducats to endow the seminary he had founded, and the residue of the immense wealth he had acquired in Spain to his nephew. Alberoni left a large quantity of manuscripts; but the genuineness of the *Political Testament*, published in his name at Lausanne in 1753, has been questioned.

An *Histoire du Cardinal Alberoni* up to 1719 was published by Jean Rousset de Missy at the Hague in 1719. A laudatory life, *Storia del Cardinale Giulio Alberoni*, was published by Stefano Bersani, a priest educated at his college, at Piacenza, in 1861. *Giulio Alberoni e il suo secolo*, by Giovanni Bianchi (1901), is briefer and more critical. See also *Lettres intimes de J. Alberoni*, edited by M. E. Bourgeois (1892).

ALBERT (1522–1557), prince of Bayreuth, surnamed THE WARLIKE, and also ALCIBIADES, was a son of Casimir, prince of Bayreuth, and a member of the Franconian branch of the Hohenzollern family. Born at Ansbach on the 28th of March 1522, he lost his father in 1527 and came under the guardianship of his uncle George, prince of Ansbach, a strong adherent of the reformed doctrines. In 1541 he received Bayreuth as his share of the family lands, and as the chief town of his principality was Kulmbach he is sometimes referred to as the margrave of Brandenburg-Kulmbach. His restless and turbulent nature marked him out for a military career; and having collected a small band of soldiers, he assisted the emperor Charles V. in his war with France in 1543. The peace of Crépy in September 1544 deprived him of this employment, but he had won a considerable reputation, and when Charles was preparing to attack the league of Schmalkalden, he took pains to win Albert's assistance. Sharing in the attack on the Saxon electorate, Albert was taken prisoner at Rechlitz in March 1547 by John Frederick, elector of Saxony, but was released as a result of the emperor's victory at Mühlberg in the succeeding April. He then followed the fortunes of his friend Maurice, the new elector of Saxony, deserted Charles, and joined the league which proposed to overthrow the emperor by an alliance with Henry II. of France. He took part in the subsequent campaign, but when the treaty of Passau was signed in August 1552 he separated himself from his allies and began a crusade of plunder in Franconia. Having extorted a large sum of money from the burghers of Nuremberg, he quarrelled with his supporter, the French king, and offered his services to the emperor. Charles, anxious to secure such a famous fighter, gladly assented to Albert's demands and gave the imperial sanction to his possession of the lands taken from the bishops of Würzburg and Bamberg; and his conspicuous bravery was of great value to the emperor on the retreat from Metz in January 1553. When Charles left Germany a few weeks later, Albert renewed his depredations in Franconia. These soon became so serious that a league was formed to crush him, and Maurice of Saxony led an army against his former comrade. The rival forces met at Sievershausen on the 9th of July 1553, and after a combat of unusual ferocity Albert was put to flight. Henry II., duke of Brunswick, then took command of the troops of the league, and after Albert had been placed under the imperial ban in December 1553 he was defeated by Duke Henry, and compelled to fly to France. He there entered the service of Henry II., and had undertaken a campaign to regain his lands when he died at Pforzheim on the 8th of January 1557.

See J. Voigt, *Markgraf Albrecht Alcibiades von Brandenburg-Kulmbach* (Berlin, 1852).

ALBERT I. (*c.* 1100–1170), margrave of Brandenburg, surnamed THE BEAR, was the only son of Otto the Rich, count of Ballenstedt, and Eilika, daughter of Magnus Billung, duke of Saxony. He inherited the valuable Saxon estates of his father in 1123, and on his mother's death, in 1142, succeeded to one-half of the lands of the Billungs. About 1123 he received from Lothair, duke of Saxony, the margraviate of Lusatia, and, after Lothair became German king, accompanied him on the disastrous expedition to Bohemia in 1126, when he suffered a short imprisonment. In 1128 his brother-in-law, Henry II., margrave of the Saxon north mark, died, and Albert, disappointed at not receiving this fief, attacked Udo, the succeeding margrave, and was consequently deprived of Lusatia by Lothair. In spite of this, he went to Italy in 1132 in the train of the king, and his services there were rewarded, in 1134, by the investiture of the north mark, which was again without a ruler. For three years he was occupied in campaigns against the Wends, and by an arrangement made with Pribislaus, duke of Brandenburg, Albert secured this district when the duke died in 1150. Taking the title margrave of Brandenburg, he pressed the warfare against the Wends, extended the area of his mark, did much for the spread of Christianity and civilization therein, and so became the founder of the margraviate of Brandenburg. In 1137 his cousin, Henry the Proud, had been deprived by King Conrad III. of his Saxon duchy, which was given to Albert. After meeting with some success in his efforts to take possession, he was driven from Saxony, and also from his mark by Henry, and compelled to take refuge in South Germany, and when peace was made in 1142 he renounced the Saxon dukedom and received the counties of Weimar and Orlamünde. It was possibly at this time that Albert was made arch-chamberlain of the Empire, an office which afterwards gave the margraves of Brandenburg the rights of an elector. A feud with Henry the Lion, duke of Saxony, was followed, in 1158, by a pilgrimage to the Holy Land, and in 1162 Albert accompanied the emperor Frederick I. to Italy, and distinguished himself at the storming of Milan. In 1164 he joined a league of princes formed against Henry the Lion, and peace being made in 1169, Albert divided his territories among his six sons, and died on the 13th of November 1170, and was buried at Ballenstädt. His personal qualities won for him the surname of "the Bear," and he is also called by later writers "the Handsome."

See L. von Heinemann, *Albrecht der Bär* (Darmstadt, 1864).

ALBERT III. (1414–1486), elector of Brandenburg, surnamed ACHILLES because of his knightly qualities, was the third son of Frederick I. of Hohenzollern, elector of Brandenburg, and was born at Tangermünde on the 9th of November 1414. After passing some time at the court of the emperor Sigismund, he took part in the war against the Hussites, and afterwards distinguished himself whilst assisting the German king, Albert II., against the Poles. On the division of territory which followed his father's death in 1440, Albert received the principality of Ansbach; and although his resources were very meagre he soon took a leading place among the German princes, and was especially prominent in resisting the attempts of the towns to obtain self-government. In 1443 he formed a league directed mainly against Nuremberg, over which town members of his family had formerly exercised the rights of burgrave. It was not until 1448, however, that he found a pretext for attack, and the war which lasted until 1453 ended in a victory for the Nurembergers, and the recognition of their independence. He supported the emperor Frederick III. in his struggle with the princes who desired reforms in Germany, and in return for this loyalty received many marks of favour from Frederick, including extensive judicial rights which aroused considerable irritation among neighbouring rulers. In 1457 he arranged a marriage between his eldest son John, and Margaret, daughter of William III., landgrave of Thuringia, who inherited the claims upon Hungary and Bohemia of her mother, a granddaughter of the emperor Sigismund. The attempt to secure these thrones for the Hohenzollerns through this marriage failed, and a similar fate befell Albert's efforts to revive in his own favour the disused title of duke of Franconia. The sharp dissensions which existed among the princes over the question of reform culminated in open warfare in 1460, when Albert was confronted with a league under the leadership of the elector palatine, Frederick I., and Louis IX. (the Rich), duke of Bavaria-Landshut. Worsted in this struggle, which was concluded in 1462, Albert made an alliance with his former enemy, George Podĕbrad, king of Bohemia, a step which caused Pope Paul II. to place him under the ban.

In 1470 Albert, who had inherited Bayreuth on the death of his brother John in 1464, became elector of Brandenburg owing to the abdication of his remaining brother, the elector Frederick II. He was soon actively engaged in its administration, and by the treaty of Prenzlau in 1472 he brought Pomerania also under his supremacy. Having established his right to levy a tonnage on wines in the mark, he issued in February 1473 the important *dispositio Achillea*, which decreed that the mark of Brandenburg should descend in its entirety to the eldest son, while the younger sons should receive the Franconian possessions of the family. After treating in vain for a marriage between one of his sons and Mary, daughter and heiress of Charles the Bold, duke of Burgundy, Albert handed over the government of Brandenburg to his eldest son John, and returned to his Franconian possessions. In 1474 he married his daughter Barbara to Henry XI., duke of Glogau, who left his possessions on his death in 1476 to his widow with reversion to her family, an arrangement which was resisted by Henry's kinsman, John II., duke of Sagan. Aided by Matthias Corvinus, king of Hungary, John invaded Brandenburg, and the Pomeranians seized the opportunity to revolt. Under these circumstances Albert returned to Brandenburg in 1478, compelled the Pomeranians to own his supremacy, and after a stubborn struggle secured a part of Duke Henry's lands for his daughter in 1482. His main attention was afterwards claimed by the business of the Empire, and soon after taking part in the election of Maximilian as king of the Romans he died at Frankfort on the 11th of March 1486. He left a considerable amount of treasure. His first wife was Margaret of Baden, by whom he had six children; and his second was Anne of Saxony, by whom he had thirteen.

Albert was a man of relentless energy and boundless ambition, who by reason of his physical and intellectual qualities was one of the most prominent princes of the 15th century.

See *Das kaiserliche Buch des Markgrafen Albrecht Achilles, Vorkurfürstliche Periode, 1440–1470*, edited by C. Höfler (Bayreuth, 1850); *Kurfürstliche Periode*, edited by J. von Minutoli (Berlin, 1850); *Quellensammlung zur Geschichte des Hauses Hohenzollern*, Band I., edited by C. A. H. Burkhardt (Jena, 1857); O. Franklin, *Albrecht Achilles und die Nuremberger, 1449–1453* (Berlin, 1866); *Politische Korrespondenz des Kurfürsten Albrecht Achilles, 1470–1486*, edited by F. Priebatsch (Leipzig, 1894–1898); J. G. Droysen, *Geschichte der preussischen Politik* (Berlin, 1855–1886).

ALBERT (FRANCIS CHARLES AUGUSTUS ALBERT EMMANUEL) (1819–1861), prince-consort of England, was born at Rosenau on the 26th of August 1819. He was the second son of the hereditary duke of Saxe-Coburg-Gotha (belonging to the Ernestine or elder branch of the royal family of Saxony) by his first wife, the princess Louise of Saxe-Gotha-Altenburg (*d.* 1831), from whom the duke was separated in 1824. His father's sister married the duke of Kent, and her daughter, afterwards Queen Victoria of England, Prince Albert's wife, was thus his first cousin. They were born in the same year. Albert and his elder brother, Ernest, were close companions in youth, and were educated under the care of Consistorialrath Florschütz, subsequently proceeding to the university of Bonn. There Prince Albert devoted himself especially to natural science, political economy and philosophy, having for teachers such men as Fichte, Schlegel and Perthes; he diligently cultivated music and painting, and excelled in gymnastic exercises, especially in fencing. The idea of a marriage between him and his cousin Victoria had always been cherished by their uncle, King Leopold I. of Belgium, and in May 1836 the duke of Saxe-Coburg-Gotha and his two sons paid a visit to Kensington Palace, where Princess Victoria, as she then was, lived, for the purpose of making acquaintance for the first time. The visit was by no means to the taste of King William IV., who disapproved of the match and favoured Prince Alexander of Orange. But Leopold's plan was known to Princess Victoria, and William's objections were fruitless. Princess Victoria, writing to her uncle Leopold (May 23, 1836), said that Albert was "extremely handsome"; and (June 7) thanked him for the "prospect of great happiness you have contributed to give me in the person of dear Albert. He possesses every quality that could be desired to render me perfectly happy." No formal engagement was entered into, but the situation was privately understood as one which in time would naturally develop. After the queen came to the throne, her letters show her interest in Albert's being educated for the part he would have to play. In the winter of 1838–1839 the prince travelled in Italy, accompanied by Baron Stockmar, formerly Leopold's doctor and private secretary, and now the queen's confidential adviser. On the 10th of October 1839 he and Ernest went again to England to visit the queen, with the object of finally settling the marriage. Mutual inclination and affection at once brought about the desired result. They became definitely engaged on the 15th of October, and on the 10th of February 1840 the marriage was celebrated at the chapel-royal, St James's.

The position in which the prince was placed by his marriage, while it was one of distinguished honour, was also one of considerable difficulty; and during his lifetime the tactful way in which he filled it was very inadequately appreciated. The public life of the prince-consort cannot be separated from that of the queen, and it is unnecessary here to repeat such details as are given in the article on her (see VICTORIA, QUEEN). The prejudice against him, on account of what was regarded as undue influence in politics, was never fully dissipated till after his death. His co-operation with the queen in dealing with the political responsibilities which devolved upon the sovereign represented an amount of conscientious and self-sacrificing labour which cannot easily be exaggerated; and his wisdom in council could only be realized, outside a very small circle, when in later years the materials for the history of that time became accessible. He was indeed a man of cultured and liberal ideas, well qualified to take the lead in many reforms which the England of that day sorely needed. He was specially interested in endeavours to secure the more perfect application of science and art to manufacturing industry. The Great Exhibition of 1851 originated in a suggestion he made at a meeting of the Society of Arts, and owed the greater part of its success to his intelligent and unwearied efforts. He had to work for its realization against an extraordinary outburst of angry expostulations. Every stage in his project was combated. In the House of Peers, Lord Brougham denied the right of the crown to hold the exhibition in Hyde Park; in the Commons, Colonel Sibthorp prophesied that England would be overrun with foreign rogues and revolutionists, who would subvert the morals of the people, filch their trade secrets from them, and destroy their faith and loyalty towards their religion and their sovereign. Prince Albert was president of the exhibition commission, and every post brought him abusive letters, accusing him, as a foreigner, of being intent upon the corruption of England. He was not the man to be balked by talk of this kind, but quietly persevered, looking always to the probability that the manufacturing power of Great Britain would be quickened by bringing the best manufactured products of foreign countries under the eyes of the mechanics and artisans. A sense of the artistic was at this time almost wholly wanting among the English people. One day the prince had a conversation with a great manufacturer of crockery, and sought to convert him to the idea of issuing something better than the eternal willow-pattern in white with gold, red or blue, which formed the staple of middle and lower class domestic china. The manufacturer held out that new shapes and designs would not be saleable; but he was induced to try, and he did so with such a rapid success that a revolution in the china cupboards of England was accomplished from that time. The exhibition was opened by the queen on the 1st of May 1851, and was a colossal success; and the realized surplus of £150,000 went to establish and endow the South Kensington Museum (afterwards renamed "Victoria and Albert") and to purchase land in that neighbourhood. Similar institutions, on a smaller scale but with a kindred aim, always found in him warm advocacy and substantial support. It was chiefly at meetings in connexion with these that he found occasion for the delivery of addresses characterized by profound thought and comprehensiveness of view, a collection of which was published in 1857. One of the most favourable specimens of his powers as a speaker is the inaugural address which he delivered as president of the British Association for the Advancement of Science when it met at Aberdeen in 1859. The education of his family and the management of his domestic affairs furnished the prince with another very important sphere of action, in which he employed himself with conscientious devotedness.

The estates of the duchy of Cornwall, the hereditary appanage of the prince of Wales, were so greatly improved under his father's management that the rent-roll rose from £11,000 to £50,000 a year. Prince Albert, indeed, had a peculiar talent for the management of landed estates. His model farm at Windsor was in every way worthy of the name; and the grounds at Balmoral and Osborne were laid out entirely in conformity with his designs.

A character so pure, and a life so useful and well-directed in all its aims, could scarcely fail to win respect among those who were acquainted with the facts. As the prince became better known, public mistrust began to give way. In 1847, but only after a significantly keen contest with Earl Powis, he was elected chancellor of the university of Cambridge; and he was afterwards appointed master of the Trinity House. In June 1857 the formal title of prince-consort was conferred upon him by letters patent, in order to settle certain difficulties as to precedence that had been raised at foreign courts.

But in the full career of his usefulness he was cut off. During the autumn of 1861 he was busy with the arrangements for the projected international exhibition, and it was just after returning from one of the meetings in connexion with it that he was seized with his last illness. Beginning at the end of November with what appeared to be influenza, it proved to be an attack of typhoid fever, and, congestion of the lungs supervening, he died on the 14th of December. The grief of the queen was overwhelming and the sympathy of the whole nation marked a revulsion of feeling about the prince himself which was not devoid of compunction for earlier want of appreciation. The magnificent mausoleum at Frogmore, in which his remains were finally deposited, was erected at the expense of the queen and the royal family; and many public monuments to "Albert the Good" were erected all over the country, the most notable being the Albert Hall (1867) and the Albert Memorial (1876) in London. His name was also commemorated in the queen's institution of the Albert medal (1866) in reward for gallantry in saving life, and of the order of Victoria and Albert (1862).

By the queen's authority, her secretary, General Grey, compiled *The Early Days of the Prince Consort*, published in 1867; and *The Life and Letters of the Prince Consort* (1st vol., 1874; 2nd, 1880) was similarly edited by Sir Theodore Martin. A volume of the *Principal Speeches and Addresses of Prince Albert*, with an introduction by Sir Arthur Helps, was published in 1862. See also the *Letters of Queen Victoria* (1907). (H. Ch.)

ALBERT I. (*c.* 1250–1308), German king, and duke of Austria, eldest son of King Rudolph I., the founder of the greatness of the house of Habsburg, was invested with the duchies of Austria and Styria, together with his brother Rudolph, in 1282. In 1283 his father entrusted him with their sole government, and he appears to have ruled them with conspicuous success. Rudolph was unable to secure the succession to the German throne for his son, and on his death in 1291, the princes, fearing Albert's power, chose Adolph of Nassau as king. A rising among his Swabian dependants compelled Albert to recognize the sovereignty of his rival, and to confine himself to the government of the Habsburg territories. He did not abandon his hopes of the throne, and, in 1298, was chosen German king by some of the princes, who were dissatisfied with Adolph. The armies of the rival kings met at Göllheim near Worms, where Adolph was defeated and slain, and Albert submitted to a fresh election. Having secured the support of several influential princes by extensive promises, he was chosen at Frankfort on the 27th of July 1298, and crowned at Aix-la-Chapelle on the 24th of August following. Albert sought to play an important part in European affairs. He seemed at first inclined to press a quarrel with France over the Burgundian frontier, but the refusal of Pope Boniface VIII. to recognize his election led him to change his policy, and, in 1299, a treaty was made between Albert and Philip IV., king of France, by which Rudolph, the son of the German king, was to marry Blanche, a daughter of the French king. He afterwards became estranged from Philip, and, in 1303, was recognized as German king and future emperor by Boniface, and, in return, admitted the right of the pope alone to bestow the imperial crown, and promised that none of his sons should be elected German king without the papal consent. Albert had failed in his attempt to seize Holland and Zealand, as vacant fiefs of the Empire, on the death of Count John I. in 1299, but in 1306 he secured the crown of Bohemia for his son Rudolph on the death of King Wenceslaus III. He also renewed the claim which had been made by his predecessor, Adolf, on Thuringia, and interfered in a quarrel over the succession to the Hungarian throne. His attack on Thuringia ended in his defeat at Lucka in 1307, and, in the same year, the death of his son Rudolph weakened his position in eastern Europe. His action in abolishing all tolls established on the Rhine since 1250, led to the formation of a league against him by the Rhenish archbishops and the count palatine of the Rhine; but aided by the towns, he soon crushed the rising. He was on the way to suppress a revolt in Swabia when he was murdered on the 1st of May 1308, at Windisch on the Reuss, by his nephew John, afterwards called "the Parricide," whom he had deprived of his inheritance. Albert married Elizabeth, daughter of Meinhard IV., count of Görz and Tirol, who bore him six sons and five daughters. Although a hard, stern man, he had a keen sense of justice when his selfish interests were not involved, and few of the German kings possessed so practical an intelligence. He encouraged the cities, and not content with issuing proclamations against private war, formed alliances with the princes in order to enforce his decrees. The serfs, whose wrongs seldom attracted notice in an age indifferent to the claims of common humanity, found a friend in this severe monarch, and he protected even the despised and persecuted Jews. The stories of his cruelty and oppression in the Swiss cantons first appear in the 16th century, and are now regarded as legendary.

See G. Droysen, *Albrechts I. Bemühungen um die Nachfolge im Reich* (Leipzig, 1862); J. F. A. Mücke, *Albrecht I. von Habsburg* (Gotha, 1866); A. L. J. Michelsen, *Die Landgrafschaft Thüringen unter den Königen Adolf, Albrecht, und Heinrich VII.* (Jena, 1860).

ALBERT II. (1397–1439), German king, king of Bohemia and Hungary, and (as Albert V.) duke of Austria, was born on the 10th of August 1397, the son of Albert IV. of Habsburg, duke of Austria. He succeeded to the duchy of Austria on his father's death in 1404. After receiving a good education, he undertook the government of Austria in 1411, and succeeded, with the aid of his advisers, in ridding the duchy of the evils which had arisen during his minority. He assisted the German king, Sigismund, in his campaigns against the Hussites, and in 1422 married Elizabeth, daughter and heiress of Sigismund, who designated him as his successor. When the German king died in 1437, Albert was crowned king of Hungary on the 1st of January 1438, and although crowned king of Bohemia six months later, he was unable to obtain possession of the country. He was engaged in warfare with the Bohemians and their Polish allies, when on the 18th of March 1438 he was chosen German king at Frankfort, an honour which he does not appear to have sought. Afterwards engaged in defending Hungary against the attacks of the Turks, he died on the 27th of October 1439 at Langendorf, and was buried at Stuhlweissenburg. Albert was an energetic and warlike prince, whose short reign gave great promise of usefulness for Germany.

See W. Altmann, *Die Wahl Albrecht II. zum römischen Könige* (Berlin, 1886).

ALBERT (1490–1545), elector and archbishop of Mainz, and archbishop of Magdeburg, was the younger son of John Cicero, elector of Brandenburg, and was born on the 28th of June 1490. Having studied at the university of Frankfort-on-the-Oder, he entered the ecclesiastical profession, and in 1513 became archbishop of Magdeburg and administrator of the diocese of Halberstadt. In 1514 he obtained the electorate of Mainz, and in 1518 was made a cardinal. Meanwhile to pay for the pallium of the see of Mainz and to discharge the other expenses of his elevation, Albert had borrowed a large sum of money from the Fuggers, and had obtained permission from Pope Leo X. to conduct the sale of indulgences in his diocese to obtain funds to repay this loan. For this work he procured the services of John Tetzel, and so indirectly exercised a potent influence on the course of the Reformation. When the imperial election of 1519 drew near, the elector's vote was eagerly solicited by the partisans of Charles (afterwards the emperor Charles V.) and by those of Francis I., king of France, and he appears to have received a large amount of money for the vote which he cast eventually for Charles. Albert's large and liberal ideas, his friendship with Ulrich von Hutten, and his political ambitions, appear to have raised hopes that he would be won over to the reformed faith; but after the Peasants' War of 1525 he ranged himself definitely among the supporters of Catholicism, and was among the princes who met to concert measures for its defence at Dessau in July 1525. His hostility towards the reformers, however, was not so extreme as that of his brother Joachim I., elector of Brandenburg; and he appears to have exerted himself in the interests of peace, although he was a member of the league of Nuremberg, which was formed in 1538 as a counterpoise to the league of Schmalkalden. The new doctrines nevertheless made considerable progress in his dominions, and he was compelled to grant religious liberty to the inhabitants of Magdeburg in return for 500,000 florins. During his latter years indeed he showed more intolerance towards the Protestants, and favoured the teaching of the Jesuits in his dominions. Albert adorned the *Stiftskirche* at Halle and the cathedral at Mainz in sumptuous fashion, and took as his motto the words *Domine, dilexi decorem domus tuae.* A generous patron of art and learning, he counted Erasmus among his friends. He died at Aschaffenburg on the 24th of September 1545.

See J. H. Hennes, *Albrecht von Brandenburg, Erzbischof von Mainz und Magdeburg* (Mainz, 1858); J. May, *Der Kurfürst, Kardinal, und Erzbischof Albrecht II. von Mainz und Magdeburg* (Munich, 1865–1875); W. Schum, *Kardinal Albrecht von Mainz und die Erfurter Kirchenreformation* (Halle, 1878); P. Redlich, *Kardinal Albrecht von Brandenburg, und das neue Stift zu Halle* (Mainz, 1900).

ALBERT (1490–1568), Grand Master of the Teutonic Order, and first duke of Prussia, was the third son of Frederick of Hohenzollern, prince of Ansbach and Bayreuth, and Sophia, daughter of Casimir IV., king of Poland. Born at Ansbach on the 16th of May 1490, he was intended for the church, and passed some time at the court of Hermann, elector of Cologne, who appointed him to a canonry in his cathedral. Turning to a more active life, he accompanied the emperor Maximilian I. to Italy in 1508, and after his return spent some time in Hungary. In December, Frederick, grand master of the Teutonic Order, died, and Albert, joining the order, was chosen as his successor early in 1511 in the hope that his relationship to Sigismund I., king of Poland, would facilitate a settlement of the disputes over east Prussia, which had been held by the order under Polish suzerainty since 1466. The new master, however, showed no desire to be conciliatory, and as war appeared inevitable, he made strenuous efforts to secure allies, and carried on tedious negotiations with the emperor Maximilian I. The ill-feeling, influenced by the ravages of members of the order in Poland, culminated in a struggle which began in December 1519. During the ensuing year Prussia was devastated, and Albert consented early in 1521 to a truce for four years. The dispute was referred to the emperor Charles V. and other princes, but as no settlement was reached the master continued his efforts to obtain help in view of a renewal of the war. For this purpose he visited Nuremberg in 1522, where he made the acquaintance of the reformer, Andreas Osiander, by whose influence he was won over to the side of the new faith. He then journeyed to Wittenberg, where he was advised by Martin Luther to cast aside the senseless rules of his order, to marry, and to convert Prussia into an hereditary duchy for himself. This proposal, which commended itself to Albert, had already been discussed by some of his relatives; but it was necessary to proceed cautiously, and he assured Pope Adrian VI. that he was anxious to reform the order and punish the knights who had adopted Lutheran doctrines. Luther for his part did not stop at the suggestion, but in order to facilitate the change made special efforts to spread his teaching among the Prussians, while Albert's brother, George, prince of Ansbach, laid the scheme before Sigismund of Poland. After some delay the king assented to it provided that Prussia were held as a Polish fief; and after this arrangement had been confirmed by a treaty made at Cracow, Albert was invested with the duchy by Sigismund for himself and his heirs on the 10th of February 1525. The estates of the land then met at Königsberg and took the oath of allegiance to the new duke, who used his full powers to forward the doctrines of Luther. This transition did not, however, take place without protest. Summoned before the imperial court of justice, Albert refused to appear and was placed under the ban; while the order, having deposed the grand master, made a feeble effort to recover Prussia. But as the German princes were either too busy or too indifferent to attack the duke, the agitation against him soon died away. In imperial politics Albert was fairly active. Joining the league of Torgau in 1526, he acted in unison with the Protestants, and was among the princes who banded themselves together to overthrow Charles V. after the issue of the *Interim* in May 1548. For various reasons, however, poverty and personal inclination among others, he did not take a prominent part in the military operations of this period. The early years of Albert's rule in Prussia were fairly prosperous. Although he had some trouble with the peasantry, the lands and treasures of the church enabled him to propitiate the nobles and for a time to provide for the expenses of the court. He did something for the furtherance of learning by establishing schools in every town and by giving privileges to serfs who adopted a scholastic life. In 1544, in spite of some opposition, he founded a university at Königsberg, where he appointed his friend Osiander to a professorship in 1549. This step was the beginning of the troubles which clouded the closing years of Albert's reign. Osiander's divergence from Luther's doctrine of justification by faith involved him in a violent quarrel with Melanchthon, who had adherents in Königsberg, and these theological disputes soon created an uproar in the town. The duke strenuously supported Osiander, and the area of the quarrel soon broadened. There were no longer church lands available with which to conciliate the nobles, the burden of taxation was heavy, and Albert's rule became unpopular. After Osiander's death in 1552 he favoured a preacher named John Funck, who, with an adventurer named Paul Scalich, exercised great influence over him and obtained considerable wealth at the public expense. The state of turmoil caused by these religious and political disputes was increased by the possibility of Albert's early death and the necessity in that event for a regency owing to the youth of his only son, Albert Frederick. The duke was consequently obliged to consent to a condemnation of the teaching of Osiander, and the climax came in 1566 when the estates appealed to Sigismund II., king of Poland, who sent a commission to Königsberg. Scalich saved his life by flight, but Funck was executed; the question of the regency was settled; and a form of Lutheranism was adopted, and declared binding on all teachers and preachers. Virtually deprived of power, the duke lived for two years longer, and died at Tapiau on the 20th of March 1568. In 1526 he had married Dorothea, daughter of Frederick I., king of Denmark, and after her death in 1547, Anna Maria, daughter of Eric I., duke of Brunswick. Albert was a voluminous letter-writer, and corresponded with many of the leading personages of the time. In 1891 a statue was erected to his memory at Königsberg.

See J. Voigt, *Briefwechsel der berühmtesten Gelehrten des Zeitalters der Reformation mit Herzog Albrecht von Preussen* (Königsberg, 1841); E. Joachim, *Die Politik des letzten Hochmeisters in Preussen, Albrecht von Brandenburg* (Leipzig, 1892); K. Lohmeyer, *Herzog Albrecht von Preussen* (Danzig, 1890).

ALBERT III. (1443–1500), duke of Saxony, surnamed ANIMOSUS or THE COURAGEOUS, younger son of Frederick II., the Mild, elector and duke of Saxony, was born on the 27th of January 1443, and after escaping from the hands of Kunz von Kaufungen, who had abducted him together with his brother Ernest, passed some time at the court of the emperor Frederick III. in Vienna. In 1464 he married Zedena, or Sidonia, daughter of George Poděbrad, king of Bohemia, but failed to obtain the Bohemian crown on the death of George in 1471. After the death of the elector Frederick in 1464, Albert and Ernest ruled their lands together, but in 1485 a division was made by the treaty of Leipzig, and Albert received Meissen, together with some adjoining districts, and founded the Albertine branch of the family of Wettin. Regarded as a capable soldier by the emperor, Albert, in 1475, took a prominent part in the campaign against Charles the Bold, duke of Burgundy, and in 1487 led an expedition against Matthias Corvinus, king of Hungary, which failed owing to lack of support on the part of the emperor. In 1488 he marched with the imperial forces to free the Roman king Maximilian from his imprisonment at Bruges, and when, in 1489, the king returned to Germany, Albert was left as his representative to prosecute the war against the rebels. He was successful in restoring the authority of Maximilian in Holland, Flanders and Brabant, but failed to obtain any repayment of the large sums of money which he had spent in these campaigns. His services were rewarded in 1498 when Maximilian bestowed upon him the title of hereditary governor (potestat) of Friesland, but he had to make good his claim by force of arms. He had to a great extent succeeded, and was paying a visit to Saxony, when he was recalled by news of a fresh rising. Groningen was captured, but soon afterwards the duke died at Emden, on the 12th of September 1500. He was buried at Meissen. Albert, who was a man of great strength and considerable skill in feats of arms, delighted in tournaments and knightly exercises. His loyalty to the emperor Frederick, and the expenses incurred in this connexion, aroused some irritation among his subjects, but his rule was a period of prosperity in Saxony.

See F. A. von Langenn, *Herzog Albrecht der Beherzte, Stammvater des königlichen Hauses Sachsen* (Leipzig, 1838); O. Sperling, *Herzog Albrecht der Beherzte von Sachsen als Gubernator Frieslands* (Leipzig, 1892).

ALBERT, FREDERICK AUGUSTUS, king of Saxony (1828–1902), was born on the 23rd of April 1828, being the eldest son of Prince John, who succeeded to the throne in 1854. His education was, as is usual with German princes, to a great extent military, but he attended lectures at the university of Bonn. His first experience of warfare was in 1849, when he served as a captain in the campaign of Schleswig-Holstein against the Danes. When the war of 1866 broke out, the crown-prince was placed in command of the Saxon forces opposing the Prussian army of Prince Frederick Charles. No attempt was made to defend Saxony; the Saxons fell back into Bohemia and effected a junction with the Austrians. They took a prominent part in the battles by which the Prussians forced the line of the Iser and in the battle of Gitchin. The crown-prince, however, succeeded in effecting the retreat in good order, and in the decisive battle of Königgrätz (see Seven Weeks' War) he held the extreme left of the Austrian position. The Saxons maintained their post with great tenacity, but were involved in the disastrous defeat of their allies. During these operations the crown-prince won the reputation of a thorough soldier; after peace was made and Saxony had entered the North German confederation, he was placed in command of the Saxon army, which had now become the XII. army corps of the North German army, and in this position carried out the necessary reorganization. He was a firm adherent of the Prussian alliance. On the outbreak of war in 1870 he again commanded the Saxons, who were included in the 2nd army under Prince Frederick Charles, his old opponent. At the battle of Gravelotte they formed the extreme left of the German army, and with the Prussian Guard carried out the attack on St Privat, the final and decisive action in the battle. In the reorganization of the army which accompanied the march towards Paris the crown-prince was given a separate command over the 4th army (army of the Meuse) consisting of the Saxons, the Prussian Guard corps and the IV. (Prussian Saxony) corps. He was succeeded in command of the XII. corps by his brother Prince George, who had served under him in Bohemia. He took a leading part in the operations which preceded the battle of Sedan, the 4th army being the pivot on which the whole army wheeled round in pursuit of MacMahon; and the actions of Buzancy and Beaumont on the 29th and 30th of August were fought under his direction; in the battle of Sedan itself, with the troops under his orders, he carried out the envelopment of the French on the east and north. His conduct in these engagements won for him the complete confidence of the army, and during the siege of Paris his troops formed the north-east section of the investing force. After the conclusion of the armistice he was left in command of the German army of occupation, a position which he held till the fall of the Commune. On the conclusion of peace he was made an inspector-general of the army and field-marshal. On the death of his father on the 29th of October 1873 he succeeded to the throne. His reign was uneventful, and he took little public part in politics, devoting himself to military affairs, in which his advice and experience were of the greatest value, not only to the Saxon corps but to the German army in general. In 1897 he was appointed arbitrator between the claimants for the principality of Lippe. King Albert married in 1853 Carola, daughter of Prince Gustavus of Vasa, and granddaughter of the last king of Sweden of the house of Holstein. He died on the 19th of June 1902.

ALBERT, surnamed the Degenerate (*c.* 1240–1314), landgrave of Thuringia, was the eldest son of Henry III., the Illustrious, margrave of Meissen. He married Margaret, daughter of the emperor Frederick II., in 1254, and in 1265 received from his father Thuringia and the Saxon palatinate. His infatuation for Kunigunde of Eisenberg caused his wife to leave him, and after her death in 1270 he married Kunigunde, who had already borne him a son, Apitz or Albert. He wished to make Apitz his successor in Thuringia, a plan which was resisted by his two elder sons, and a war broke out which lasted until 1307, when he abandoned Thuringia, in return for a yearly payment, but retained the title of landgrave (see Thuringia). Albert, who had married Elizabeth, daughter of Hermann III., count of Orlamünde, after the death of his second wife in 1286, died on the 13th of November 1314.

See F. X. Wegele, *Friedrich der Friedige, Markgraf von Meissen, und die Wettiner seiner Zeit* (Nördlingen, 1820); F. W. Tittmann, *Geschichte Heinrich des Erlauchten Markgraven zu Meissen* (Leipzig, 1863).

ALBERT (FRIEDRICH RUDOLF ALBRECHT), Archduke (1817–1895), Austrian field-marshal, was the eldest son of the archduke Charles (Karl Friedrich), and was born on the 3rd of August 1817 at Vienna. After being educated under the careful superintendence of his father, he entered the Austrian (*K.K.*) army as a colonel of infantry in 1837, and was transferred to the cavalry arm in 1839, becoming a major-general in 1840. A brief period of leave in this year he spent at the great manœuvres in Italy, to learn the art of troop-leading from the first soldier in Europe, Radetzky. He then took over the command of a brigade of all arms at Graz. In 1844 he married Princess Hildegarde of Bavaria. He had been made a lieutenant field-marshal in the previous year, and was now placed in command of the forces in Upper and Lower Austria. In this position he did much to maintain and improve the efficiency of the troops under his command, at a time when nearly all armies in Europe, with the exception of Radetzky's in Italy, had sunk to the lowest level. The influence of Radetzky over the young archduke was indeed remarkable. At this time the Austrian generals and staff officers had committed themselves blindly to the strategical method of the archduke Charles, the tradition of whose practical soldiership survived only in Radetzky and a few others. Albert chose to follow the latter, and was thus saved from the pseudo-scientific pedantry which brought defeat to the Austrian arms in 1859 and in 1866. His first serious service came in March 1848, when it became his duty, as district commander, to maintain order in Vienna by force, and at the outbreak of revolution in Vienna during the month of March he was in command of the troops who came into collision with the rioters. Owing to the collapse of the government it was impossible to repress the disturbances, and he was relieved from a post which brought much unpopularity and was not suitable to be held by a member of the imperial family. He went at once to the seat of war in Italy, and fought under Radetzky as a volunteer throughout the campaign of 1848, being present at the action of Pastrengo and the battles of Santa Lucia and Custozza. In the following campaign he applied for and obtained the command of a division in the II. corps (FZM. d'Aspre), though his previous grade had been that of a general commanding-in-chief. The splendid fighting of the corps at Novara was decisive of the war, and Radetzky named d'Aspre, Count Thurn, and the archduke as the general officers worthy of the greatest rewards. The field-marshal indeed recommended, and almost insisted, that Albert should receive the much-prized order of Maria Theresa. In 1850 he became a general of cavalry, and in 1851 military and civil governor of Hungary. In this important and difficult position he remained until 1860, when he was relieved at his own request. Shortly afterwards he was appointed to succeed Radetzky as commander-in-chief in Italy, and in 1863 he was promoted field-marshal. In the following year the archduke lost his wife, soon after the marriage of their elder daughter to Duke Philip of Württemberg. In 1859 and 1864 he was sent on important military and diplomatic missions to Berlin. When war became imminent in 1866, the archduke took command of the field army in Italy. The story of the campaign of 1866 in Italy will be found under Italian Wars (1848–1870); the operations of the archduke, who disposed of greatly inferior forces, were crowned with success in the brilliant victory of Custozza (June 23), and his reputation as a general-in-chief was firmly established by only eight days of field operations, though it is possible that his chief of staff, Lieut. Field-Marshal von John, contributed not a little to the success of the Austrian arms. The result of Custozza was the retreat and complete immobilization of the whole Italian army, so that Albert was able to despatch the greater part of his troops to reinforce the Bohemian army, when, after being defeated by the Prussians, it fell back on Vienna. On the 10th of July the archduke was summoned to Vienna to take supreme command of the forces which were being collected to defend the capital, but peace was made before further hostilities took place. From this time, under various titles, he acted as inspector-general of the army. Like his father, and with better fortune, he was called upon to reorganize the military system of his country on an entirely new plan, learned, as before, by defeat. The principle of universal short service, and the theory of the armed nation, were necessarily the groundwork of the reforms, and the consequent preparation of all the national resources for their task in war, by the superintendence of peace administration, by the skilful conduct of manœuvres, was thenceforward the task of his lifetime. In 1870 he conducted the military negotiations preparatory to an alliance with France, which, however, was not concluded. The tragic death of his daughter, Princess Mathilde, in 1867, and the death of his brother, Archduke Karl Ferdinand, in 1874, narrowed still further his family circle, and impelled him to even greater activity in his military duties, and to effective participation in the work of many military charities. He retained personal control of the army until his last illness, which he contracted at the funeral of his nephew Francis, ex-king of Naples. His only remaining brother, the archduke Wilhelm, had died a few months before, as the result of an accident. He himself died on the 18th of February 1895. His only son died in childhood, and his nephew Archduke Frederick (born 1856) inherited his great possessions, including the Albertina, a famous collection of books, manuscripts, engravings and maps, founded by Duke Albert of Saxe-Teschen.

Amongst the military works of the Archduke Albert may be named *Über die Verantwortlichkeit im Kriege* (a work which created a great sensation, and was translated into English and French), *Gedanken über dem Militärgeist*, *Über die höhere Leitung im Kriege*, and *Kritische Betrachtungen über den Feldzug 1866 in Italien*. He also was the principal editor of the military works of his father.

See Duncker, *F. M. Erzherzog Albrecht* (Vienna and Prague, 1897); Mathes v. Bilabrück, "Gedenkrede auf Weiland Sr. K. u. K. H. Erzh. Albrecht," *Mil.-Wissenschaftl. Verein*, 1895; Teuber, *F. M. Erzh. Albrecht, ein Lebensbild* (Vienna, 1895).

ALBERT, Madame (*c.* 1805–1846), French actress, whose maiden name was Thérèse Vernet, was born of a family of players. She first appeared in children's and *ingénue* parts, and in comic opera, and it was not until 1827, two years after her Paris *début*, that her great talents were seen and appreciated. In *Caleb Valentine*, *Henry V.*, *Madame Dubarry*, *Catherine II.*, *Leontine*, *Un duel sous le cardinal de Richelieu*, and many other plays, her grace, beauty and distinction of manner made her the idol of Paris, and her circle of admirers was widened by long tours of the provinces and abroad. Ill-health compelled her to retire in 1846. She was twice married, about 1825 to Albert Rodrigues, an actor who played under his Christian name, and in 1846 to Eugène Bignon (1812–1858), the actor and playwright.

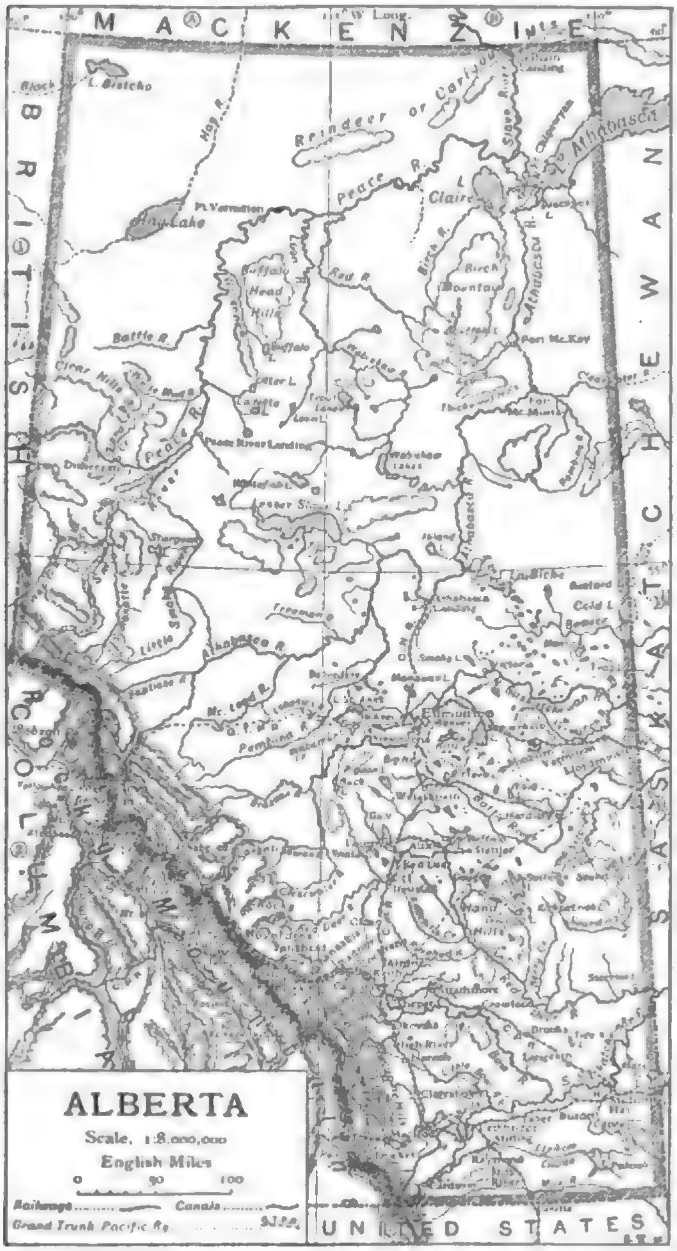
ALBERT OF AIX (fl. *c.* A.D. 1100), historian of the first crusade, was born during the later part of the 11th century, and afterwards became canon and *custos* of the church of Aix-la-Chapelle. Nothing else is known of his life except that he was the author of a *Historia Hierosolymitanae expeditionis*, or *Chronicon Hierosolymitanum de bello sacro*, a work in twelve books, written between 1125 and 1150. This history begins at the time of the council of Clermont, deals with the fortunes of the first crusade and the earlier history of the Latin kingdom of Jerusalem, and ends somewhat abruptly in 1121. It was well known during the middle ages, and was largely used by William, archbishop of Tyre, for the first six books of his *Belli sacri historia*. In modern times its historical value has been seriously impugned, but the verdict of the best scholarship seems to be that in general it forms a true record of the events of the first crusade, although containing some legendary matter. Albert never visited the Holy Land, but he appears to have had a considerable amount of intercourse with returned crusaders, and to have had access to valuable correspondence. The first edition of the history was published at Helmstadt in 1584, and a good edition is in the *Recueil des historiens des croisades*, tome iv. (Paris, 1841–1887).

See F. Krebs, *Zur Kritik Alberts von Aachen* (Münster, 1881); B. Kugler, *Albert von Aachen* (Stuttgart, 1885); M. Pigeonneau, *Le Cycle de la croisade et de la famille de Bouillon* (Paris, 1877); H. von Sybel, *Geschichte des ersten Kreuzzuges* (Leipzig, 1881); F. Vercruysse, *Essai critique sur la chronique d'Albert d'Aix* (Liége, 1889).

ALBERTA, a province of western Canada, established in 1905. Area 260,000 sq. m. It is bounded S. by the United States boundary line, 49° N.; E. by 110° W., which divides it from the province of Saskatchewan; N. by 60° N., which separates it from the North-West Territories; and W. by the line of peaks of the Rocky Mountains range, which runs north-westerly, and divides it from British Columbia. A fertile province, in the eastern and southern portions its surface consists chiefly of plains almost entirely treeless. As the slopes of the Rocky Mountains to the west are reached more trees are found, until in the foot-hills of the mountains bodies of forest timber occur. Trees become more numerous also northward in the province, until in the region north of the North Saskatchewan river forests are again met with. From the southern boundary line for two and a half degrees north the prairie is dry, but of good soil, which grows excellent crops when irrigated. North of this region the surface of the province is of most fertile soil, the ordinary rainfall sufficing for agriculture. The appearance of the prairie section of the province is that of undulating meadows, with rounded sloping ridges covered with shorter grasses, which serve for the support of great herds of cattle and horses. The wooded portions of the terrain are dotted with clumps and belts of trees of moderate size, giving them a park-like appearance. In winter the snowfall is very light, and even this is frequently removed by warm winds from the west. Within a hundred miles of the mountains there is constantly in view, in clear weather, the beautiful line of snowy peaks along the western horizon. This continues for hundreds of miles north-westward. The Rocky Mountains, which give its charm to Alberta, are ascended by a gradual approach from the east, but are exceedingly abrupt on their transalpine slope in British Columbia. The peaks of these mountains are majestic, many of them reaching a height of more than two miles above the sea. Among the more notable of these are Robson peak, 13,700 ft.; Athabasca, 13,700; Assiniboine, 11,830; Lyell, 12,000; Mummery, 12,000; Temple, 11,658; and Geikie, 11,000. Mt. Brown reaches 9050.

Through these Rocky Mountains the explorers and fur-traders, by ascending the streams running down the eastern declivities of the mountains, and crossing by short portages to the streams of the western slope, have succeeded in discovering passes by which the mountain chain can be crossed, the range rarely exceeding 60 m. in breadth. The most noted of the Alberta passes are (1) the Crow's Nest Pass, near the southern boundary line, through which a branch of the Canadian Pacific railway runs; (2) the Kicking Horse Pass, through which the main line of the Canadian Pacific railway is built; 40 m. from the eastern end of this pass is the Rocky Mountains Park, with the famous watering-place of Banff as its centre; (3) the Yellow Head Pass, running west from the northern branch of the Saskatchewan river; this pass was discovered by Capt. Palliser (1858), was crossed by Lord Milton and Dr W. B. Cheadle (1861), and by Sandford Fleming (1871–1872) in the Ocean to Ocean expedition; (4) Peace River Pass. By this pass Alexander Mackenzie made his celebrated voyage. There are other minor passes, and no doubt more to be discovered.

With the exception of the southern section, the province of Alberta may be said to be well watered. Rising from numerous valleys on the Alberta declivity of the Rocky Mountains between the international boundary line and 52° N. are streams which unite to form the Belly river, and farther north the Bow river. Running eastward these two rivers unite about 112° W., and flow on under the name of the South Saskatchewan river. North of 52° N. many small streams unite to form the Red Deer river, which flowing south-eastward joins the South Saskatchewan near 110° W. Between 52° and 53° N. rises the great river, the North Saskatchewan. It receives a southern tributary, the Battle river, which joins it about 108° W. Pursuing their courses eastward the North and South Saskatchewan rivers unite in the Saskatchewan (Cree, rapid-flowing river), which finds its way to Lake Winnipeg, and thence by way of Nelson river to Hudson Bay. It is one of the mightiest rivers of the continent.



Between 53° and 54° N. begins the height of land running north-easterly, north of which all the waters of Alberta flow toward the Arctic Sea. In northern Alberta, on the northern slope, gathering its tributaries from rills in the Rocky Mountains, the river Athabasca runs north and empties into Lake Athabasca near 58° N. North of 56° N. flows through and from the Rocky Mountains the Peace river. After descending north-eastward to within a few miles of Lake Athabasca, it is met by a stream emerging from that lake. The united river carrying down the waters of the Athabasca slope is called the Slave river, which, passing through Great Slave Lake, emerges as the great Mackenzie river, which falls into the Arctic Sea. Alberta thus gives rise to the two great rivers Saskatchewan and Mackenzie. While a number of fresh-water, or in some cases brackish, lakes each less than 100 sq. m. in extent are situated in Alberta, two of more considerable size are found. These are Lake Athabasca, 3085 sq. m. in extent, of which a part is in the province of Saskatchewan, and the other Lesser Slave Lake some 600 sq. m. in area.

Climate.—As Alberta extends for 750 m. from north to south—as great a distance as from Land's End in England to the north of the Shetland Isles—it is natural that the climate should vary considerably between parallels of 49° and 60° N., and also between 110° and 120° W. It is also further influenced by the different altitudes above the sea of the several parts of the province. Dividing the province into three equal parts of 250 m. each from north to south, these may be called (A) the south, (B) the centre, (C) the north. The following data may be considered:—

CLIMATIC TABLE

Climate.	Places.	Above the Sea.	Mean Winter Temp.
(A) Moderate and changeable	Medicine Hat, lat. 50° N. Calgary, lat. 51° Banff, lat. 51¼°	2171 ft. 3421 „ 4515 „	14·3° F. 15·4° „ 15·9° „
(B) Steady . .	Edmonton, lat. 53½°	2210 „	10·3° „
(C) Severe . .	Fort Chipewyan, lat. 59° N.	600 „	7·2° „

Climate (A) allows, in what is a great ranching district, cattle and horses to run at large through the whole winter. Through the mountain passes come at times dry winds from the Pacific coast, which lick up the snow in a few hours. These winds are known as Chinook winds. While elevating the temperature they bring more moisture into the air and produce a change not entirely desirable.

Climate (B) is the steady winter climate of Edmonton district. This while averaging a lower temperature than (A) is not so subject to change; it retains the snow for sleighing, which is a boon to the farmer. This climate is much less influenced by the Pacific winds than (A).

Climate (C), that of Fort Chipewyan, having a mean winter temperature of 22·6° lower than Calgary, is a decidedly sub-arctic climate. It is the region in winter of constant ice and snow, but its lower altitude gives it a summer climate with a mean temperature of only 1·6° less than Calgary, and 1·8° less than Edmonton. It will thus be seen that the agricultural capabilities of the Athabasca and Peace river districts, not yet fully known, are full of promise.

Fauna.—The three climatic regions of Alberta have naturally a varying fauna. The south and central region was the land of the bison, its grasses affording a great pasture ground for tens of thousands of "buffaloes." They were destroyed by whites and Indians in 1870–1882 on the approach of the Canadian Pacific railway. Grizzly, black and cinnamon bears are found in the mountains and wooded districts. The coyote or small wolf, here and there the grey wolf, the fox and the mountain lion (panther) occur. The moose and red deer are found in the wooded regions, and the jumping deer and antelope on the prairies. Wild sheep and goats live in the Rocky Mountains. The lynx, wolverine, porcupine, skunk, hare, squirrel and mouse are met. The gopher is a resident of the dry plains. District (C) is the fur-trader's paradise. The buffalo is replaced by the mountain buffaloes, of which a few survive. The musk-ox comes in thousands every year to the great northern lakes, while the mink, marten, beaver, otter, ermine and musk-rat are sought by the fur-trader. Fort Chipewyan was long known in Hudson's Bay Company history as the great depôt of the Mackenzie river district. Northern Alberta and the region farther north is the nesting-ground of the migratory birds. Here vast numbers of ducks, geese, swans and pelicans resort every year. Cranes, partridges and varieties of singing birds abound. The eagle, hawk, owl and crow are plentiful. Mosquitoes and flies are everywhere, and the wasp and wild bee also. In the rivers and lakes pike, pickerel, white fish and sturgeon supply food for the natives, and the brook trout is found in the small mountain streams. The turtle and frog also appear.

Flora.—In central and northern Alberta the opening spring brings in the prairie anemone, the avens and other early flowers. The advancing summer introduces many flowers of the sunflower family, until in August the plains are one blaze of yellow and purple. The southern part of Alberta is covered by a short grass, very nutritive, but drying up in the middle of summer until the whole prairie is brown and unattractive. The trees in the wooded sections of the province are seen in clumps and belts on the hillsides. These are largely deciduous. On the north side of the Saskatchewan river forests prevail for scores and even hundreds of miles. They contain the poplar or aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), and paper or canoe birch (*Betula papyrifera*). The Coniferae are found northward and in the mountain valleys. Some of these are: Jack pine (*Pinus Banksiana*), Rocky Mountain pine (*Pinus flexilis*), black pine (*Pinus Murrayana*), white spruce (*Picea alba*), black spruce (*Picea nigra*), Engelman's spruce (*Picea Engelmanni*), mountain balsam (*Abies subalpina*), Douglas fir (*Pseudotsuga Douglasii*), mountain larch (*Larix Lyallis*).

Population.—By the census of 1906 the population of Alberta was found to be 185,412. It has grown from 73,022 in 1901 (the area of Alberta being then slightly different). The basis of the population is Canadian, and the immigration has been chiefly from (1) the British Isles, (2) United States, (3) continent of Europe (chiefly Austria, Hungary and Russia). Of the population in 1901, 17,245 had immigrated thither from the three mentioned sources. The following table shows the percentages of origins:—

	1901.
Canadian and native born	54 %
The British Isles	6·8 %
United States	16·6 %
Continent of Europe	24·4 %

Of the Indian and Indian half-breed population there were in 1901, 14,669 of the former and 11,635 of the latter. The Indians of central Alberta are chiefly plain Crees, a tribe of Algonquin stock. In southern Alberta are several thousands of Indians on reserves south and west of Calgary, consisting of the Blackfoots of Algonquin stock, Sarcees, Piegans and a few Assiniboins.

The chief cities and towns of Alberta are Edmonton (11,167), Calgary (11,967), Medicine Hat (3020), Lethbridge (2948) and Strathcona (2927).

Industries.— The chief industries of the people are farming and ranching. Cattle, horses and sheep are largely reared in the southern prairie region on ranches or smaller holdings. In this region irrigation is widely used. Red winter wheat is now produced to a considerable degree. In the town of Raymond is a large beet sugar manufactory, and in the vicinity great quantities of beets are grown by irrigation. In central Alberta coarse grains—oats and barley—and some wheat are grown, in conjunction with mixed farming. While washing out the sands of the North Saskatchewan for gold is still somewhat resorted to, the only real mining in Alberta is that for coal. Vast beds of coal are found extending for hundreds of miles, a short distance below the surface of the plains. The coal belongs to the Cretaceous beds, and while not so heavy as that of the Coal Measures is of excellent quality. In the valley of the Bow river, alongside the Canadian Pacific railway, valuable beds of anthracite coal are worked, and the coal is carried by railway as far east as Winnipeg. The usual coal deposits of Alberta are of bituminous or semi-bituminous coal. These are largely worked at Lethbridge in southern Alberta and Edmonton in the centre of the province. Many other parts of the province have pits for private use. The Athabasca river region, as well as localities far north on the Mackenzie river, has decided indications of petroleum, though it is not yet developed. Natural gas has been found at several points. The most notable gas discovery is that at Medicine Hat, which has wells with unlimited quantities. The gas is excellent, is used for lighting the town, supplies light and fuel for the people, and a number of industries are using the gas for manufacturing.

Communications.—For transportation the North Saskatchewan is to some extent depended on for carrying freight by steamboats, but railways are widespread in the province. The Canadian Pacific railway has its main line running from east to west chiefly between 50 and 51° N. Over this line passes an enormous trade from the Atlantic to the Pacific Ocean—the railway with its "Empress" steamers on the Pacific and also on the Atlantic Ocean claiming to have as its termini Liverpool and Yokohama. A branch line of the Canadian Pacific railway runs from Medicine Hat between 49° and 50° N., passing through the Crow's Nest Pass of the Rocky Mountains and carrying on trade with British Columbia. Another branch from Calgary runs southward to Macleod, and to Lethbridge there comes from the south a branch of the Great Northern railway of the United States, connecting with the state of Montana. From Calgary to Edmonton northward runs a line under the control of the Canadian Pacific railway. From this railway also run, eastward from Lacombe and Wetaskiwin, branch lines to complete the system. In 1906 the new line of the Canadian Northern railway was opened, connecting Winnipeg, 1000 m. to the east, along the North Saskatchewan river, with Edmonton. The Grand Trunk Pacific railway, backed by the Canadian government, forms a new transcontinental line; the prairie section from Winnipeg to Edmonton was in 1908 under contract.

Administration, &c.—The local government of Alberta is carried on by a provincial organization resembling that of the other Canadian provinces. The capital of the province is Edmonton, and here reside the lieutenant-governor and cabinet. The legislature consists of one house—the Legislative Assembly—of twenty-five members. Responsible government after the British model is followed, and the revenue is chiefly derived from grants from the Dominion government. Alberta has a system of municipal government similar to that of the other provinces.

Education is given by a public-school system, which, while nominally providing for separate schools for Catholics and Protestants, makes it practically impossible at most points to carry on such schools. A normal school is situated at Calgary. There is a college for secondary education in Calgary and another in Edmonton.

The following are the leading denominations in Alberta:—

	1901.
Roman Catholics	12,957
Presbyterians	10,655
Methodists	9,623
Church of England	8,888
Lutherans	5,810
Greek Church	4,618
Mormons	3,212
Baptists	2,722

The Mormons of Alberta are in the most southerly part of the province, and are a colony from the Mormon settlements in Utah, U.S. On coming to Canada they were given lands by the Dominion of Canada. The organization adopted in Utah among the Mormons is found also in Alberta, but the Canadian Mormons profess to have received a later revelation condemning polygamy.

History.—The present province of Alberta as far north as the height of land (53° N.) was from the time of the incorporation of the Hudson's Bay Company (1670) a part of Rupert's Land. After the discovery of the north-west by the French in 1731 and succeeding years the prairies of the west were occupied by them, and Fort La Jonquière was established near the present city of Calgary (1752). The North-West Company of Montreal occupied the northern part of Alberta district before the Hudson's Bay Company succeeded in coming from Hudson Bay to take possession of it. The first hold of the Athabasca region was gained by Peter Pond, who, on behalf of the North-West Company of Montreal, built Fort Athabasca on river La Biche in 1778. Roderick Mackenzie, cousin of Sir Alexander Mackenzie, built Fort Chipewyan on Lake Athabasca in 1788. By way of the North Saskatchewan river Alexander Mackenzie crossed the height of land, and proceeding northward discovered the river which bears his name, and also the Arctic Sea. Afterward going westward from Lake Athabasca and through the Peace river, he reached the Pacific Ocean, being the first white man to cross the North American continent, north of Mexico.

As part of the North-West Territories the district of Alberta was organized in 1875. Additional privileges and a local legislature were added from time to time. At length in 1905 the district of Alberta was enlarged and the present province formed by the Dominion parliament. (G. Br.)

ALBERT EDWARD NYANZA, a lake of Central Africa, the southern of the two western reservoirs of the Nile. It lies in the Albertine rift-valley between 0° 8′ and 0° 40′ S. and 20° 28′ and 29° 52′ E., at an elevation of 3004 ft. above the sea. It is roughly oval in shape and has no deep indentations. On its N.E. side it is connected by a winding channel, 25 m. long and from a quarter of a mile to a mile wide, flowing between high banks, with a smaller sheet of water, Lake Dweru, which extends north of the equator. Albert Edward Nyanza has a length of 44 m. and a breadth of 32 m. (maximum measurement). Dweru is about 20 m. long and 10 across at its widest part. The area of the two lakes is approximately 820 sq. m., or about the size of Leicestershire, England. A swampy plain, traversed by the Ruchuru and other rivers, extends south of the Nyanza and was once covered by its waters. The plain contains several salt-pans, and at the S.E. corner are numerous geysers. Along the eastern shore the low land extends to Kamarangu, a point about midway between the south and north ends of the lake, a considerable stretch of ground intervening between the wall of the rift-valley and the water, two terraces being clearly defined. The euphorbia trees and other vegetation on the lower terrace are of small size and apparently of recent origin. At some distance from the lake runs a belt of forest. North of Kamarangu the wall of the valley approaches the water in a series of bluffs some 300 to 350 ft. high. At the N.E. end the hills again recede and the plain widens to include Dweru. On the west side of the Nyanza the wall of the rift-valley runs close to the lake shore and at the N.W. corner the mountains close in on the water. North of the lake a high alluvial plain stretches to the southern slopes of the Ruwenzori mountains. From Ruwenzori a subsidiary range, known as the Kipura mountains, runs due south to the lake shore, where it ends in a low rounded hill. In general, the plain rises above the lake in a series of bold bluffs, a wide margin of swamp separating them from the water. The Semliki, the only outlet of the lake, issues from its N.W. end. Round the north-eastern shore of the lake are numerous crater lakes, many salt, the most remarkable being that of Katwe. This lake lies west of the Dweru channel and is separated from Albert Edward Nyanza by a ridge of land, not more than 160 ft. in breadth. The sides of this ridge run down steeply to the water on either side. The waters of the Katwe lake have a beautiful rose colour which becomes crimson in the shadows. The salt is highly prized and is exported to great distances.

The main feeder of Albert Edward Nyanza, and western head-stream of the Nile, the Ruchuru, rises on the north side of the volcanoes north of Lake Kivu (see Mfumbiro). On reaching the level plain 15 m. from the lake its waters become brackish, and the vegetation on its banks is scanty. The reedy marshes near its mouth form a retreat for a primitive race of fishermen. Lake Dweru, the shores of which are generally high, is fed by the streams from the eastern slopes of the Ruwenzori range. One of these, the Mpango, is a larger river than the Ruchuru. The outlet of the Nyanza, the Semliki, and the part played by the lake in the Nile system are described under Albert Nyanza.

A feature of Lake Albert Edward Nyanza is the thick haze which overhangs the water during the dry season, blotting out from view the mountains. In the rains, when the sky is clear, the magnificent panorama of hills encircling the lake on the west and north-west is revealed. The lake water is clear of a light green colour, and distinctly brackish. Fish abound, as do waterfowl, crocodiles and, in the southern swamps, hippopotami. In the rainy season the lake is subject to violent storms.

The entire area of Albert Edward Nyanza was found, by the work of the Anglo-German Boundary Commission of 1902–1904, to lie within the limits of the sphere of influence of the Congo Free State as defined in the agreement of the 12th of May 1894 between that state and Great Britain. Dweru was discovered in 1875 by H. M. Stanley, then travelling westward from Uganda, and by him was named Beatrice Gulf in the belief that it was part of Albert Nyanza. In 1888–1889 Stanley, approaching the Nile region from the west, traced the Semliki to its source in Albert Edward Nyanza, which lake he discovered, naming it after Albert Edward, prince of Wales, afterwards Edward VII. Stanley also discovered the connecting channel between the larger lake and Dweru. The accurate mapping of the lake was mainly the work of British officials and travellers, such as Scott Elliott, Sir F. D. Lugard, Ewart Grogan, J. E. Moore and Sir H. Johnston; while Emin Pasha and Franz Stuhlmann, deputy-governor (1891) of German East Africa, explored its southern shores. (See Albert Nyanza and Nile, and the authorities there quoted.) (W. E. G.; F. R. C.)

ALBERTI, DOMENICO (*c.* 1710–1740), Italian musician, is known in musical history as the writer of dozens of sonatas in which the melody is supported from beginning to end by an extremely familiar formula of arpeggio accompaniment, consequently known as the Alberti bass. He thus shows how advanced was the decay of polyphonic sensibility (as a negative preparation for the advent of the sonata-style) already during the lifetime of Bach. His works have no other special qualities, though it is probable that Mozart's first violin sonatas, written at the age of seven, were modelled on Alberti in spite of their superior cleverness.

ALBERTI, LEONE BATTISTA (1404–1472), Italian painter, poet, philosopher, musician and architect, was born in Venice on the 18th of February 1404. He was so skilled in Latin verse that a comedy he wrote in his twentieth year, entitled *Philodoxius*, deceived the younger Aldus, who edited and published it as the genuine work of Lepidus. In music he was reputed one of the first organists of the age. He held the appointment of canon in the metropolitan church of Florence, and thus had leisure to devote himself to his favourite art. He is generally regarded as one of the restorers of the ancient style of architecture. At Rome he was employed by Pope Nicholas V. in the restoration of the papal palace and of the foundation of Acqua Vergine, and in the ornamentation of the magnificent fountain of Trevi. At Mantua he designed the church of Sant' Andrea and at Rimini the celebrated church of San Francesco, which is generally esteemed his finest work. On a commission from Rucellai he designed the principal façade of the church of Santa Maria Novella in Florence, as well as the family palace in the Via della Scala, now known as the Palazzo Strozzi. Alberti wrote works on sculpture, *Della Statua*, and on painting, *De Pictura*, which are highly esteemed; but his most celebrated treatise is that on architecture, *De Re Aedificatoria*, which has been translated into Italian, French, Spanish and English. Alberti died at Rome in the April of 1472.

See Passerini, *Gli Alberti di Firenze* (1869, 1870); Mancini, *Vita di Alberti* (Firenze, 1882); V. Hoffmann, *Studien zu Leon Battista Alberti's zehn Büchern: De Re Aedificatoria* (Frankenberg, 1883).

ALBERTINELLI, MARIOTTO (1474–1515), Italian painter, was born in Florence, and was a fellow-pupil and partner of Fra Bartolommeo, with whom he painted many works. His chief paintings are in Florence, notably his masterpiece, the "Visitation of the Virgin" (1503) at the Uffizi.

ALBERTITE, a variety of asphalt found in Albert county, New Brunswick. It is of jet-black colour and brilliant pitch-like lustre. Its percentage chemical composition is:—

C.	H.	O.	N.	S.	Ash.
86·04	8·96	1·97	2·93	trace	0·10

It softens slightly in boiling water, but only fuses imperfectly when further heated, and it is less soluble than ordinary asphalt in oil of turpentine.

ALBERT LEA, a city and the county-seat of Freeborn county, Minnesota, U.S.A., about 97 m. S. of St Paul. Pop. (1890) 3305; (1900) 4500; (1905, state census) 5657, of whom 1206 were foreign-born, including 461 Norwegians, 411 Danes and 98 Swedes. It is served by two branches of the Chicago, Milwaukee & St Paul, by the main line and one branch of the Chicago, Rock Island & Pacific, by the Illinois Central, by the Iowa Central, and by the Minneapolis & St Louis railways. It is attractively situated between Fountain Lake and Albert Lea Lake, and is a summer resort. It has a public library and the Freeborn County Court House, and is the seat of Albert Lea College (Presbyterian, for women), founded in 1884, and of Luther Academy (Norwegian Evangelical Lutheran), founded in 1888. Albert Lea is a railway and manufacturing centre of considerable importance, has grain elevators and foundries and machine shops, and manufactures bricks, tiles, carriages, wagons, flour, corsets, refrigerators and woollen goods. The city is also the centre of large dairy interests, and there are many creameries in the county. Numerous artesian wells furnish the city with an ample supply of water of unusual excellence. Albert Lea was settled in 1855 and received a city charter in 1878. The city and the lake were named in honour of Lieutenant Albert Miller Lea (1808–1891), a West Point graduate (1831) who, on behalf of the United States government, first surveyed the region and described it in a report published in 1836. He was a lieutenant-colonel of engineers in the Confederate army during the Civil War.

ALBERT NYANZA, a lake of Central Africa, the northern of the two western reservoirs of the Nile, lying in the western (Albertine) rift-valley, near its north end. The southern reservoir is Albert Edward Nyanza (*q.v.*). Lake Albert lies between 1° 9′ and 2° 17′ N. and 30° 30′ and 31° 35′ E., at an elevation of about 2000 ft. above the sea. Its greatest length is about 100 m., its greatest width 22 m., its area being approximately 1640 sq. m., about the size of Lancashire, England. South of the lake is a wide plain, traversed by the Semliki river, which enters the Nyanza through a swamp of tall weeds, chiefly ambach and papyrus. Both east and west the walls of the rift-valley are close to the lake, the water in many places washing the base of the cliffs. Elsewhere the narrow foreshore is thickly wooded. The ascent to the plateaus is generally by three tiers of hills rising one behind the other. On the west side the mountains present many pointed and conical summits; on the east the cliffs rise abruptly 1000 to 2000 ft. On either coast wild gorges and ravines, densely wooded, break the outline of the mountains. Through these gorges dash magnificent cascades, others leaping the escarpments of the plateaus in waterfalls of great volume and depth. Towards the north the hills recede from the coast and on both sides flats extend for distances varying from 5 to 15 m. On the eastern side, 92 m. from the southern end of the Nyanza, the Victoria Nile enters the lake, here not more than 6 m. across, through a wilderness of woods, the delta of the Nile extending over 4 m. The mouth of the main stream is obstructed by a bar of its own formation; the current is sluggish; there are many side channels, and the appearance of the lake gives no hint that a great river has joined its waters. For 5 or 6 m. north of the junction of the Victoria Nile the lake suffers no material diminution in width. Then, however, the eastern and western shores approach each other, and a current is perceptible flowing north. The lake has become the Bahr-el-Jebel, or Mountain river, as this section of the Nile is called. Throughout its extent Albert Nyanza is shallow; at its southern end the water for a considerable distance is not more than 3 ft. deep. The deepest soundings give only 50 to 55 ft., the average depth being 30 to 40 ft.

The Albertine Basin of the Nile.—Albert Nyanza receives the whole of the drainage of Albert Edward Nyanza and the Semliki river, and with them and its own basin forms the "Albertine" Nile system. Its waters, as stated above, mingle with those of the Victoria Nile, their united volume flowing north towards the Mediterranean. A study of the changes going on in the rift-valley in which the lakes lie leads, however, to the belief that the Albert Edward and Albert Nyanzas are drying up, a process which the nature of the drainage areas is helping to bring about. That the Albert Edward Nyanza once covered a much larger area than it does at present is certain. At that time, recent from a geological standpoint, the valley to the north, through which now flows the Semliki river, was blocked. The removal of the block led to the shrinkage of the lake and the formation of the Semliki, which found its way to the more northern lake—Albert Nyanza. Gradually the Semliki eroded its bed, and consequently the level of Albert Edward Nyanza continued to fall. The process continues but is checked by the existence of the rock barrier which stretches across the Semliki. This stream leaves Albert Edward Nyanza at its N.W. end in 0° 8′ 30″ S., and after a course of about 160 m. enters Albert Nyanza in 1° 9′ N. In its upper and in its lower course the river flows either through high alluvial plains, in which it has scored a deep channel, or across swamp land. In the middle section, which has a length of some 75 m., the river runs in a deep narrow valley covered with the densest forest. On the west this valley is bounded by the Congo mountains, which form the wall of the rift-valley, on the east by the mighty range of Ruwenzori, whose heights tower over 16,000 ft. above sea-level. In this length of 75 m. the river falls in cataracts and rapids over 800 ft. This rocky barrier acts as a regulator for the water received from Albert Edward Nyanza and, by checking the erosion of the river bed, tends to maintain the level of the lake. When this bar wears away Albert Edward Nyanza will, in all probability, disappear as a lake and will become a river, a continuation of its present most southern affluent, the Ruchuru.

Albert Nyanza, on the other hand, is threatened in the distant future with destruction from another cause—the filling of its bed by the alluvium poured into it by the Semliki, the Victoria Nile and, in a lesser degree, by other streams. The Semliki receives directly or indirectly the whole of the drainage of Ruwenzori, and also that of the eastern face of the Congo mountains as well as the drainage basin of Albert Edward Nyanza. The amount of alluvial matter carried is enormous; from Ruwenzori alone the detritus is very great. Charged with all this matter, the Semliki, as it emerges from the region of forest and cataracts (in which, often closely confined by its mountain barriers, the stream is deep and rapid), becomes sluggish, its slope flattens out, and its waters, unable to carry their burden, deposit much of it upon the land. This process, continually going on, has formed a large plain at the south end of Albert Nyanza, which has seriously encroached upon the lake. At the northern end of the lake the sediment brought down by the Victoria Nile is producing a similar effect. Albert Nyanza has indeed shrunk in its dimensions during the comparatively few years it has been known to Europeans. Thus at the S.W. end, Nyamsasi, which was an island in 1889, has become a peninsula. Islands which in 1876 were on the east coast no longer exist; they now form part of the foreshore. On the other hand, the shrinkage of the lake level caused the appearance in 1885 of an island where in 1879 there had been an expanse of shallow water. It seems probable that, in a period geologically not very remote, the "Albertine" system will consist of one great river, extending from the northern slopes of the Kivu range, where the Ruchuru has its rise, to the existing junction of the Victoria Nile with Albert Nyanza.

The combined drainage area, including the water surface of Albert Edward Nyanza, the Semliki and Albert Nyanza, is some

16,600 sq. m. Throughout this area the rainfall is heavy (40 to 60 in. or more per annum), the volume of water entering Albert Nyanza by the Semliki when in flood being not less than 700 cubic metres per second. Of the water received by Albert Nyanza annually (omitting the Victoria Nile from the calculation) between 50 and 60% is lost by evaporation, whilst 24,265,000,000 cubic metres are annually withdrawn by the Bahr-el-Jebel. The "Albertine" system plays a comparatively insignificant part in the annual flood rise of the White Nile, but to its waters are due the maintenance of a constant supply to this river throughout the year.

Discovery and Exploration.—Albert Nyanza was first reached by Sir Samuel Baker on the 14th of March 1864 near Vacovia, a small village of fishermen and salt-makers on the east coast. From a granitic cliff 1500 ft. above the water he looked out over a boundless horizon on the south and south-west, and towards the west descried at a distance of 50 or 60 m. mountains about 7000 ft. high. Albert Nyanza was consequently entered on his map as a vast lake extending about 380 m. But the circumnavigation of the lake by Gessi Pasha (1876), and by Emin Pasha in 1884, showed that Baker had been deceived as to the size of the lake. By the end of the 19th century the topography of the lake region was known with fair accuracy. The lake forms part of the (British) Uganda Protectorate, but the north-west shores were leased in 1894 to the Congo Free State during the sovereignty of king Leopold II. of Belgium. Of this leased area a strip 15 m. wide, giving the Congo State a passage way to the lake, was to remain in its possession after the determination of the lease.

See Nile; Sir W. Garstin's *Report upon the Basin of the Upper Nile* (Egypt, No. 2, 1904); Capt. H. G. Lyons' *The Physiography of the River Nile and its Basin* (Cairo, 1906), and the authorities quoted in those works. (W. E. G.; F. R. C.)

ALBERTUS MAGNUS (ALBERT OF COLOGNE, ?1206–1280), count of Bollstädt, scholastic philosopher, was born of the noble family of Bollstädt at Lauingen in Suabia. The date of his birth, generally given as 1193, is more probably 1206. He was educated principally at Padua, where he received instruction in Aristotle's writings. In 1223 (or 1221) he became a member of the Dominican order, and studied theology under its rules at Bologna and elsewhere. Selected to fill the position of lecturer at Cologne, where the order had a house, he taught for several years there, at Regensburg, Freiburg, Strassburg and Hildesheim. In 1245 he went to Paris, received his doctorate and taught for some time, in accordance with the regulations, with great success. In 1254 he was made provincial of his order, and fulfilled the arduous duties of the office with great care and efficiency. During the time he held this office he publicly defended the Dominicans against the university of Paris, commented on St John, and answered the errors of the Arabian philosopher, Averroes. In 1260 the pope made him bishop of Regensburg, which office he resigned after three years. The remainder of his life he spent partly in preaching throughout Bavaria and the adjoining districts, partly in retirement in the various houses of his order; in 1270 he preached the eighth Crusade in Austria; almost the last of his labours was the defence of the orthodoxy of his former pupil, Thomas Aquinas. He died in 1280, aged seventy-four. He was beatified in 1622, and he is commemorated on the 16th of November. Albert's works (published in twenty-one folios by the Dominican Pierre Jammy in 1651, and reproduced by the Abbé Borgnet, Paris, 1890, 36 vols.) sufficiently attest his great activity. He was the most widely read and most learned man of his time. The whole of Aristotle's works, presented in the Latin translations and notes of the Arabian commentators, were by him digested, interpreted and systematized in accordance with church doctrine. Albert's activity, however, was rather philosophical than theological (see SCHOLASTICISM). The philosophical works, occupying the first six and the last of the twenty-one volumes, are generally divided according to the Aristotelian scheme of the sciences, and consist of interpretations and condensations of Aristotle's relative works, with supplementary discussions depending on the questions then agitated, and occasionally divergences from the opinions of the master. His principal theological works are a commentary in three volumes on the *Books of the Sentences* of Peter Lombard (*Magister Sententiarum*), and the *Summa Theologiae* in two volumes. This last is in substance a repetition of the first in a more didactic form. Albert's knowledge of physical science was considerable and for the age accurate. His industry in every department was great, and though we find in his system many of those gaps which are characteristic of scholastic philosophy, yet the protracted study of Aristotle gave him a great power of systematic thought and exposition, and the results of that study, as left to us, by no means warrant the contemptuous title sometimes given him—the "Ape of Aristotle." They rather lead us to appreciate the motives which caused his contemporaries to bestow on him the honourable surnames "The Great" and "Doctor Universalis." It must, however, be admitted that much of his knowledge was ill digested; it even appears that he regarded Plato and Speusippus as Stoics. Albertus is frequently mentioned by Dante, who made his doctrine of free-will the basis of his ethical system. Dante places him with his pupil Aquinas among the great lovers of wisdom (*Spiriti Sapienti*) in the Heaven of the Sun.

See Paget Toynbee, "Some Obligations of Dante to Albertus Magnus" in *Romania*, xxiv. 400-412, and the *Dante Dictionary* by the same author. For Albert's life see J. Sighart, *Albertus Magnus, sein Leben und seine Wissenschaft* (Regensburg, 1857; Eng. trans., Dixon, London, 1876); H. Finke, *Ungedrückte Dominikanerbriefe des 13. Jahrh.* (Paderborn, 1891). For his philosophy A. Stöckl, *Geschichte d. scholastischen Philosophie*; J. E. Erdmann, *Grundriss d. Ges. d. Phil.* vol. i. 8. The histories of Hauréau, Ritter, Prantl and Windelband may also be consulted. See also W. Feiler, *Die Moral d. A. M.* (Leipzig, 1891); M. Weiss, *Ueber mariologische Schriften des A. M.* (Paris, 1898); Jos. Bach, *Des A. M. Verhältniss zu d. Erkenntnisslehre d. Griechen, Römer, Araber u. Juden* (Vienna, 1881); Herzog-Hauck, *Realencyk.* (1897); Vacant, *Dict. Theol. Cathol.* (*s.v.*); Ch. Jourdain in *Dict. d. sciences philos.* (*s.v.*); M. Joel, *Das Verhältniss A. d. G. zu Moses Maimonides* (Breslau, 1863).

ALBERUS, ERASMUS (*c.* 1500–1553), German humanist, reformer and poet, was a native of the village of Sprendlingen near Frankfort-on-Main, where he was born about the year 1500. Although his father was a schoolmaster, his early education was neglected. Ultimately in 1518 he found his way to the university of Wittenberg, where he studied theology. He had here the good fortune to attract the attention of Luther and Melanchthon, and subsequently became one of Luther's most active helpers in the Reformation. Not merely did he fight for the Protestant cause as a preacher and theologian, but he was almost the only member of Luther's party who was able to confront the Roman Catholics with the weapon of literary satire. In 1542 he published a prose satire to which Luther wrote the preface, *Der Barfüsser Mönche Eulenspiegel und Alkoran*, an adaptation of the *Liber conformitatum* of the Franciscan Bartolommeo Albizzi of Pisa (Pisanus, d. 1401), in which the Franciscan order is held up to ridicule. Of higher literary value is the didactic and satirical *Buch von der Tugend und Weisheit* (1550), a collection of forty-nine fables in which Alberus embodies his views on the relations of Church and State. His satire is incisive, but in a scholarly and humanistic way; it does not appeal to popular passions with the fierce directness which enabled the master of Catholic satire, Thomas Murner, to inflict such telling blows. Several of Alberus's hymns, all of which show the influence of his master Luther, have been retained in the German Protestant hymnal. After Luther's death, Alberus was for a time *Diakonus* in Wittenberg; he became involved, however, in the political conflicts of the time, and was in Magdeburg in 1550–1551, while that town was besieged by Maurice of Saxony. In 1552 he was appointed *Generalsuperintendent* at Neubrandenburg in Mecklenburg, where he died on the 5th of May 1553.

Das Buch von der Tugend und Weisheit has been edited by W. Braune (1892); the sixteen *Geistliche Lieder* by C. W. Stromberger (1857). Alberus's prose writings have not been reprinted in recent times. See F. Schnorr von Carolsfeld, *Erasmus Alberus* (1894).

ALBERY, JAMES (1838–1889), English dramatist, was born in London on the 4th of May 1838. On leaving school he entered an architect's office, and started to write plays. After many failures he at last succeeded in getting an adaptation—*Dr Davy*

—produced at the Lyceum (1866). His most successful piece, *Two Roses*, a comedy, was produced at the Vaudeville in 1870, in which Sir Henry Irving made one of his earliest London successes as Digby Grant. He was the author of a large number of other plays and adaptations, including *Jingle* (a version of *Pickwick*), produced at the Lyceum in 1878, and *Pink Dominoes*, the latter being one of a series of adaptations from the French which he made for the Criterion theatre. At that house his wife, the well-known actress, Miss Mary Moore, played the leading parts. He died on the 15th of August 1889.

ALBI, a city of south-western France, capital of the department of Tarn, 48 m. N. E. of Toulouse, on a branch line of the Southern railway. Pop. (1906) 14,956. Albi occupies a commanding position on the left bank of the Tarn; it is united to its suburb of La Madeleine on the right bank by a medieval and a modern bridge. The old town forms a nucleus of narrow, winding streets surrounded by boulevards, beyond which lie modern quarters with regular thoroughfares and public gardens. The cathedral of Sainte Cécile, a fine fortress-church in the Gothic style, begun in 1277, finished in 1512, rises high above the rest of the town. The exterior, flanked at the western end by a lofty tower and pierced by high, narrow windows, is devoid of ornament. Its general plainness contrasts with the elaborate carving of the stone canopy which shelters the southern portal. In the interior, which is without transepts or aisles, the rood-screen and the choir-enclosure, which date from about 1500, are masterpieces of delicate sculpture; the vaulting and the walls are covered with paintings of the 15th and 16th centuries. The archbishop's palace to the north-east of the cathedral is a fortified building of the 14th century. St Salvi, the chief of the other churches of Albi, belongs to the 13th and 15th centuries. A statue of the sailor La Pérouse (1741–1788) stands in the square named after him.

Albi is the seat of an archbishop, a prefect and a court of assizes. It has tribunals of first instance and of commerce, a board of trade-arbitrators, a chamber of commerce, a *lycée* and training colleges. The industrial establishments of the town include dye-works, distilleries, tanneries, glass-works and important flour-mills. It is also a centre for hat-making, and produces cloth-fabrics, lace, umbrellas, casks, chairs, wooden shoes, candles and pastries. Trade is in wine and anise.

Albi (*Albiga*) was, in the Gallo-Roman period, capital of the Albigenses, and later of the viscounty of Albigeois, which was a fief of the counts of Toulouse. From the 12th century onwards, its bishops, the first of whom appears to have lived about the 3rd century, began to encroach on the authority of the viscounts; the latter, after the Albigensian war, lost their estates, which passed to Simon de Montfort and then to the crown of France. By a convention concluded in 1264 the chief temporal power in the city was granted to the bishops. The archbishopric dates from 1678.

ALBIAN (Fr. *Albien*, from Alba = Aube in France), in geology the term proposed in 1842 by A. d'Orbigny for that stage of the Cretaceous System which comes above the Aptian and below the Cenomanian (*Pal. France. Crét.* ii.). The precise limits of this stage are placed somewhat differently by English and continental geologists. In England it is usual to regard the Albian stage as equivalent to the Upper Greensand *plus* Gault, that is, to the "Selbornian" of Jukes-Browne. But A. de Lapparent would place most of the Upper Greensand in the Cenomanian. The English practice is to commence the *upper* Cretaceous with the Albian; on the other hand, this stage closes the *lower* Cretaceous according to continental usage. It is necessary therefore, when using the term Albian, to bear these differences in mind, and to ascertain the exact position of the strata by reference to the zonal fossils. These are, in descending order, *Pecten asper* and *Cardiaster fossarius*, *Schloenbachia rostrata*, *Hoplites lautus* and *H. interruptus*, *Douvilleiceras mammillatum*. In addition to the formations mentioned above, the following representatives of the Albian stage are worthy of notice: the gaize and phosphatic beds of Argonne and Bray in France; the Flammenmergel of North Germany; the lignites of Utrillas in Spain; the Upper Sandstones of Nubia, and the Fredericksburg beds of North America.

See Gault, Greensand, and Cretaceous. (J. A. H.)

ALBIGENSES, the usual designation of the heretics—and more especially the Catharist heretics—of the south of France in the 12th and 13th centuries. This name appears to have been given to them at the end of the 12th century, and was used in 1181 by the chronicler Geoffroy de Vigeois. The designation is hardly exact, for the heretical centre was at Toulouse and in the neighbouring districts rather than at Albi (the ancient *Albiga*). The heresy, which had penetrated into these regions probably by trade routes, came originally from eastern Europe. The name of Bulgarians (*Bougres*) was often applied to the Albigenses, and they always kept up intercourse with the Bogomil sectaries of Thrace. Their dualist doctrines, as described by controversialists, present numerous resemblances to those of the Bogomils, and still more to those of the Paulicians, with whom they are sometimes connected. It is exceedingly difficult, however, to form any very precise idea of the Albigensian doctrines, as our knowledge of them is derived from their opponents, and the very rare texts emanating from the Albigenses which have come down to us (*e.g.* the *Rituel cathare de Lyon* and the *Nouveau Testament en provençal*) contain very inadequate information concerning their metaphysical principles and moral practice. What is certain is that, above all, they formed an anti-sacerdotal party in permanent opposition to the Roman church, and raised a continued protest against the corruption of the clergy of their time. The Albigensian theologians and ascetics, the Cathari or *perfecti*, known in the south of France as *bons hommes* or *bons chrétiens*, were few in number; the mass of believers (*credentes*) were perhaps not initiated into the Catharist doctrine; at all events, they were free from all moral prohibition and all religious obligation, on condition that they promised by an act called *convenenza* to become "hereticized" by receiving the *consolamentum*, the baptism of the Spirit, before their death or even *in extremis*.

The first Catharist heretics appeared in Limousin between 1012 and 1020. Several were discovered and put to death at Toulouse in 1022; and the synod of Charroux (dep. of Vienne) in 1028, and that of Toulouse in 1056, condemned the growing sect. The preachers Raoul Ardent in 1101 and Robert of Arbrissel in 1114 were summoned to the districts of the Agenais and the Toulousain to combat the heretical propaganda. But, protected by William IX., duke of Aquitaine, and soon by a great part of the southern nobility, the heretics gained ground in the south, and in 1119 the council of Toulouse in vain ordered the secular powers to assist the ecclesiastical authority in quelling the heresy. The people were attached to the *bons hommes*, whose asceticism imposed upon the masses, and the anti-sacerdotal preaching of Peter of Bruys and Henry of Lausanne in Périgord, Languedoc and Provence, only facilitated the progress of Catharism in those regions. In 1147 Pope Eugenius III. sent the legate Alberic of Ostia and St Bernard to the affected district. The few isolated successes of the abbot of Clairvaux could not obscure the real results of this mission, and the meeting at Lombers in 1165 of a synod, where Catholic priests had to submit to a discussion with Catharist doctors, well shows the power of the sect in the south of France at that period. Moreover, two years afterwards a Catharist synod, in which heretics from Languedoc, Bulgaria and Italy took part, was held at St Félix de Caraman, near Toulouse, and their deliberations were undisturbed. The missions of Cardinal Peter (of St Chrysogonus), formerly bishop of Meaux, to Toulouse and the Toulousain in 1178, and of Henry, cardinal-bishop of Albano (formerly abbot of Clairvaux), in 1180–1181, obtained merely momentary successes. Henry of Albano attempted an armed expedition against the stronghold of heretics at Lavaur and against Raymond Roger, viscount of Béziers, their acknowledged protector. The taking of Lavaur and the submission of Raymond Roger in no way arrested the progress of the heresy. The persistent decisions of the councils against the heretics at this period—in particular, those of the council of Tours (1163) and of the oecumenical

Lateran council (1179)—had scarcely more effect. But on ascending the papal throne, Innocent III. resolved to suppress the Albigenses. At first he tried pacific conversion, and in 1198 and 1199 sent into the affected regions two Cistercian monks, Regnier and Guy, and in 1203 two monks of Fontfroide, Peter of Castelnau and Raoul (Ralph), with whom in 1204 he even associated the Cistercian abbot, Arnaud (Arnold). They had to contend not only with the heretics, the nobles who protected them, and the people who listened to them and venerated them, but also with the bishops of the district, who rejected the extraordinary authority which the pope had conferred upon his legates, the monks. In 1204 Innocent III. suspended the authority of the bishops of the south of France. Peter of Castelnau retaliated by excommunicating Raymond VI., count of Toulouse, as an abettor of heresy (1207), and kindled in the nobles of the south that animosity of which he was the first victim (1209). As soon as he heard of the murder of Peter of Castelnau, the pope ordered the Cistercians to preach the crusade against the Albigenses. This implacable war, which threw the whole of the nobility of the north of France against that of the south, and destroyed the brilliant Provençal civilization, ended, politically, in the treaty of Paris (1229), by which the king of France dispossessed the house of Toulouse of the greater part of its fiefs, and that of Béziers of the whole of its fiefs. The independence of the princes of the south was at an end, but, so far as the heresy was concerned, Albigensianism was not extinguished, in spite of the wholesale massacres of heretics during the war. Raymond VII. of Toulouse and the count of Foix gave asylum to the "faidits" (proscribed), and the people were averse from handing over the *bons hommes*. The Inquisition, however, operating unremittingly in the south at Toulouse, Albi, Carcassonne and other towns during the whole of the 13th century and a great part of the 14th, succeeded in crushing the heresy. There were indeed some outbursts of rebellion, some fomented by the nobles of Languedoc (1240–1242), and others emanating from the people of the towns, who were embittered by confiscations and religious persecutions (*e.g.* at Narbonne in 1234 and Toulouse in 1235), but the repressive measures were terrible. In 1245 the royal officers assisting the Inquisition seized the heretical citadel of Montségur, and 200 Cathari were burned in one day. Moreover, the church decreed severe chastisement against all laymen suspected of sympathy with the heretics (council of Narbonne, 1235; Bull *Ad extirpanda*, 1252).

Hunted down by the Inquisition and quickly abandoned by the nobles of the district, the Albigenses became more and more scattered, hiding in the forests and mountains, and only meeting surreptitiously. There were some recrudescences of heresy, such as that produced by the preaching (1298–1309) of the Catharist minister, Pierre Authier; the people, too, made some attempts to throw off the yoke of the Inquisition and the French,[1] and insurrections broke out under the leadership of Bernard of Foix, Aimery of Narbonne, and, especially, Bernard Delicieux at the beginning of the 14th century. But at this point vast inquests were set on foot by the Inquisition, which terrorized the district. Precise indications of these are found in the registers of the Inquisitors, Bernard of Caux, Jean de St Pierre, Geoffroy d'Ablis, and others. The sect, moreover, was exhausted and could find no more adepts in a district which, by fair means or foul, had arrived at a state of peace and political and religious unity. After 1330 the records of the Inquisition contain but few proceedings against Catharists. (See also under CATHARS.)

AUTHORITIES.—See C. Schmidt's *Histoire de la secte des Cathares ou Albigeois* (Paris, 1849), which is still the most important work on the subject. The following will be found useful: D. Vaissete, *Histoire de Languedoc*, vols. iii. iv. vii. viii. (new edition); Ch. Molinier, *L'Inquisition dans le Midi de la France* (Paris, 1880), and the other works by the same author; L. Tanon, *Histoire des tribunaux de l'Inquisition en France* (Paris, 1893). *Les Albigeois, leurs origines* (Paris, 1878), by Douais, should be read with caution. Of the sources, which are very numerous, may be mentioned: the *Liber Sententiarum* of the Inquisition of Carcassonne, published by Ph. van Limborch at the end of his *Historia Inquisitionis* (Amsterdam, 1692); other registers of the Inquisition analysed at length by Ch. Molinier, *op. cit.*, some published in vol. ii. of the *Documents pour l'histoire de l'Inquisition* (Paris, 1900), by C. Douais; numerous texts concerning the last days of Albigensianism, collected by M. Vidal, "Les derniers ministres albigeois,' in *Rev. de quest. histor.* (1906). See also the *Rituel cathare*, ed. by Cunitz (Jena, 1852); the *Nouveau Testament en provençal*, ed. by Clédat (Paris, 1887); and the very curious *Débat d'Ysarn et de Sicart de Figueiras*, ed. by P. Meyer (1880). On the ethics of the Catharists, see Jean Guiraud, *Questions d'histoire et d'archéologie chrétienne* (Paris, 1906); and P. Alphandéry, *Les idées morales chez les hétérodoxes latins au début du XIIIe siècle* (Paris, 1903). (P. A.)

ALBINO, a biological term (Lat. *albus*, white), in the usual acceptation, for a pigmentless individual of a normally pigmented race. Among some flowering plants, however, the character has become one of specific rank, and among animals we have in the polar bear and the Greenland hare instances where partial albinism—for in them the eyes are black and other parts may be pigmented—has also become a specific character.

A true or complete albino is altogether devoid of pigment. One result of this among the Vertebrata is that the eyeball is pink in colour, since the cornea, iris and retina being transparent, the red blood contained in the capillaries is unmasked by the absence of pigmentary material. In man, and doubtless also in lower forms, the absence of this pigment produces the well-marked albinotic facies. This is a condition in which the eyelids are brought into a nearly closed position accompanied by blinking movements and a general wrinkling of the skin around the immediate neighbourhood of the eyes. It is the result of the too great intensity of the light incident upon the retina, and which in normal eyeballs is adequately diminished by the absorptive power of the pigmentary material.

In a complete albino not only is all pigment absent in the skin, but also that which is normally present in deeper organs, such as the sympathetic nervous system and in the *substantia nigra* of the brain. There is some reason to believe that a peculiar condition found in the majority of human albinoes, and known as nystagmus, is correlated with the absence of pigment in the central nervous system. This condition is one marked by unsteadiness—a sort of flickering rolling—of the eyeballs, and it becomes more marked as they endeavour to adjust their accommodation to near objects. It is thought to depend upon some connexion, not yet anatomically demonstrated, between the third cranial nerve and its nucleus in the floor of the *iter* and the *substantia nigra*.

In addition to complete albinism, there exist, however, various albinotic conditions in which more or less pigment may be present. Familiar instances of this partial albinism is seen in the domestic breed of Himalayan rabbits. In these animals the eyeball and the fur of the body are unpigmented, but the tips of the ear pinnae and extremities of the fore and hind limbs, together with the tail, are marked by more or less well defined colour. One remarkable feature of these animals is that for a few months after birth they are complete albinoes. Occasionally, however, some are born with a grey colour and a few may be quite black, but ultimately they attain their characteristic coat. There is some reason to believe, as we shall see later, that in spite of the presence of a little pigment and of occasional wholly pigmented young ones, Himalayans must be regarded as true albinoes. Other individual rabbits, but belonging to no particular breed, are similarly marked, but in addition the eyeballs are black. Some domesticated mice are entirely white with the exception that they have black eyeballs; and individuals of this type are known in which there is a reduction of pigment in the eyeballs, and since the colour of the blood is then partially visible these appear of a reddish-black colour. Such cases are interesting as representing the last step in the graded series through which the condition of complete pigmentation passes into that of complete albinism.

There is evidence, as shown by G. M. Allen, that partial albinism is a condition in which pigment is reduced around definite body centres, so that unpigmented areas occur between the pigment patches or at their borders. In the mouse, ten such centres may be distinguished, arranged symmetrically five on either side of the median plane—a cheek patch, neck patch, shoulder patch, side patch and rump patch. Various degrees in the reduction of the pigment patches up to that of complete elimination may be traced.

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[1] These they often confounded, and a heretic is described as saying: "Clergy and French, they are one and the same thing."

Some animals are wholly pigmented during the summer and autumn, but through the winter and spring they are in the condition of extreme partial albinism and become almost complete albinoes. Such instances are found in the Scotch blue hare (*Lepus timidus*), in the Norway hare, in the North American hare (*L. americanus*), in the arctic fox (*Canis lagopus*), in the stoat and ermine, and among birds, in the ptarmigan, and some other species of *Lagopus*. How the change from the autumnal to the winter condition takes place appears not to be definitely settled in all cases, and accurate observations are much to be desired. In the case of the Norway hare, it has been stated that a general moult, including all the hairs and under fur, takes place and new white hairs are substituted. The process of moulting is said to begin in the middle of autumn and is completed before the end of December, by which time the fur is in its winter condition, and is closer, fuller and longer than in summer (*Naturalists' Library*, vol. vii.). On the other hand, it has been stated that during the whole of the transformation in the fur no hairs fall from the animal, and it is attributed to an actual change in the colour of the hair (*Edinburgh Philosophical Journal*, vol. xi. p. 101). In the case of the American hare, however, some very careful observations have been made by F. H. Welch. In this animal the long hairs (which form the pile) become white at their extremities, and in some of them this whiteness extends through their whole length. At the same time, new hairs begin to develop and to grow rapidly, and soon outstrip the hairs of the autumn pile. From their first appearance these new hairs are white and stiff, and they are confined to the sides and back of the body. It is not clear from Welch's account what is the cause of the whiteness of the tips of the hairs of the autumn coat, but his figures suggest that it is due to the development of gas in the interspaces between the keratin bridges and trabeculae of the hairs. There is nothing to show whether the pigment persists or is absorbed. Probably it persists. In this event, the whiteness of the tips will be due to the scattering or irregular reflexion of the incident rays of light from the surface of the numerous gas bubbles. In the case of the ptarmigan the evidence is clear that the existing autumnal feathers do change, more or less completely, to white. But the evidence is not conclusive as to whether any part of the winter condition is additionally produced by moulting.

The condition of albinism thus assumed as a seasonal variation is never complete, for the eyes at least retain their pigmented state. The reason of this is readily understood when it is borne in mind how disadvantageous to the function of sight is the unpigmented condition of an albino's eyeball; a disadvantage which would be probably much accentuated, in the cases now under consideration, by the bright glare from the surface of the snow, which forms the natural environment of these animals at the particular period of the year when the winter change occurs. In some cases, as in all the varying hares, in addition to the eyes retaining their normal pigmentation, areas similar in extent and situation to those on the Himalayan rabbits also retain their pigmentation; and in the ptarmigan there is a black band on each side of the head stretching forwards and backwards from the eyeball, and the outer tail feathers are black.

Albinism is restricted to no particular class of the animal kingdom; for partial albinism at least is known to occur in Coelentera, worms, Crustacea, Myriapoda, Coleoptera, Arachnida and fishes. The individuals in which this diminished pigmentation is found are for the most part those living in caves, and it is probable that their condition is not truly albinotic, but only temporary and due to the absence of the stimulus of light. This may be also true of some of those instances that have occurred among frogs, in *Proteus*, and with an axolotl once possessed by the present writer. This latter animal was quite white, with the exception of the black eyeballs. At the end of four weeks after it was first purchased the dorsal or upper surface of its external gills developed a small amount of dark pigment. Within the next few weeks this increased in quantity and the dorsal surface of the head and of the front end of the trunk began to be pigmented. The animal died at the end of the eighth week, but it is possible that had it lived it would have become wholly pigmented. But, apart from these instances, albinism is known, according to W. E. Castle, who cites it on the authority of Hugh M. Smith, to occur among a breed of albino trout, which breed true and are reared in the State fish-hatcheries of America. With birds and mammals, however, there is no doubt that complete albino individuals do occur; and among species which, like the jackdaw, certain deer and rabbits, are normally deeply pigmented.

Albinism occurs in all races of mankind, among mountainous as well as lowland dwellers. And, with man, as with other animals, it may be complete or partial. Instances of the latter condition are very common among the negroes of the United States and of South America, and in them assumes a piebald character, irregular white patches being scattered over the general black surface of the body. Occasionally the piebald patches tend to be symmetrically arranged, and sometimes the eyeballs are pigmentless (pink) and sometimes pigmented (black).

According to A. R. Gunn, of Edinburgh University, who has recently been investigating the subject of albinism in man, there is reason to believe that a condition of piebald albinism occurs also in Europeans (Scotsmen). He has examined subjects in which the whole of the hair of the body is white, but the eyeballs are pigmented, often deeply; and, conversely, he has seen cases in which the eyes are pink but the hair is pigmented. The hair and the eyes may be regarded as skin patches, in which sometimes the one and sometimes the other is pigmentless. He believes that, were it not for the generally very pale colour of white-skinned races, this piebald condition would be as manifest in them as in negroes, over the whole surface of the body.

In complete human albinoes, albinism is correlated, in addition to nystagmus, with a peculiar roughness of the skin, making it harsh to the touch. The skin is also milky-white in appearance.

According to C. J. Seligmann, there exists among the Papuans an albinotic race whose skin varies in colour from a pink-white to that of *café au lait;* the eyes are generally greenish, hazel or brown, and the hair is tow-coloured. The skin where unexposed is pinker than that of a normal North European. Like complete albinoes, this race suffers from photophobia, and is characterized by the albinotic facies.

Before we can inquire into the cause and meaning of albinism it will be necessary first to consider the nature of pigmentation. It has recently been ascertained that the coloration of certain sponges is due to the interaction of an oxydizing ferment, tyrosinase, upon certain colourless chromogenic substances. In 1901, Otto v. Furth and Hugo Schneider showed that a tyrosinase could be obtained from the blood of certain insects, and, acting upon a chromogen present in the blood, converted it into a pigmentary substance of melanin-like nature. Hans Przibram also extracted a tyrosinase from the ink-sac of *Sepia*, and, causing it to act upon a watery solution of tyrosin, obtained a black pigment. From the blood of *Bombyx mori*, V. von Ducceshi has also obtained a tyrosinase.

Subsequently (1903) L. Cuénot, in order to explain certain features in the hereditary transmission of coat colour in mice, postulated the hypothesis that the grey colour of the wild mouse (which is known to be a compound of black, chocolate and yellow pigments) may be due either to the interaction of a single ferment and three chromogens, or *vice versa*, to one chromogenic substance and three ferments.

Since then (1904) Miss Florence Durham has shown that if the skins of young or embryonic mammals (rats, rabbits and guinea-pigs) be ground up and extracted in water, and the expressed juice be then incubated with solid tyrosin for twenty-four hours, with the addition of a very small amount of ferrous sulphate to act as an activator, a pigmentary substance is thrown down. The colour of this substance is that of the pigment in the skin or hairs of the animal used. Miss Durham interprets her results as indicating that the skin of these pigmented animals normally secretes one or more tyrosinases. The same result was obtained from the skins of some unhatched chickens. The skins of albinoes gave no results

Not only have such results been obtained with sponges, insects, cephalopods, birds and mammals, but Em. Bourquelot and G. Bertrand have shown that certain fungi, the tissues of which, when exposed to the air by injury, become immediately coloured, do so owing to the action of tyrosinase upon one or more chromogenous substances present in the plant. We may conceive, then, that a pigmented animal owes its colour to the power that certain tissues of its body possess to secrete both tyrosinases and chromogenic substances. And the period at which this process is most active is at birth, or preceding it or immediately succeeding it. In spite of the inquiry being only in its initial stages, there is already good evidence to believe that Cuénot's theory is correct, and that an albino is an individual whose skin lacks the power to secrete either the ferment or the chromogen. It forms one but not both of these substances.

A moment's consideration, however, will show that, while an albino may be an individual in which one or more of the complementary bodies of pigmentation are absent, a pigmented animal is something more than an individual which carries all the factors necessary for the development of colour. For it must be borne in mind that animals are not only coloured but the colour is arranged in a more or less definite pattern. The wild mouse, rat and rabbit are self-coloured, but the domesticated forms include various piebald patterns, such as spotted forms among mice, and the familiar black and white hooded and dorsal-striped pattern of some tame rats.

Colour, therefore, must be correlated with some determinant (determining factor) for pattern, and it cannot, therefore, exist alone in an animal's coat. And we must conceive that each kind of pattern—the self, the spotted, the striped, the hooded and all others—has its own special determinant. Given the presence of all the necessary determinants for the development of pigment in a mammal's coat, some or all of the hairs may bear this pigment according to the pattern determinants, or absence of pattern determinants, which the cells of the hair papillae carry. And this brings us to the question as to whether in a piebald animal the pigmented hairs are in any way different from the pigmentless or white hairs. No adequate investigation of this subject has yet been made, but some observations made by the author of this article, on the piebald black and white rat, show that differences connected with the microscopic structure exist.

There is thus evidence that colour is correlated with other factors which determine pattern. And this leads to the inquiry as to whether albinoes ever exhibit evidence that they carry the pattern determinants in the absence of those for pigmentation. For it is to be expected *a priori* that, since albinoes were derived from pigmented progenitors and may at any time appear, side by side with pigmented brothers, in a litter from pigmented parents, they would be carrying the pattern determinants of some one or other of their pigmented ancestors. Now we know, from the numerous experiments in heredity which have resulted since the rediscovery of Mendel's principles, that an individual may carry a character in one of two conditions. It may be carried as a somatic character, when it will be visible in the body tissues, or it may be carried as a gametic character, and its presence can only then be detected in subsequent generations, by adequately devised breeding tests.

With regard to pattern, the evidence is now clear that albinoes may carry the determinants in both these ways. So far as they are carried gametically, *i.e.* by the sex-cells, it has been shown by Cuénot and G. M. Allen for mice, by C. C. Hurst for rabbits, and by L. Doncaster and G. P. Mudge for rats, that in a cross between a coloured individual of known gametic purity and an albino, the individuals of the progeny in either the first or second, or both generations, may differ, and that the difference in some cases wholly depends upon the albino used. It has been shown that the individuals in such an offspring may bear patterns which never occurred in the ancestry of the coloured parent, but did in that of the albino; and, moreover, if the same coloured parent be mated with another individual, either albino or coloured, that their offspring may never contain members bearing such patterns. The particular pattern will only appear when the coloured parent is mated with the particular albino. And yet the albino itself shows no somatic pattern or pigment. So clear is the evidence on this point that any one adequately acquainted at first hand with the phenomena, by employing an albino of known gametic structure and mating it with a coloured individual, also of known gametic constitution, could predict the result.

With respect to albinoes carrying pattern as a visible somatic character, *i.e.* in the body cells, no definite evidence has as yet been published. But W. Haacke has described a single albino rat, in which he states that the hairs of the shoulder and mid-dorsal regions were of a different texture from those of the rest of the body. And it is possible that this albino, had it developed colour, would have been of the piebald pattern. But the author of this article has quite recently reared some albinoes in which the familiar shoulder hood and dorsal stripe of the piebald rat is perfectly obvious, in spite of the absence of the slightest pigmentation. The hairs which occupy the region which in the pigmented individual is black, are longer, thinner and more widely separated than those in the regions which are white. As a result of this, the pink skin is quite visible where these hairs occur, but elsewhere it is invisible. Thus these albinoes exhibit a pattern of pink skin similar in form with the black pattern of the piebald rat. Moreover, some of the albinoes possess these particular " pattern " hairs all over the body and obviously such individuals are carrying the self pattern. There are other details into which we cannot here enter, but which support the interpretation put upon these facts, *i.e.* that these particular albinoes are carrying in the soma the pattern determinants simultaneously with the absence of some of the factors for pigmentation.

Not only do albinoes thus carry the determinants for pattern, but it has been known for some time that they also carry gametically, but never visible somatically, the determinants for either the ferment or the chromogen for one or more colours. L. Cuénot was the first to show this for albino mice. He was able by appropriate experiments to demonstrate that when an albino is derived (extracted) from a coloured ancestry, and is then crossed with a coloured individual, both the colour of the pigmented parent and of the pigmented ancestry of the albino may appear among the individuals of the offspring.

Immediately subsequent to Cuénot, G. M. Allen in America demonstrated the same fact upon the same species of rodents. C. C. Hurst, more recently, has shown that albino rabbits, whether pure bred for eight generations at least, or extracted from pigmented parents, may carry the determinants for black or for black and grey. In this latter case the determinants for black are carried by separate gametes from those carrying grey, and the two kinds of sex-cells exist in approximately equal numbers. This is likewise true of albino mice when they carry the determinants for more than one colour.

Since Hurst's work, L. Doncaster and G. P. Mudge have both shown that albino rats also carry in a latent condition the determinants for black or grey. The experiments of the latter author show that, if a gametically pure black rat be crossed with an albino derived from a piebald black and white ancestry, all the offspring in successive litters will be black; but if the same black parent be crossed with albinoes extracted from parents of which one or both are grey, then both grey and black members will appear in the successive litters.

The proportions in which the various coloured individuals appear are approximately those demanded by the Mendelian principle of gametic purity and segregation. Cuénot and Hurst have also shown that when albinoes of one colour extraction are crossed with albinoes of another colour extraction the segregation of the colour determinants in the gametogenesis of the albinoes takes place in precisely the same way that it does in the gametogenesis of a pigmented individual; that is, in Mendelian fashion. Or, to express it otherwise, an albino extracted from yellow parents, bred with an albino extracted from black parents, will give an albino offspring whose gametes in equal numbers are bearers of the black and yellow determinants. And when one of these albinoes is bred with a pure coloured individual, a mixed offspring will appear in the first generation. Some of the individuals will be one or other of the two colours, the determinants of which were borne by the albino, and others the colour of the pigmented parent. But in such albino crosses the colour characters are latent because albinoes do not carry the whole of the complements for colour production. They carry only some determinant or determinants which are capable of developing colour when they interact with some other determinant or determinants carried alone by pigmented individuals. Whether albinoes carry the tyrosinase or other ferment, or whether they carry the chromogen or chromogens, is not yet settled. Miss Durham's work suggests that they carry the latter. But that they never bear both is proved by the fact that, when albinoes are crossed with each other, none but albinoes ever result in the offspring. One apparent exception to this rule only is known, and this almost certainly was due to error.

It is not only among albino animals that colour factors are carried in a latent condition, but also in white flowers. W. Bateson has shown this to be the case for the sweet-pea (*Lathyrus odoratus*), var. Emily Henderson, and for certain white and cream stocks (*Matthiola*). When white Emily Henderson (the race having round pollen grains) is crossed with a blue-flowered pea, purple offspring result. Similarly, when white Emily Henderson (long pollen grains) is crossed with white Emily Henderson (round pollen grains), the offspring wholly consists of the reversionary purple type, and sometimes wholly of a red bicolor form known as "Painted Lady." These two types never appear in the same family. With the stocks, when a white-flowered and hairless form is crossed with a cream-flowered and hairless one, all the offspring are purple and hairy. Bateson considers that the purple colour is due to the simultaneous existence in the plant of two colour factors which may be designated by C and R. If either one of these two is absent the plant is colourless. Cream-coloured flowers are regarded as white because cream is due to yellow plastids and not to sap colour. Thus the cream plant may carry C and the white one R. When they are crossed the two factors for colour production are brought together. Obviously, we may regard C as a tyrosinase and R as a chromogen, or *vice versa;* and in the case of the white sweet-pea crossed with a blue-flowered one, and producing purple offspring, we may imagine that the white flower brought in an additional tyrosinase or a chromogen not present in the blue flower, which, when combined or mixed with the chromogen or tyrosinase for blue, gave purple. A similar explanation may apply to C. Correns's experiment, in which he crossed white *Mirabilis jalapa* with a yellow form, and always obtained red-flowered offspring.

In heredity, complete albinism among animals is always recessive; and partial albinism (piebald) is always recessive to complete pigmentation (self-coloured). When an albino mouse, rat, guinea-pig or rabbit is crossed with either a pure self or pure pied-coloured form, the offspring are similar to, though not always exactly like, the coloured parent; provided, of course, that the albino is pure and is not carrying some colour or pattern determinant which is dominant to that of the coloured parent used. No albinoes, in such a case, will appear among the first generation, but if the individuals of this (F.1) generation are crossed *inter se* or back crossed with the albino parent, then albino individuals reappear among the offspring. In the former case they would form one-quarter of the individuals of this second (F.2) generation, and in the latter, one-half.

The recessive nature of albinism and its distribution in Mendelian fashion is almost certainly as true for man as for lower forms. This has been shown by W. C. Farabee for negroes in Coahoma county, Mississippi. The facts are as follows. An albino negro married a normal negress. They had three children, all males. All three sons married, and two of them had only normal children, judged of course by somatic characters. But the third son married twice, and by the first wife had five normal and one albino children, and by the second, six normal and three albino children. If we assume that the two negresses which the third son married were themselves carrying albinism recessive—an exceedingly probable condition considering that albino negroes are not uncommon—the result is accurately in accordance, as W. E. Castle has shown, with Mendelian expectation. For there is expected in the offspring of this third son coloured individuals and albinoes in the proportion of 3:1. There is actually 11:4, which is the nearest possible approximation with the number 15.

The operation of Mendelian processes in human heredity is further shown by the close relationship that exists between the appearance of albinoes and cousin marriages. An albino is a homozygote; that is, all its gametes are carrying the character of albinism and none of them bear the alternative character—the allelomorph—of pigmentation. By pigmentation is here meant all those factors which go to its production. Now such a gametic (egg or sperm) constitution can only result when two individuals, all or some of whose gametes are pure with regard to the character albinism, meet in fertilization. Hence it is readily seen that it is among cousin marriages that the greater probabilities exist that two individuals bearing identical characters will meet, than in the population at large. This can be illustrated in the following scheme. Let A stand for a pure albino and (A)N for a normal person, who nevertheless carries the character albinism (A) recessive. Then, in the scheme below, if A^b and $(A)N^b$ are two brothers who both marry normal wives N, their children N(A) in the first case will be all normal in appearance but will be carrying albinism recessive; and in the second case some will be pure normal individuals N, and some will be like the children of the first brother, *i.e.* N(A). Now, if one of these latter children of the second brother marries a cousin—a child of the first brother,—their offspring, if large enough, will consist of some pure normals N, impure normals N(A), and of albinoes A.

$$A^b \times N \qquad \underbrace{(A)N^b}\times N$$

$$\overline{N(A)} \qquad \overline{N(A)+N}$$

$$\overline{N+2N(A)+A}$$

No other rational explanation of the close relationship between albinism and cousin marriages is at present forthcoming. And, when the whole facts are borne in mind, there can be no reasonable doubt that the Mendelian principles offer an intelligible solution of the problem.

A popular conception exists that albinoes are less constitutionally strong than the pigmented individuals of the same species. In support of this belief there is more or less scientifically ascertained evidence. Conversely, there is, however, conclusive evidence that in some instances and in respect of certain qualities the opposite belief is true.

To deal with the former belief first, we have the remarkable case cited by Charles Darwin on the authority of Professor I. J. Wyman. In Virginia the paint-root plant (*Lachnanthes tinctoria*) occurs abundantly, and Professor Wyman noticed that all the pigs in this district were black. Upon inquiry of the farmers he found that all the white pigs born in a litter were destroyed, because they could not be reared to maturity. The root of this plant, when eaten by white pigs, caused their bones to turn to a pink colour and their hoofs to fall off, but the black pigs could eat the same plant with impunity. Partial albinism in this case was undoubtedly correlated with some inherent constitutional defect, in virtue of which the individuals characterized by it were injuriously affected by the juices of a plant quite innocuous to their pigmented brethren. Heusinger has shown that white sheep and pigs are injured by the ingestion of certain plants, while the pigmented individuals may eat them without harm. In Devonshire and in parts of Kent the farmers entertain a marked prejudice against white pigs, because "the sun blisters their skin." More remarkable is the case of certain cattle, whose skin is piebald, marked by a general ground colour over which are scattered patches of unpigmented coat. In these animals, in certain inflammatory skin eruptions, caused by the ingestion of harmful plants, the albinotic areas are alone affected. And with certain cutaneous diseases accompanied by constitutional disturbances which afflict cattle, the affection in the skin appears on the patches bearing white hairs, the other parts remaining apparently healthy. Such cases suggest that we should be more correct in regarding, not albinism as correlated with constitutional defects, but rather pigmentation as correlated with powers of immunity or increased resistance against certain injurious processes. In the West Indies "the only horned cattle fit for work are those which have a good deal of black in them; the white are terribly tormented by the insects and they are weak and sluggish in proportion to the black."

Coming to man, it is known that some albino negroes are peculiarly sensitive to the bites of insects; and with Europeans it is a generally observed fact that the fairer individuals are more seriously affected by the bites of fleas and bugs than are darker ones. Dr Twining, in the *British Association Reports for 1845*, p. 70, cites some instances described by Humboldt, who says that the copper-coloured natives of the high plain of Bogoto, and at a lower level on the Magdalena river, were generally free from goitre. Professor Pöffig, also cited by Dr Twining, states that on the east side of the Andes in Chile, in some of the races which live there, he did not see a single case of goitre, and yet in the white inhabitants, who live exactly as the natives, it prevails in a great degree.

Turning now to instances of the opposite kind, it is known that silkworms which spin colourless cocoons are more resistant to the attacks of a certain deadly fungus than are those which spin the yellow ones. In some parts of North America it is found that the white peaches are much less liable to the attack of a disease known as the "yellows" than are the yellow-fleshed ones. In the region of the Mississippi, Farabee has observed that the albino negroes are taller and broader than the black-skinned individuals. We may assume that increased stature and breadth imply some sort of inherent physical superiority, and if such an assumption is valid we have in man evidence that albinism is correlated not with constitutional defectiveness but with greater perfectness.

But the question as to whether albinoes are more or less constitutionally vigorous than pigmented individuals of the same species may be tested by exact measurement. In 1893 W. D. Halliburton and T. G. Brodie, in ascertaining the physiological properties of nucleo-proteids, found that when they were intravascularly injected into pigmented rabbits, coagulation of the blood resulted, but of the eight albinoes which they used, none clotted. At a subsequent period (1897) Halliburton and J. W. Pickering showed that the three synthesized colloids of Grimaux in the same way produced coagulation in pigmented animals, but failed to do so in albinoes. Pickering, still later, showed, in the case of four Norway hares, two of which were injected while in their pigmented or summer coat, and two while in their albino or winter coat, that coagulation occurred in the former cases but not in the latter.

Quite recently, however, the author of this article has made a more detailed examination of the question, operating upon several hundreds of rabbits. And he found that all albinoes do not fail to clot when intravascularly injected with nucleo-proteids. Only about 9% of them thus failed absolutely to manifest any trace of coagulation. But about 7% showed an exceedingly limited coagulation, in which the clot was colourless and flocculent, and confined to the heart. The rest gave a typical and more or less wide-spread coagulation. Moreover, it was found that all the failures of coagulation occurred when the nucleo-proteid used was obtained from pigmented animals. When it was derived from albinoes no failures occurred. All pigmented animals clotted when the nucleo-proteid was derived from either source. The Himalayan rabbits reacted like complete albinoes, and 12% of them failed to clot when injected with nucleo-proteid extracted from pigmented animals.

The interesting fact was thus ascertained that all albinoes are not alike. To students of heredity this is precisely what would have been expected. For, as the facts above described show, albinoes, though apparently identical externally, are yet the carriers of different hereditary characters. Among albino rats, for instance, the author of this article has reason to believe, upon theoretical grounds resting on an experimental basis, that probably no less than thirteen types exist. With rabbits and mice there must be a still larger number.

In the intravascular coagulation experiments above described, all the rabbits were carefully weighed, and the amount of nucleo-proteid injected until coagulation occurred was measured. This would give for albinoes and pigmented individuals the amount per kilogramme of body-weight required to kill in each case, and would afford a measurement of the relative resistance of the two races. It was found that the resistance of albinoes towards the coagulative effects of injected nucleo-proteids was to that of pigmented individuals as 1·5 to 1·0. In this case, the greater constitutional vigour of the albino is thus accurately demonstrated. But it does not necessarily follow that with other materials and with other constitutional qualities the state of things would not be reversed.

One other feature remains to be mentioned. Albinism appears, in the processes of heredity, to be sometimes indissolubly correlated with certain peculiar traits. It is well known that the long-haired albino rabbit, called Angora, when at rest, has the habit of swaying its head sideways in a peculiar fashion. C. C. Hurst has shown that the long-haired and albino characters are always accompanied in heredity with the swaying habit. The Angora character never occurs without it.

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ALBINONI, TOMASSO (*c.* 1674–*c.* 1745), Italian musician, was born at Venice. He was a prolific composer of operas attracting contemporary attention for their originality, but is more remarkable as a composer of instrumental music, which greatly attracted the attention of Bach, who wrote at least two fugues on Albinoni's themes and constantly used his basses for harmony exercises for his pupils.

ALBINOVANUS PEDO, Roman poet, flourished during the Augustan age. He wrote a Theseis, referred to in a letter from his intimate friend Ovid (*Ex Ponto*, iv. 10), epigrams which are commended by Martial (ii. 77, v. 5) and an epic poem on the exploits of Germanicus. He had the reputation of being an excellent raconteur, and Quintilian (x. i. 90) awards him qualified praise as a writer of epics. All that remains of his works is a beautiful fragment, preserved in the *Suasoriae* (i. 15) of the rhetorician Seneca, from a description of the voyage of Germanicus (A.D. 16) through the river Ems to the Northern Ocean, when he was overtaken by the storm described by Tacitus (*Ann.* ii. 23). The cavalry commander spoken of by the historian is probably identical with the poet. Three elegies were formerly attributed to Pedo by Scaliger; two on the death of Maecenas (*In Obitum Maecenatis* and *De Verbis Maecenatis moribundi*), and one addressed to Livia to console her for the death of her son Drusus (*Consolatio ad Liviam de Morte Drusi* or *Epicèdion Drusi*, usually printed with Ovid's works); but it is now generally agreed that they are not by Pedo. The *Consolatio* has been put down as late as the 15th century as the work of an Italian imitator, there being no MSS. and no trace of the poem before the publication of the *editio princeps* of Ovid in 1471. There is an English verse translation of the elegies by Plumptre (1907).

See Bährens, *Poetae Latini Minores* (1879) and *Fragmenta Poetarum Latinorum* (1886); Haupt, *Opuscula*, i. (1875); Haube, *Beitrag zur Kenntnis des Albinovanus Pedo* (1880).

ALBINUS (originally WEISS), **BERNHARD SIEGFRIED** (1697–1770), German anatomist, was born on the 24th of February 1697, at Frankfort-on-Oder, where his father, Bernhard Albinus (1653–1721), was professor of the practice of medicine. In 1702 the latter was transferred to the chair of medicine at Leiden, and it was there that Bernhard Siegfried began his studies, having for his teachers such men as H. Boerhaave and Nikolaus Bidloo. Having finished his studies at Leiden, he went to Paris, where, under the instruction of Sébastien Vaillant (1669–1722), J. B. Winslow (1669–1760) and others, he devoted himself especially to anatomy and botany. After a year's absence he was, on the recommendation of Boerhaave, recalled in 1719 to Leiden to be a lecturer on anatomy and surgery. Two years later he succeeded his father in the professorship of these subjects, and speedily became one of the most famous teachers of anatomy in Europe, his class-room being resorted to not only by students but by many practising physicians. In 1745 Albinus was appointed professor of the practice of medicine, being succeeded in the anatomical chair by his brother Frederick Bernhard (1715–1778), who, as well as another brother, Christian Bernhard (1700–1752), attained considerable distinction. Bernhard Siegfried, who was twice rector of his university, died on the 9th of September 1770 at Leiden.

ALBION (in Ptolemy Ἀλουίων; Lat. *Albion*, Pliny 4.16[30],102), the most ancient name of the British Islands, though generally restricted to England. The name is perhaps of Celtic origin, but the Romans took it as connected with *albus*, white, in reference to the chalk-cliffs of Dover, and A. Holder (*Alt-Keltischer Sprachschatz*, 1896) unhesitatingly translates it *Weissland*, "white-land." The early writer (6th cent. B.C.) whose *periplus* is translated by Avienus (end of 4th cent. A.D.) does not use the name Britannia; he speaks of *νῆσος Ἰέρνων καὶ Ἀλβιόνων* ("island of the Ierni and the Albiones"). So Pytheas of Massilia (4th cent. B.C.) speaks of Ἄλβιον and Ἰέρνη. From the fact that there was a tribe called the Albiones on the north coast of Spain in Asturia, some scholars have placed Albion in that neighbourhood (see G. F. Unger, *Rhein. Mus.* xxxviii., 1883, pp. 156-196). The name Albion was taken by medieval writers from Pliny and Ptolemy.

ALBION, a city of Calhoun county, Michigan, U.S.A., on the Kalamazoo river, 21 m. W. of Jackson. Pop. (1890) 3763; (1900) 4519, of whom 622 were foreign-born; (1904, state census) 4943. Albion is served by the Michigan Central and the Jackson division of the Lake Shore and Michigan Southern railways, and by an inter-urban electric line. The city has a public park and a public library. The W. part of the city has most of the factories; the principal manufactures are flour, agricultural implements, windmills, gasolene engines, harness and proprietary medicines. On a commanding site in the E. part of the city is Albion College (Methodist Episcopal; co-educational), embracing a College of Liberal Arts, a preparatory department, a conservatory of music, a school of art, a school of oratory, a normal course, and a commercial department. The college was incorporated in 1835 as Spring Arbor Seminary, and in 1839 by an amended charter was located at Albion, where it was first opened in 1843 under the name of the Wesleyan Seminary of Albion; in 1849 it became the Wesleyan Seminary and Female Collegiate Institute, with power to grant degrees to women only; but in 1861 the present name was adopted and the college was permitted to grant degrees to men and women. In 1906 it had a library of 16,500 volumes, a faculty of 19, and an enrolment of 483 (211 being women). The municipality owns and operates the water-works, the water-supply being obtained from artesian wells. Albion was settled in 1831, was incorporated as a village in 1866 and was chartered as a city in 1885.

ALBION, a village and the county-seat of Orleans county, New York, U.S.A., about 30 m. W.N.W. of Rochester. Pop. (1890) 4586; (1900) 4477, (984 being foreign-born and 43 negroes); (1905, state census) 5174; (1910) 5016. The village is served by the New York Central & Hudson River railway, by the Buffalo, Lockport & Rochester electric railway, and by the Erie Canal. In Albion are the Western House of Refuge for Women (a state institution established in 1890), a public park, the Swan Library, and the county buildings, including the court house, the jail and the surrogate's office; and about 2 m. to the S.E. is the beautiful Mount Albion Cemetery. Albion is the centre of the Medina sandstone industry, and lies in the midst of a good farming region, of which it is the principal shipping point, especially for apples, cabbages and beans. The village manufactures agricultural implements, vinegar, evaporated fruit, and canned fruit and vegetables, and has two large cold-storage houses. Albion was settled in 1812, was incorporated in 1823 and became the county-seat in 1825.

ALBITE, a mineral of the felspar group, belonging to the division of the *plagioclases* (*q.v.*). It is a sodium and aluminium silicate, $NaAlSi_3O_8$, and crystallizes in the anorthic system. Like all the felspars it possesses two cleavages, one perfect and the other less so, which are here inclined at an angle of 86° 24′. On the more perfect cleavage, which is parallel to the basal plane (P), is a system of fine striations, parallel to the second cleavage (M), due to twinning according to the "albite law" (figs. 1 and 2). The hardness is 6, and the specific gravity 2.63. The colour is usually pure white, hence the name (from the Lat. *albus*) for the species.

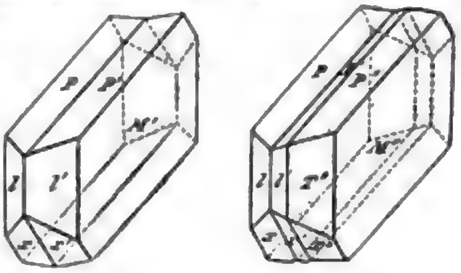

FIG. 1. FIG. 2.

Twinned crystals of Albite.

Albite forms an essential constituent of many acidic igneous and crystalline rocks; in granites, diorites, andesites, &c., it occurs as a primary mineral, whilst in crystalline schists, phyllites and crystalline limestones it is of secondary (metamorphic) origin. The beautifully developed crystals so abundant in crystal-lined crevices of Alpine granites and gneisses have been deposited, with other minerals, from solution; the crystals lining veins in the slates of Tintagel in Cornwall have the same origin.

Several varieties of albite are distinguished, of which the following may be here specially mentioned. *Pericline* (from the Gr. περικλινής, "sloping") is the name given to large opaque white crystals from the chlorite-schists of the Alps; they are tabular parallel to the direction of perfect cleavage and are twinned according to the "pericline law." *Peristerite* (from the Gr. *περιστερά*, a dove) is characterized by a beautiful bluish sheen, somewhat resembling that seen on the neck of a pigeon; it is found mainly in Ontario. Aventurine and moonstone varieties occur, though these special appearances are more usually displayed by the oligoclase and orthoclase felspars respectively. (L. J. S.)

'ALBO, JOSEPH, a Spanish Jewish theologian of the 15th century. He was author of a very popular book on the philosophy of Judaism, entitled *'Iqqarim* or *Fundamentals*. Maimonides in the 12th century had formulated the principles of Judaism in thirteen articles; Albo reduced them to three: (i) The Existence of God, (ii) Revelation and (iii) Divine Retribution. Albo set the example of minimizing Messianism in the formulation of Jewish beliefs. Though he fully maintained the Mosaic authorship of the Law and the binding force of tradition, he discriminated between the essential and the non-essential in the practices and beliefs of Judaism. An English translation of the *'Iqqarim* appeared in the *Hebrew Review*, vols. i.-iii.

ALBOIN (d. 572 or 573), king of the Lombards, and conqueror of Italy, succeeded his father Audoin about 565. The Lombards were at that time dwelling in Noricum and Pannonia (archduchy of Austria, Styria and Hungary, west of the Danube). In alliance with the Avars, and Asiatic people who had invaded central Europe, Alboin defeated the Gepidae, a powerful nation on his eastern frontier, slew their king Cunimund, whose skull he fashioned into a drinking-cup, and whose daughter Rosamund he carried off and made his wife. Three years later (in 568), on the alleged invitation of Narses (*q.v.*), who was irritated by the treatment he had received from the emperor Justin II., Alboin invaded Italy, probably marching over the pass of the Predil. He overran Venetia and the wide district which we now call Lombardy, meeting with but feeble resistance till he came to the city of Ticinum (Pavia), which for three years (569–572) kept the Lombards at bay. While this siege was in progress Alboin was also engaged in other parts of Italy, and at its close he was probably master of Lombardy, Piedmont and Tuscany, as well as of the regions which afterwards went by the name of the duchies of Spoleto and Benevento. In 572 or 573, however, he was assassinated by his chamberlain Peredeo at the instigation of Queen Rosamund, whom Alboin had grievously insulted by forcing her to drink wine out of her father's skull. After his death and the short reign of his successor Cleph the Lombards remained for more than ten years in a state of anarchy.

The authorities for the history of Alboin are Procopius, Paulus Diaconus and Agnellus (in his history of the church of Ravenna).

ALBONI, MARIETTA (1823–1894), Italian opera-singer, was born at Cesena, Romagna, and was trained in music at Bologna, where she became a pupil of Rossini. She had a magnificent contralto voice, and in 1843 made her first appearance at La Scala, Milan, being recognized at once as a public favourite. In England her reputation was established by her appearance at Covent Garden in 1847, and she had brilliant success all over Europe in the leading operatic rôles; in 1853 she repeated these triumphs in the United States. Indeed, with the exception of Malibran, she had no compeer among the contraltos of the century, the old Italian school of singing finding in her a really great representative. She married first Count A. Pepoli, who died in 1866, and secondly (1877) a French officer, M. Zieger; she lived in Paris after her first marriage, and died at Ville d'Avray in 1894.

ALBORNOZ, GIL ALVAREZ DE, Spanish cardinal, was born at Cuenca early in the 14th century. He was the son of Gil Alvarez de Albornoz and of Doña Teresa de Luna, sister of Kimeno de Luna, archbishop of Toledo. He was educated at Saragosa, while his uncle was bishop of that see, and studied law at Toulouse. The powerful influence of his family opened him a public career early in life. He was made archdeacon of Calatrava, and became a member of the king's council while young. In 1337 he was chosen archbishop of Toledo in succession to his uncle by the favour of the king, Alphonso XI. At the battle of Tarifa he fought against a great invasion from Africa in 1340, and at the taking of Algeciras in 1344 he led the armed levy of his archbishopric. In 1343 he had been sent to Pope Clement VI. at Avignon to negotiate a grant of a tax on the revenues of the Church for the Crusade. His military and diplomatic ability became known to the pope, who made him a cardinal in 1350. Albornoz left Spain on the death of the king Alphonso XI. in that year, and never returned. It has been said, but not on contemporary evidence, that he fled from fear of Peter the Cruel. In 1353 Innocent VI. sent him as a legate into Italy, with a view to the restoration of the papal authority in the states of the Church. He was recalled in 1357, but was sent again to Italy after a brief interval, and in 1362 had paved the way for the return of Urban V. to Rome. As legate, Albornoz showed himself to be an astute manager of men and effective fighter. He began by making use of Rienzi, whose release from prison at Avignon he secured. After the murder of the tribune in 1354 Albornoz pursued his task of restoring the pope's authority by intrigue and force with remarkable success. As a mark of gratitude the pope appointed him legate at Bologna in 1367, but he died at Viterbo the same year. According to his own desire his remains were carried to Toledo, where Henry of Castile caused them to be entombed with almost royal honours. A work by Albornoz on the constitution of the Church of Rome, first printed at Jesi in 1473, is now very rare. The college of St Clement at Bologna was founded by Albornoz for the benefit of Spanish students.

See "De Vita et Rebus Gestis Aegidii Albornotii," in Sepulveda's *Opera Omnia*, vol. iv. (1780); *Cardenal Albornos der zweite Begründer des Kirchenstaates*, by Dr H. J. Wurm (1892).

ALBRECHTSBERGER, JOHANN GEORG (1736–1809), Austrian musician, was born at Kloster-Neuburg, near Vienna, on the 3rd of February 1736. He studied musical composition under the court organist, Mann, and became one of the most learned and skilful contrapuntists of his age. After being employed as organist at Raab and Maria-Taferl, he was appointed in 1772 organist to the court of Vienna, and in 1792 *Kapellmeister* of St Stephen's cathedral. His fame as a theorist attracted to him in the Austrian capital a large number of pupils, some of whom afterwards became eminent musicians. Among these were Beethoven, Hummel, Moscheles and Josef Weigl (1766–1846). Albrechtsberger died in Vienna on the 7th of March 1809. His published compositions consist of preludes, fugues and sonatas for the piano and organ, string quartets, &c.; but the greater proportion of his works, vocal and instrumental, exists only in manuscript. They are in the library of the Vienna *Gesellschaft der Musikfreunde*. Probably the most valuable service he rendered to music was in his theoretical works. In 1790 he published at Leipzig a treatise on composition, of which a third edition appeared in 1821. A collection of his writings on harmony, in three volumes, was published under the care of his pupil Ignaz von Seyfried (1776–1841) in 1826. There is an English version of this published by Novello in 1855. Beethoven knew his own needs when he put himself under Albrechtsberger on finding that Haydn was not thoroughly disposed for the trouble of training him; and though Albrechtsberger could see nothing in him, and warned his other pupils against "that young man who would never turn out anything in good style," he justified Beethoven's confidence.

ALBRET. The lordship (seigneurie) of Albret (Labrit, Lebret), situated in the Landes, gave its name to one of the most powerful feudal families of France in the middle ages. Its members distinguished themselves in the local wars of that epoch; and during the 14th century they espoused the English cause for some time, afterwards transferring their support to the side of France. Arnaud Amanieu, lord of Albret, helped to take Guienne from the English. His son Charles became constable of France, and was killed at the battle of Agincourt in 1415. Alain the Great, lord of Albret (d. 1522), wished to marry Anne of Brittany, and to that end fought against Charles VIII.; but his hopes being defeated by the betrothal of Anne to Maximilian of Austria, he surrendered Nantes to the French in 1486. At that time the house of Albret had attained considerable territorial importance, due in great part to the liberal grants which it had obtained from successive kings of France. John of Albret, son of Alain, became king of Navarre by his marriage with Catherine of Foix. Their son Henry, king of Navarre, was created duke of Albret and peer of France in 1550. By his wife Margaret, sister of the French king, Francis I., he had a daughter, Jeanne d'Albret, queen of Navarre, who married Anthony de Bourbon, duke of Vendôme, and became the mother of Henry IV., king of France. The dukedom of Albret, united to the crown of France by the accession of this prince, was granted to the family of La Tour d'Auvergne in 1651, in exchange for Sedan and Raucourt.

To a younger branch of this house belonged Jean d'Albret, seigneur of Orval, count of Dreux and of Rethel, governor of Champagne (d. 1524), who was employed by Francis I. in many diplomatic negotiations, more particularly in his intrigues to get himself elected emperor in 1519. (M. P.*)

ALBRIGHT, JACOB (1759–1808), American clergyman, was born near Pottstown, Pennsylvania, on the 1st of May 1759. He was of "Pennsylvania-German" parentage, his name being originally Albrecht, and was educated in the Lutheran faith. At an early age he became a tile-burner. In 1790 he was converted to Methodism, and in 1796 determined to devote himself to preaching that faith among the Pennsylvania Germans. His efforts met with great success, and in 1800 he founded what was virtually a new and independent church organization on the Methodist system, of which he became the presiding elder, and eventually (1807) bishop. This church is officially the Evangelical Association, but its adherents have been variously known as "New Methodists," "Albrights," and "Albright Brethren." Albright died on the 18th of May 1808, at Mühlbach, Pennsylvania.

ALBUERA, or ALBUHERA, **LA,** a small village of Spain, in the province of Badajoz, 13 m. S.E. of the town of that name. Pop. (1900) 820. Albuera is celebrated on account of the victory gained there on the 16th of May 1811 by the British, Portuguese and Spaniards, under Marshal Beresford, over the French army commanded by Marshal Soult. (See PENINSULAR WAR.)

ALBUFERA DE VALENCIA, a lagoon, 7 m. S. of Valencia in Spain, about 12 m. in length and 4 in breadth, 12 ft. being its greatest depth. It communicates with the sea by a narrow outlet, which can be opened or closed at pleasure. The lake is crown property, and is of great value from the fish and wildfowl with which it abounds. Rice is grown in large quantities by the inhabitants of the adjoining villages. In 1812 Marshal Suchet was created duke of Albufera by Napoleon for his conquest of Valencia, and invested with the domain; but the battle of Vittoria in 1813 deprived him of his possession, though he still retained the title. Subsequently the revenues of Albufera were conferred upon the duke of Wellington in token of the gratitude of the Spanish nation. (See PENINSULAR WAR.)

ALBULAE AQUAE, a group of springs, 4 m. W. of Tibur, the water of which is bluish, strongly impregnated with sulphur and carbonate of lime, and rises at a temperature of about 75° F. Remains of a Roman thermal establishment exist near the principal spring, the so-called Lago della Regina (which is continually diminishing in size owing to the deposit left by the water), and dedicatory inscriptions in honour of the waters have been found. The baths are still frequented by the Romans, though the modern establishment is about 1 m. S. on the high road.

See T. Ashby in *Papers of the British School at Rome*, iii. 117.

ALBULA PASS, now the principal route from the N. to the Upper Engadine in the Swiss canton of the Grisons. It was already frequented in the 13th century, while a carriage road (highest point, 7595 ft.) was constructed across it in 1865, but for a long time it was not as much used as the easier and more direct Julier Pass (7504 ft.), until the opening of the railway in 1903, which has vastly increased its practical importance. Starting from Coire the Rhine valley is followed to Reichenau (6¼ m.), and then that of the Hinter Rhine to Thusis (10¼ m.). The line then runs through the grand Schyn gorge (cut by the Albula torrent) to Tiefenkastell (7½ m.), where it leaves the Julier road on the right (S.) and continues to follow the course of the Albula past Filisur and Bergün (12½ m.) to the mouth (5879 ft.) of the great tunnel (3¾ m. in length; highest point, 5987 ft.) which has been pierced below the pass. The descent lies through the Bevers glen to Bevers (2½ m.), where the Upper Engadine is reached, about 5 m. below St. Moritz, which is 56 m. from Coire by this route. (W. A. B. C.)

ALBUM (Lat. *albus*, white), in ancient Rome, a board chalked or painted white, on which decrees, edicts and other public notices were inscribed in black. The Annales Maximi of the Pontifex Maximus, the annual edicts of the praetor, the lists of Roman and municipal senators (*decuriones*) and jurors (*album iudicum*) were exhibited in this manner. In medieval and modern times *album* denotes a book of blank pages in which verses, autographs, sketches, photographs and the like are collected. It is also applied to the official list of matriculated students in a university, and to the roll in which a bishop inscribes the names of his clergy. In law, the word is the equivalent of *mailles blanches*, for rent paid in silver ("white") money.

ALBUMAZAR, more properly ABU-MAASCHAR (805–885), Arab astronomer, was born at Balkh, flourished at Bagdad, and died at Wasid in Central Asia. His principal works are: *De Magnis Conjunctionibus* (Augsburg, 1489); *Introductorium in Astronomiam* (Venice, 1506); and *Flores Astrologici* (Augsburg, 1488). He maintained in the first that the world, created when the seven planets were in conjunction in the first degree of Aries, will come to an end at a like conjunction in the last degree of Pisces.

See *Biog. Universelle* (Jourdain); Lalande, *Bibliographie Astronomique*; Poggendorff, *Biog. literarisches Handwörterbuch*; Houzeau, *Bibl. Astronomique.*

ALBUMIN, or ALBUMEN (Lat. *albus*, white), an organic substance typical of a group of bodies (albumins or albuminates) of very complicated chemical composition. They are sometimes called the histogenetic bodies or proteids, because they are essential to the building up of the animal organism. The vegetable kingdom is the original source of albuminous substances, the albumins being found in greatest quantity in the seed. They also occur in the fluids of the living organism. The chemistry of the albumins is one of the most complicated and difficult in the whole domain of organic chemistry. It has attracted the attention of many workers, and has formed the subject of a huge literature. In this field Béchamp, Cohnheim, Albrecht Kossel, and, especially, Emil Fischer and his pupils have been extremely active. The general trend of these researches lies in the study of the decomposition or "breaking down" products of the albumin molecules; once these are accurately determined, the synthesis of an albumin is but a matter of time. Already we have proceeded far in our knowledge of the decomposition products, and certain simple proteids have been synthesized.

General characters.

The albumins contain in all cases the elements carbon, hydrogen, nitrogen, sulphur and oxygen; their composition, however, varies within certain limits: C = 50-55 %, H = 6·9-7·3 %, N = 15-19 %, S = 0·3-2·4 %, O = 19-24 %. crystallized albumin is C = 51·48 %, H = 6·76 %, N = 18·14 %, S = 0·96 %, O = 22·66 %, which points to the formula $C_{720}H_{1134}N_{218}S_5O_{248}$, corresponding to the molecular weight 16,954. A high molecular weight characterizes these substances, but so far no definite value has been determined by either physical or chemical means; A. P. Sabanezhev obtained the value 15,000 by Raoult's method for purified egg albumin. All albumins are laevo-rotatory; and on incineration a small amount of inorganic ash is invariably left. They are usually insoluble in water, alcohol and ether; and their presence as solutes in vegetable and animal fluids is not yet perfectly understood, but it is probably to be connected with the presence of salts or other substances. A remarkable change occurs when many albumins are boiled with water, or treated with certain acids, their solubility and general characters being entirely altered, and the fluid becoming coagulated. This change is seen in the transformation of the "white" of an egg on boiling. Albumins are generally detected by taking advantage of this property, or of certain colour changes. The reagents in common use are: Millon's reagent, a solution of mercuric nitrate containing nitrous acid, this gives a violet-red coloration; nitric acid, which gives a yellow colour, turning to gold when treated with ammonia (xanthoproteic reaction); fuming sulphuric acid, which gives violet solutions; and caustic potash and copper sulphate, which, on warming, gives a red to violet coloration (biuret reaction).

Decomposition products.

Boiling with dilute mineral acids, or baryta water, decomposes albumins into carbon dioxide, ammonia and fatty amino- and other acids. These decomposition products include: glycocoll or aminoacetic acid, NH_2CH_2COOH, alanine or aminopropionic acid, $CH_3\cdot CH(NH_2)\cdot COOH$, *α*-aminobutyric acid, *α*-aminovalerianic acid, leucin or isobutyl-*α*-aminoacetic acid, $(CH_3)_2CH\cdot CH_2\cdot CH(NH_2)\cdot COOH$, isoleucin, probably *β*-aminocaproic acid, serin or *α*-amino-*β*-hydroxypropionic acid, $HO\cdot CH_2\cdot CH(NH_2)\cdot COOH$, aspartic acid or aminosuccinic acid, $HOOC\cdot CH_2\cdot CH(NH_2)\cdot COOH$, glutaminic acid or *α*-amino-*n*-glutaric acid, $HOOC\cdot (CH_2)_2\cdot CH(NH_2)\cdot COOH$, diaminoacetic acid, *α*-*β*-diaminopropionic acid, lysin. or *α*-*ε*-diamino-*n*-caproic acid, $NH_2(CH_2)_4\cdot CH(NH_2)\cdot COOH$, arginin or guanidine-*α*-amino-*n*-valerianic acid, $(NH)(NH_2)C\cdot NH\cdot (CH_2)_3\cdot CH(NH_2)\cdot COOH$, ornithin or *αδ*-diamino valerianic acid, $NH_2\cdot (CH_2)_3\cdot CH(NH_2)\cdot COOH$, histidin or *α*-amino-*β*-imidazolpropionic acid, $HOOC\cdot CH(NH_2)\cdot CH_2\cdot \overline{C:CH\cdot N:CH\cdot NH}$, proline or *α*-pyrrolidin carboxylic acid, $HOOC\cdot \underline{CH\cdot NH\cdot CH_2\cdot CH_2\cdot CH_2}$, hydroxyproline, phenyl alanine or phenyl-*α*-aminopropionic acid, $C_6H_5\cdot CH_2\cdot CH(NH_2)\cdot COOH$, tyrosine or p-hydroxyphenyl-*α*-aminopropionic acid, phenyl ethylamine, p-hydroxyphenyl ethylamine, tryptophane or indol aminopropionic acid, A. cystin (protein-cystin) or *α*-amino-*β*-thioglyceric acid "disulphide," $(S\cdot CH_2\cdot CH(NH_2)\cdot COOH)_2$, B. cystin (stone-cystin), or *α*-thio-*β*-aminoglyceric acid "disulphide," $(NH_2\cdot CH_2\cdot CH:S\cdot COOH)_2$. This list is not exhaustive; other products are given in Gustav Mann, *Chemistry of the Proteids* (1906), to which reference should be made for a complete account of this class of compounds.

Classification of albumins.

The complexity of composition militates in a great measure against a rational classification of albumins by purely chemical considerations. Such classifications have been attempted by A. Kossel and by W. Kühne and E. P. Pick; but in the present state of our knowledge, however, the older classification of E. Dreschel and F. Hoppe-Seyler, based primarily on solubilities and distribution, may be conveniently retained. This classification is with certain modifications as follows:—

I. *Albumins proper*: characterized by having colloidal solutions.
   (1) Albumins: serum-albumin, egg-albumin, lact-albumin.
   (2) Globulins: serum-globulin, egg-globulin, lacto-globulin, cell-globulins.
   (3) Plant-globulins and plant-vitellines.
   (4) Fibrinogen.
   (5) Myosin.
   (6) Phosphorus containing albumins (nucleo-albumins), caseins, vitellines, nucleo-albumins of the cell-protoplasm, mucoid nucleo-albumins.
   (7) Histones.
   (8) Protamines.

II. *Transformation products of the albumins proper.*
   (1) Acid-albumins, alkali albuminates.
   (2) Albumoses, peptones and peptides.
   (3) Halogen-albumins, oxyprotein, oxyprotsulphonic acid, &c.

III. *Proteids.*
   (1) Nucleo-proteids.
   (2) Haemoglobin and allied substances.
   (3) Glyco-proteids, mucins, mucoids, helico-proteid.

IV. *Albuminoids.*
   (1) Collagen.
   (2) Keratin.
   (3) Elastin.
   (4) Fibroin.
   (5) Spongin, &c.
   (6) Amyloid.
   (7) Albumoid.
   (8) Colouring matters derived from albumin.

Albumins proper.—Albumins (as classified above) are soluble in water, dilute acids and alkalies, and in saturated neutral salt solutions; they are coagulated by heat. "Serum-albumin," or "blood-albumin," possibly $C_{450}H_{720}N_{116}S_6O_{140}$, occurs in blood-serum, lymph, chyle, milk, &c.; its coagulation temperature is about 67°. It differs from egg-albumin in its specific rotation (−57° to −64°), and in being slowly coagulated by alcohol and ether. Egg-albumin is the chief constituent of the white of egg; this fluid also contains a globulin and a mucoid. It coagulates at about 56°, and its specific rotation is −30·70°. "Lact-albumin" occurs in all kinds of milk. The globulins are insoluble in water and in dilute acids, but soluble in alkalies and in neutral salt solutions; these solutions are coagulated on boiling. "Serum-globulin," also termed globulin or fibrino-plastic globulin, paraglobulin and paraglobin, occurs in blood serum; "cell-globulins" occur in many organs—liver, kidneys, pancreas and the thyroid gland, also in muscle-plasma; "crystalline," a globulin occurring in two forms *α* and *β*, is found in the lens of the eye; "egg-globulin" and "lacto-globulin" occur respectively in the white of egg and in milk. Plant albumins or phyto-albumins have been chiefly investigated in the case of those occurring in seeds; most are globulins insoluble in pure water, but soluble in salt solutions; "edestin," a globulin of this class, is very widely distributed. Other varieties or classes of these compounds are: plant caseins, phyto-vitellines, legumins and conglutins. Fibrinogen occurs in the blood plasma, and is changed by a ferment into fibrin, to which the clotting of blood is due. Fibrinogen is insoluble in water, but soluble in salt solutions; it has three different coagulation temperatures, 56°, 67°, 75°. Fibrin, produced from fibrinogen by a ferment, is a jelly-like substance, coagulable by heat, alcohol, &c. The muscle-albumins include "myosin" or paramyosinogen, a globulin, which by coagulation induces *rigor mortis*, and the closely related "myosinogen" or myogen; myoglobulin and myoalbumin are also found in muscles. The nucleo-albumins or phospho-globulins are insoluble in water and acids, but soluble in alkalies, and have an acid reaction. "Caseinogen" (after W. D. Halliburton) is the chief albumin of milk; its composition varies with the animal. It is insoluble in water, while its salts are readily soluble. "Eucasein" is the ammonium salt; "nutrose" and "plasmon" are sodium salts. By the rennet ferment caseinogen is converted into casein, a substance resembling caseinogen in being soluble in water, but differing in having an insoluble calcium salt. The formation of casein involves the curdling of milk. Other phosphoglobulins are vitelline, found in the yolk of hens' eggs, and ichthulin, found in the eggs of fish. *Histones* are a class of albumins soluble in water and acids, but essentially basic in character; hence they are precipitated by alkalies. It is remarkable that many histones are soluble in an excess of alkali. They do not exist in a free state, but in combination with a "prosthetic group" (after A. Kossel) they give rise to important cell constituents—haemoglobin, nucleo-proteids, &c. "Thymus histone" occurs in the thymus gland; globin occurs in combination as haemoglobin; other histones have been extracted from the red blood corpuscles of the goose and the testes of fishes and other animals. The *protamines* are a well-characterized class of albumins found in the ripe spermatozoa of fishes.

Albumoses and Peptones.—The primary products of the dissociation of albumins are the albumoses, characterized by not being coagulable by heat, more soluble than the albumins, having a far less complex composition, and capable of being "salted out" by certain salts, and the peptones, similar to albumoses but not capable of being "salted out"; moreover, peptones are less complex than albumoses. By further decomposition peptones yield peptides, a certain number of which have been synthesized by Emil Fischer and his collaborators. Albumoses and peptones are white powders, readily soluble in water, with the exception of the hetero-albumoses—a subdivision of primary albumoses. They give the biuret and xanthoproteic reactions, and form salts with both acids and bases. Albumoses and peptones are obtained by peptic digestion, the latter being termed peptic-peptones; tryptic digestion also produces peptones. Acids and moist heat induce similar changes.

Proteids.—These substances are combinations of one or more albumins with a radical of an essentially different nature, termed by Kossel a "prosthetic group." It is convenient to classify proteids by those groups. "Nucleo-proteids," constituents of the cell-nucleus, are combinations of albumins and nucleic acid; they always contain iron. They are loose, white, non-hygroscopic powders, soluble in water and salt solutions, and have an acid reaction; they give the colour reactions of albumins. Nucleic acid is at present of unknown constitution; decomposition products are: phosphoric acid, uracil or 2.6-dioxy-pyrimidin,[1] cytosin or 2-oxy-6-amino-pyrimidin, thymin (nucleosin) or 2.6-dioxy-5-methyl pyrimidin hypoxanthin[1] or 6-oxypurin, xanthin or 2.6-dioxypurin, adenine or 6 amino-purin, guanine or 2-amino-6-oxypurin, pentoses (l-xylose), laevulinic acid, ammonia, etc. The nucleic acids vary with the source of the proteids, there being considerable differences in chemical composition. In general they are white, loose powders, slightly soluble in cold water, more soluble in hot water; they are precipitated by mineral acids, but dissolve in an excess. They are dextro-rotatory, and the specific rotation is numerically greater than that of albumin; hence the proteids are, in general, dextro-rotatory.

An important nucleo-proteid is haemoglobulin or haemoglobin, the colouring matter of the red blood corpuscles of vertebrates; a related substance, haemocyanin, in which the iron of haemoglobin is replaced by copper, occurs in the blood of cephalopods and crayfish. Haemoglobin is composed of a basic albumin and an acid substance haematin; it combines readily with oxygen, carbon dioxide and carbon monoxide to form loose compounds (see NUTRITION). It coagulates at 64°. By a dilute acid haemoglobin is decomposed into globin, and "haematin," a ferri-pyrrol derivative of the probable formula $C_{34}H_{34}N_4FeO_5$; under certain conditions the iron-free "haematoporphyrin" is obtained. This last substance may be reduced to mesoporphyrin, $C_{34}H_{38}O_4N_4$, which by further reduction gives haemopyrrol, $C_8H_{13}N$, possibly methyl-propyl-pyrrol or butyl-pyrrol. Other derivatives are haemin, haemochromogen and the haematinic acids.

"Glyco-proteids" differ from nucleo-proteids in containing a carbohydrate radical, which is liberated only by boiling with mineral acids or alkalies. The mucins and mucoids belong to this group; they are acid and contain no phosphorus; they give the albumin colour reactions but are not coagulated by heat. Mucins occur in most of the slimy fluids of the body; they vary in composition with their source. Mucoids resemble mucins in their composition and reactions, but differ, in general, in their physical properties. They occur in tendons, bones and cartilage. The "phospho-glyco-proteids" resemble the mucins and mucoids in containing a carbohydrate residue, but differ in containing phosphorus. Ichthulin (see above) may be placed in this group; "helico-proteid," found in the serous gland of *Helix pomatia*, the vineyard snail, also belongs here.

Albuminoids is the anatomical name given to albuminous substances forming the connective tissues. Chemically they resemble the albumins, being split up by acids or ferments into albumoses, peptones and amino-acids, forming salts, and giving the same colour reactions. They are quite insoluble in water and in salt solutions, and difficultly soluble in dilute acids and alkalies. Typical albuminoids are gelatin, keratin, elastin, fibroin, spongin and conchiolin.

"Collagen" (Gr. κόλλα, glue, and root γεν- of γεννάειν, to produce, γίγνεσθαι, to become), the ground-substance of bones and tissues, is decomposed by boiling water or on warming with acids into substances named gelatin, glutin or glue. Gelatin forms a white amorphous powder; the commercial product, however, generally forms glassy plates. The decomposition products are generally the same as with the general albumin; it gives the biuret reaction; forms salts with acids and alkalies, but is essentially acid in nature. Immersed in cold water gelatin does not dissolve but swells up; it dissolves readily in hot water, forming, according to the quantity present, a thick jelly which solidifies to a hard mass on cooling (the "glue" of the wood-worker), or a thin jelly (used in cookery). Gelatin occurs also in the cornea and the sclerotic coat of the eye; and in fish scales, the latter containing 80% of collagen, and 20% of ichthylepidin, a substance differing from gelatin in giving a well-marked Millon's reaction. Keratin (Gr. κέρας, a horn), the chief constituent of horny material, occurs in hair, nails, hoofs and feathers. It is quite insoluble in water, dilute acids and alkalies. Related to this substance are "neuro-keratin," found in the medullary sheath of nerves, and "gorgonin," the matrix of the axial skeleton of the coral *Gorgonia Cavolinii*. Elastin occurs either as thick strands or as membranes; it constitutes the "elastic tissue" of the anatomist. Its insolubility is much the same as keratin. "Fibroin" and silk-glue or sericin occur in natural silk fibres. Fibroin is insoluble in water, acids and alkalies; silk-glue resembles gelatin in its solubility, but it is less readily gelatinized. "Spongin," the matrix of bath-sponge, is insoluble in water and dilute acids, but soluble in concentrated mineral acids. "Conchiolin," the matrix of shells of the mollusca, is only slightly soluble in acids. "Cornein" forms the framework of corals. "Amyloid" occurs as a pathological product, and also in the healthy aorta and in old cartilage. It is an albumin, and not a carbohydrate as was formerly held; and gives most of the colour reactions of albumins. It forms shiny, homogeneous masses, quite insoluble in cold water and in salt solutions, but soluble in alkalies. The albumoids include, according to Cohnheim, substances which possess certain properties in common, but differ from the preceding groups. In general they resemble coagulated albumin, and also the gelatin-yielding tissues, but they themselves do not yield gelatin.

Colouring matters derived from albumins include the "melanins" (Gr. μέλας, black), substances which differ very considerably in composition, the sulphur and iron content being by no means constant; they do not give the reactions of albumins. The black colouring matter of hair, the skin of negroes, and of the ink bag of *Sepia* have been examined. Melanins obtained from tumours form black, shiny masses; they are insoluble in water, neutral salt solutions, dilute acids and in the common organic solvents.

ALBUMINURIA (Physiological or Functional), a term indicating the presence of albumin in the urine. This may depend on a number of morbid conditions, of which kidney troubles, acute illnesses and venous congestion are some of the commoner. But after exclusion of all known pathological causes, there still remains a large class of cases among subjects who appear to be in perfect health. This form has been called functional or physiological albuminuria, intermittent albuminuria, &c. Its recognition is of extreme importance, as it must be distinguished from the albuminuria due to Bright's disease and other troubles. The following are the main forms that have been described:—(1) Dietetic Albuminuria. This form affects some people after partaking of a meal consisting largely of albuminous foods, such as eggs. In others any extra indulgence in the pleasures of the table may give rise to it. (2) Cyclic Albuminuria. This name was first used by the physiologist Pavy, but other observers have called the same condition "postural albuminuria." It occurs in people enjoying perfect health, and is characterized by

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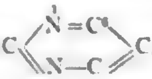
[1] The pyrimidin ring is numbered 2C  C_4. For the purin ring, see PURIN.

the presence of albumin in the urine at certain times of the day. It has been shown to depend entirely on the assumption of the erect position, and it disappears as a result of the recumbent position at night. (3) Albuminuria from exercise. This form affects some people after any unusual muscular exertion. (4) Prolonged mental strain or worry may give rise to a transient form of albuminuria. (5) Adolescent albuminuria is met with in some subjects, especially boys. The question of the real significance of "physiological" albuminuria is one about which there is much difference of opinion. But its importance and recognition—especially in questions of life insurance—admits of no question.

ALBUQUERQUE, ALPHONSO D' (in Old Port. Affonso d'Alboquerque) (1453–1515), surnamed the Great, and the Portuguese Mars, was born in 1453 at Alexandria, near Lisbon. Through his father, Gonzalvo, who held an important position at court, he was connected by illegitimate descent with the royal family of Portugal. He was educated at the court of Alphonso V., and after the death of that monarch seems to have served for some time in Africa. On his return he was appointed *estribeiro-mor* (chief equerry) to John II. In 1503 he set out on his first expedition to the East, which was to be the scene of his future triumphs. In company with his kinsman Francisco he sailed round the Cape of Good Hope to India, and succeeded in establishing the king of Cochin securely on his throne, obtaining in return for this service permission to build a Portuguese fort at Cochin, and thus laying the foundation of his country's empire in the East. He returned home in July 1504, and was well received by King Emmanuel, who entrusted him with the command of a squadron of five vessels in the fleet of sixteen which sailed for India in 1506 under Tristan da Cunha. After a series of successful attacks on the Arab cities on the east coast of Africa, Albuquerque separated from Da Cunha, and sailed with his squadron against the island of Ormuz, in the Persian Gulf, which was then one of the chief centres of commerce in the East. He arrived on the 25th of September 1507, and soon obtained possession of the island, though he was unable long to maintain his position. With his squadron increased by three vessels, he reached the Malabar coast at the close of the year 1508, and immediately made known the commission he had received from the king empowering him to supersede the governor Francisco de Almeida. The latter, however, refused to recognize Albuquerque's credentials and cast him into prison, from which he was only released, after three months' confinement, on the arrival of the grand-marshal of Portugal with a large fleet. Almeida having returned home, Albuquerque speedily showed the energy and determination of his character. An unsuccessful attack upon Calicut in January 1510, in which the commander-in-chief received a severe wound, was immediately followed by the investment and capture of Goa. Albuquerque, finding himself unable to hold the town on his first occupation, abandoned it in August, to return with the reinforcements in November, when he obtained undisputed possession. He next directed his forces against Malacca, which he subdued after a severe struggle. He remained in the town nearly a year in order to strengthen the position of the Portuguese power. In 1512 he sailed for the coast of Malabar. On the voyage a violent storm arose, Albuquerque's vessel, the "Flor de la Mar," which carried the treasure he had amassed in his conquests, was wrecked, and he himself barely escaped with his life. In September of the same year he arrived at Goa, where he quickly suppressed a serious revolt headed by Idalcan, and took such measures for the security and peace of the town that it became the most flourishing of the Portuguese settlements in India. Albuquerque had been for some time under orders from the home government to undertake an expedition to the Red Sea, in order to secure that channel of communication exclusively to Portugal. He accordingly laid siege to Aden in 1513, but was repulsed; and a voyage into the Red Sea, the first ever made by a European fleet, led to no substantial results. In order to destroy the power of Egypt, he is said to have entertained the idea of diverting the course of the Nile and so rendering the whole country barren. His last warlike undertaking was a second attack upon Ormuz in 1515. The island yielded to him without resistance, and it remained in the possession of the Portuguese until 1622. Albuquerque's great career had a painful and ignominious close. He had several enemies at the Portuguese court who lost no opportunity of stirring up the jealousy of the king against him, and his own injudicious and arbitrary conduct on several occasions served their end only too well. On his return from Ormuz, at the entrance of the harbour of Goa, he met a vessel from Europe bearing despatches announcing that he was superseded by his personal enemy Soarez. The blow was too much for him and he died at sea on the 16th of December 1515. Before his death he wrote a letter to the king in dignified and affecting terms, vindicating his conduct and claiming for his son the honours and rewards that were justly due to himself. His body was buried at Goa in the Church of our Lady, and it is perhaps the most convincing proof possible of the justice of his administration that, many years after, Mussulmans and Hindus used to go to his tomb to invoke protection against the injustice of his successors. The king of Portugal was convinced too late of his fidelity, and endeavoured to atone for the ingratitude with which he had treated him by heaping honours upon his natural son Affonso. The latter published a selection from his father's papers under the title *Commentarios do Grande Affonso d'Alboquerque*.

See the *Cartas de Albuquerque*, published by the Lisbon Academy (vol. i., 1884); also Morse Stephens' *Life of Albuquerque*; an article in the *Bolitim* of the Lisbon Geographical Society (January to June 1902) on "O antigo Imperialismo portuguez, &c.," has especial reference to Albuquerque.

ALBUQUERQUE, a city and the county-seat of Bernalillo county, New Mexico, U. S. A., situated in the central part of the territory, about 325 m. S. by W. of Denver, on the E. bank of the Rio Grande, at an altitude of 4950 ft. Pop. (1890) 3785; (1900) 6238, of whom 956 were foreign-born and 226 were negroes. In 1900 Albuquerque was the largest city in the territory. It is the connecting point of two main lines of the Atchison, Topeka & Santa Fé railway system. A short distance E. of the city is the university of New Mexico, under territorial control, founded in 1889 and opened in 1892; in 1908 it had a college of letters and science, a school of engineering, a school of education, a preparatory school and a commercial school. Albuquerque is also the seat of the Harwood Industrial School (Methodist) for Mexican girls, of the Menaul Mission School (Presbyterian) for Mexican boys, and of a government Indian training school (1881) for boys and girls. The city has a public library. The excellent climate has given Albuquerque and the surrounding country a reputation as a health resort. The city is an important railway centre, has extensive railway repair shops and stock-yards, and exports large quantities of live-stock, hides and wool. The largest industrial establishment is the American Lumber Company's plant, including a saw-mill, a sash, door and blind factory and a box factory. The timber used, chiefly white pine, is obtained from the Zuñi mountains. The city has also flour and woollen mills, breweries and ice factories. The old Spanish town of Albuquerque (pop. in 1900 about 1200) lies about 1 m. W. of the present city; it was founded in 1706, and was named in honour of the duke of Albuquerque, viceroy of New Spain from 1702 to 1710. During the Civil War it was occupied, late in February 1862, by Confederate troops under General Henry Hopkins Sibley (1816–1886), who soon afterwards advanced with his main body into northern New Mexico. In his retreat back into Texas he made a stand on the 8th of April 1862 at Albuquerque, where during the whole day there was a fight at long range and with few casualties against a detachment of Union soldiers commanded by Colonel Edward R. S. Canby (1819–1873). The modern city dates its origin from the completion of the first railway to Albuquerque in 1880.

ALBURNUM (sapwood), the outermost and youngest part of the wood of a tree, through which the sap rises. It is distinguished from the harder inner and older wood, the duramen or heart-wood.

ALBURY, a town in Goulburn county, New South Wales, Australia, 386 m. by rail W.S.W. of Sydney. Pop. (1901) 5821. It stands near the border of Victoria, on the right bank of the Murray river, here crossed by two bridges, one built of wood carrying a road, the other of iron bearing the railway. The Murray is navigable for small steamers from this town to its mouth, a distance of 1800 miles. Albury is the centre of a sheep-rearing and agricultural district; grapes, cereals and tobacco are largely grown, and the wine produced here is held in high repute throughout Australia. The tree under which the first explorers encamped here in November 1824 is still standing in an enclosed space. Albury became a municipality in 1859.

ALCAEUS (Alkaios), Greek lyric poet, an older contemporary of Sappho, was a native of Mytilene in Lesbos and flourished about 600 B.C. His life was greatly mixed up with the political disputes and internal feuds of his native city. He belonged to one of the noble families, and sided with his class against the "tyrants" who at that time set themselves up in Mytilene. He was in consequence obliged to leave his native country, and spent a considerable time in exile. He is said to have become reconciled to Pittacus, the ruler set up by the popular party, and to have returned to Lesbos. The date of his death is unknown. The subjects of his poems, which were composed in the Aeolic dialect, were of various kinds: some were hymns to the gods; others were of a martial or political character; others breathed an ardent love of liberty and hatred of tyrants; lastly, some were love-songs. Alcaeus was allotted the second place among the nine lyric poets in the Alexandrian canon. The considerable number of fragments extant, and the well-known imitations of Horace, who regarded Alcaeus as his great model, enable us to form a fair idea of the character of his poems. A new fragment has recently been discovered, together with some fragments of Sappho (*Classical Review*, May 1902).

See Bergk, *Poetae Lyrici Graeci* (1882); also *The Songs of Alcaeus*, by J. Easby-Smith (Washington, 1901); Plehn, *Lesbiacorum Liber* (1826); Flach, *Geschichte der griechischen Lyrik* (1883–1884); Farnell, *Greek Lyric Poets* (1891).

ALCAICS, in ancient poetry, a name given to several kinds of verse, from Alcaeus, their reputed inventor. The first kind consists of five feet, viz. a spondee or iambic, an iambic, a long syllable and two dactyles; the second of two dactyles and two trochees. Besides these, which are called *dactylic Alcaics*, there is another, simply styled *Alcaic*, consisting of an epitrite, two choriambi and a bacchius; thus—

Cur timet fla|vum Tiberim | tangere, cur | olivum?

The Alcaic ode is composed of several strophes, each consisting of four verses, the first two of which are always eleven-syllable alcaics of the first kind; the third verse is an iambic dimeter hypercatalectic consisting of nine syllables; and the fourth verse is a ten-syllable alcaic of the second kind. The following strophe is of this species, which Horace calls *Alcaei minaces camenae*—

Non possidentem multa vocaveris
Recte beatum; rectius occupat
Nomen beati, qui deorum
Muneribus sapienter uti.

There is also a decasyllabic variety of the Alcaic metre.

The Alcaic measure was one of the most splendid inventions of Greek metrical art. In its best examples it gives an impression of wonderful vigour and spontaneity. Tennyson has attempted to reproduce it in English in his

O mighty-mouthed inventor of harmonies,
O skilled to sing of time or eternity,
God-gifted organ-voice of England,
Milton, a name to resound for ages.

German is, however, the only modern literature in which alcaics have been written with much success. They were introduced by Klopstock, and used by Hölderlin, by Voss in his translations of Horace, by A. Kopisch and other modern German poets.

ALCALÁ (Moorish *al Kala*, the "Fortress" or "Castle"), the name of thirteen Spanish towns, all founded or named by the Moors. Alcalá de Henares (pop. (1900) 11,206) is separately described on account of its historical importance. Alcalá la Real (15,973), a picturesque town with a fine abbey, is situated in mountainous country in the extreme south-west of Jaén. Its distinctive name *la Real*, "the Royal," was conferred in memory of its capture by Alphonso XI. of Leon in 1340. In 1810 the French under Count Sebastiani here defeated the Spaniards. Alcalá de los Gazules (8877), on the river Barbate, in the province of Cadiz, has a thriving trade in cork and agricultural produce. Alcalá de Guadaira (8198), on the river Guadaira, near Seville, is popularly called Alcalá de los Panadores, or "Alcalá of the Bakers," because it supplies Seville with large quantities of bread. Alcalá de Chisbert (6293) is situated on the coast of Castellon de la Plana; Alcalá del Río (3006), on the Guadalquivir, 6 m. N. of Seville; Alcalá del Júcar (2968), on the Júcar, in Albacete; Alcalá de la Selva (1490), on the southern slopes of the Sierra del Gúdar, in Teruel; Alcalá de la Vega (712), on the river Cabriel, in Cuenca; Alcalá de Gurrea (632), on the river Seton, in Huesca; Alcalá del Obispo (432), in the same province; Alcalá de Ebro (388) and Alcalá de Moncayo (367), both in Saragossa.

ALCALÁ DE HENARES, a town of Spain, in the province of Madrid, 17 m. E.N.E. of Madrid, on the river Henares, and the Madrid-Saragossa railway. Pop. (1900) 11,206. Alcalá de Henares contains a military academy and various public institutions, but its commercial importance is slight and its main interest is historical. The town has been identified with the Roman *Complutum*, which was destroyed about the year 1000, and was rebuilt by the Moors in 1083. In later times it was renowned for its richly endowed university, founded by Cardinal Jimenes de Cisneros in 1510, which at the height of its prosperity numbered 12,000 students, and was second only to that of Salamanca. Here the famous edition of the Bible known as the *Complutensian Polyglot* was prepared from 1514 to 1517. The college of San Ildefonso, completed in 1583, was the chief university building. Its modernized Gothic church, the Colegiata, contains the 16th century marble monument of Jimenes (d. 1517) and a fine reredos. The greatest of Spanish writers, Cervantes, was born at Alcalá de Henares, and baptized in the otherwise insignificant church of S. Maria on the 9th of October 1547. A tablet, set up in 1840, marks the house in which he is said to have been born. Other illustrious natives of the town were the emperor Ferdinand I. (1503–1564) and the Spanish dramatist and historian Antonio de Solis (1610–1686). After the removal of the university to Madrid in 1836 the town rapidly declined, and the government turned most of the principal buildings erected by Cardinal Jimenes in the 16th century into a depot for the archives of various state departments. Here are kept very complete and curious documents of the Inquisition, showing all its workings from the 15th to the 19th century. One of the principal libraries is the former palace of the archbishops of Toledo.

For a fuller description of Alcalá see the *Guia del viajero en Alcalá de Henares*, by L. A. de la Torre (Alcalá, 1882). The following works are mainly of historical interest:—M. de Ayala and F. Sastre, *Alcalá de Henares* (Madrid, 1890); J. C. Garcia, *Ensayo de una Tipografia Complutense* (Madrid, 1889); M. Portilla y Esquivel, *Historia de la ciudad de Compluto* (Alcalá, 1725–1728); and the "Annales Complutenses" and "Chronicon Complutense" in *España Sagrada*, by H. Florez and others (Madrid, 1754–1879).

ALCALDE (from the Arab. *al-quadi*, the "*Cadi*" or "judge"), the title in Spanish for officials of somewhat varied functions, in which, however, there is always a judicial element. *Alcalde de corte* was a judge of the palace court, having jurisdiction in and about the residence of the king. But the mayor of a town or village who discharged the functions of a justice of the peace was also an *alcalde*. It is in this sense that the title is now exclusively used. He is subject to yearly election and the post has often been an undesirable one in Spain. The title of *alcalde* must be carefully distinguished from *alcaide*, which is derived from the Arabic *al-quāid*, a general, and means the governor of a fortress.

ALCAMENES, a Greek sculptor of Lemnos and Athens. He was a younger contemporary of Pheidias and noted for the delicacy and finish of his works, among which a Hephaestus and an Aphrodite "of the Gardens" were conspicuous. Pausanias says (v. 10. 8) that he was the author of one of the pediments of the temple of Zeus at Olympia (see GREEK ART), but this seems a chronological and stylistic impossibility. At Pergamum there was discovered in 1903 a copy of the head of the Hermes "Propylaeus" of Alcamenes (*Athenische Mittheilungen*, 1904, p. 180). As, however, the deity is represented in an archaistic and conventional character, this copy cannot be relied on as giving us much information as to the usual style of Alcamenes, who was almost certainly a progressive and original artist. It is safer to judge him by the sculptural decoration of the Parthenon, in which he must almost certainly have taken a share under the direction of Pheidias.

ALCAMO, a town of Sicily, in the province of Trapani, 24 m. W.S.W. of Palermo direct (51½ m. by rail). Pop. (1881) 37,497; (1901) 51,809. It was founded in A.D. 828 by the Saracenic chief Al-Kamuk, who erected the castle (which still stands, though considerably altered), but was christianized by the emperor Frederick II. in 1233, who removed the site lower down. It possesses some medieval buildings of interest. The surrounding district is very fertile and the trade in agricultural products is considerable.

ALCANTARA, a small seaport of Brazil, in the state of Maranhão, on the W. shore of the bay of São Marcos, 16 m. from the city of Maranhão by water. It has a fairly good harbour, and excellent cotton and rice are grown in the vicinity and shipped thence.

ALCÁNTARA, a town of western Spain, in the province of Cáceres, situated on a rocky height on the left bank of the river Tagus, 7 m. from the Portuguese frontier. Pop. (1900) 3248. Alcántara (in Arab. "the bridge") owes its name to the magnificent Roman bridge which spans the Tagus on the north-west. This was originally built about A.D. 105, in honour of the Roman emperor Trajan and at the cost of eleven Lusitanian communities. It is entirely constructed of granite blocks, without cement, and consists of six arches of various sizes, with a total length of 616 feet and a height of about 190 ft. in the middle piers, which are surmounted by a fortified gateway. One of the arches was broken down in 1213 and rebuilt in 1553; another was blown up by the British troops in 1809, and, though temporarily reconstructed, was again destroyed in 1836, to prevent the passage of the Carlist forces. But in 1860 the whole was restored. A small Roman temple, dedicated to Trajan and other deified emperors, stood on the left bank, adjoining the bridge. It is doubtful, however, if Alcántara marks the site of any Roman town, though archaeologists have sometimes identified it either with *Norba Caesarea* or with *Interamnium*. It first became famous about 1215 as the stronghold of the knightly Order of Alcántara. Many of the grand masters of this order lie buried in the 13th-century Gothic church. The town possesses another interesting church built in 1506.

See *Antiguedades y santos de la muy noble villa de Alcántara*, by J. Arias de Quintanadueñas (Madrid, 1661); and *Retrato politico de Alcántara*, by L. Santibañez (Madrid, 1779).

ALCAVALA (Spanish, from Arab. *al-quabalah*, "tax," *quabala*, "to receive"; cf. Fr. *gabelle*), a duty formerly charged in Spain and its colonies on all transfers of property, whether public or private. Originally imposed in 1341 by Alphonso XI. to secure freedom from the Moors, it was an *ad valorem* tax of 10, increased afterwards to 14%, on the selling price of all commodities, whether raw or manufactured, chargeable as often as they were sold or exchanged. It subjected every farmer, manufacturer, merchant and shopkeeper to the continual visits and examination of the tax-gatherers, whose number was necessarily very great. This monstrous impost was permitted to ruin the industry and commerce of the greater part of the kingdom up to the time of the invasion of Napoleon. Catalonia and Aragon purchased from Philip V. an exemption from the alcavala, and, though still burdened with other heavy taxes, were in consequence in a comparatively flourishing state.

ALCÁZAR DE SAN JUAN, or ALCÁZAR, a town of Spain, in the province of Ciudad Real, in the plain of La Mancha, at the junction of the Madrid-Manzanares and Madrid-Albacete railways. Pop. (1900) 11,499. Owing to its position on two important railways, Alcázar has a flourishing transit-trade in the wines of Estremadura and Andalusia; the soda and alkali of La Mancha are used in the manufacture of soap; and gunpowder, chocolate and inlaid daggers are also made here. Alcázar is sometimes identified with the Roman *Alce*, captured by Tiberius Sempronius Gracchus in 180 B.C. It derives its existing name from its medieval Moorish castle (*al-kasr*), which was afterwards garrisoned by the knights of St John. The townsfolk contend that the great Cervantes was a native of Alcázar; and, although this claim must be disallowed, much of the action of his masterpiece, *Don Quixote*, takes place in the neighbourhood. El Toboso, for instance, a village 12 m. E.N.E. [pop. (1900) 1895], was the home of the Lady Dulcinea del Toboso; Argamasilla de Alba (3505), 22 m. S.E., is declared by tradition to be the birthplace of Don Quixote himself. Local antiquaries even identify the knight with Don Rodrigo de Pacheco, whose portrait adorns the parish church; and the same authorities hold that part of the romance was written while Cervantes was a prisoner in their town. An edition of *Don Quixote* was published at Argamasilla in 1864.

ALCESTER, FREDERICK BEAUCHAMP PAGET SEYMOUR, BARON (1821–1895), British admiral, son of Colonel Sir Horace Beauchamp Seymour and cousin of Francis George Hugh Seymour, 5th marquess of Hertford, was born on the 12th of April 1821. Entering the navy in 1834, he served in the Mediterranean and the Pacific, was for three years flag-lieutenant to his uncle Sir George Seymour, and was promoted to be commander in 1847. He served in Burma as a volunteer in 1852, was made a captain in 1854, took the "Meteor" iron-clad battery out to the Black Sea and home again in 1856, was captain of the "Pelorus" on the Australian station from 1857 to 1863, and commanded the naval brigade in New Zealand during the Maori War, 1860–61, for which he was made a C.B. He became a rear-admiral in 1870; in 1871–1872 he commanded the flying squadron, was a lord of the admiralty in 1872–1874, and commanded the Channel fleet, 1874–1876. On the 31st of December 1876 he was made a vice-admiral, a K.C.B. on the 2nd of June 1877. In 1880–1883 he was commander-in-chief of the fleet in the Mediterranean, and in 1880 had also the chief command of the European squadron sent to the coast of Albania as a demonstration to compel the Porte to cede Dulcigno to Montenegro. On the 24th of May 1881 he was made a G.C.B., and on the 6th of May 1882 was promoted to the rank of admiral. In July 1882 he commanded at the bombardment of Alexandria and in the subsequent operations on the coast of Egypt, for which service he was raised to the peerage as Baron Alcester of Alcester in the county of Warwick, received a parliamentary grant of £25,000, the freedom of the city of London and a sword of honour. On his return from the Mediterranean he was for a couple of years again at the admiralty, and in 1886 he was placed on the retired list. For the next nine years he lived chiefly in London, but latterly his health was much broken, and he died on the 30th of March 1895. He was unmarried and the peerage became extinct.

ALCESTER [pronounced *Auster*], a market-town in the Stratford-on-Avon parliamentary division of Warwickshire, England, 16 m. W.S.W. from Warwick by the Great Western railway, served also by the Birmingham-Evesham branch of the Midland railway. Pop. (1901) 2303. It is pleasantly situated among low wooded hills at the junction of the small stream Alne with the Arrow, a northern tributary of the Avon. The church of St Nicholas, with the exception of the Decorated tower, is a reconstruction of 1734; among several monuments is a fine example of Chantrey's work, to the 2nd marquess of Hertford (d. 1822). There are a picturesque town hall (1641), raised on stone columns, and a free grammar school. The manufacture of needles is less important than formerly, having been absorbed into the centre of the industry at Redditch in the neighbouring county of Worcestershire. There are implement works and cycle works, and brewing is prosecuted.

The name (Alnecestre, Alyncester) signifies "the camp on the Alne." A small Romano-British town or village was situated here, on the road which runs from Derby and Wall, near Lichfield, to join the Fosse Way near Cirencester. Its name is not known. A relief figure in stone, some pavements, potsherds, coins and burials have been found, but nothing to indicate an important station. No written document relating to Alcester exists before the reign of Henry I. No mention occurs in Domesday, but it is given in a list of serjeanties of the reign of Henry III. as having been a royal borough in the time of Henry I., and in 1177 it rendered four marks' aid with the other boroughs of the county. However, there is no evidence of the grant of a royal charter, and the title of borough soon lapsed. In the reign of Henry III. a moiety of the manor was purchased by Sir Walter Beauchamp, who granted a charter to the inhabitants of the town establishing a Tuesday market for corn, cattle, and all kinds of merchandise, and also obtained grants of fairs at the feasts of St Giles (afterwards transferred to the feast of St Faith) and St Barnabas. In 1444 Sir John Beauchamp purchased the remaining moiety of the manor, and was granted an additional fair at the feast of St Dunstan. From this date the Beauchamps were lords of the whole manor until it passed by female descent to the Grevilles in the reign of Henry VIII. In 1140 a Benedictine monastery was founded here by Ralph Boteler of Oversley, and received the name of the Church of Our Lady of the Isle, owing to its insulation by a moat meeting the river Arrow. The monastery was suppressed among the smaller houses in 1536. Traces of the moat and the foundations are still to be seen in Priory Close. The ancient fairs survived to the end of the 19th century. In 1830 the needle-manufacture employed nearly a thousand hands.

ALCESTIS (ALKESTIS), in Greek legend the daughter of Pelias and Anaxibia, and wife of Admetus, king of Pherae in Thessaly. She consented to die in place of her husband, and was afterwards rescued by Heracles. This beautiful story of conjugal devotion forms the subject of the *Alcestis* of Euripides, which furnished the basis of Robert Browning's *Balaustion's Adventure*. Sophocles also wrote an *Alcestis*, of which only fragments remain.

See Dissel, *Der Mythos von Admetus und Alkestis*, 1882.

ALCHEMY. In the narrow sense of the word, alchemy is the pretended art of making gold and silver, or transmuting the base metals into the noble ones. The idea of such transmutation probably arose among the Alexandrian Greeks in the early centuries of the Christian era; thence it passed to the Arabs, by whom it was transmitted to western Europe, and its realization was a leading aim of chemical workers down to the time of Paracelsus and even later. But "alchemy" was something more than a particularly vain and deluded manifestation of the thirst for gold, as it is sometimes represented; in its wider and truer significance it stands for the chemistry of the middle ages. The idea of transmutation, in the country of its origin, had a philosophical basis, and was linked up with the Greek theories of matter there current; thus, by supplying a central philosophical principle, it to some extent unified and focussed chemical effort, which previously, so far as it existed at all, had been expended on acquiring empirical acquaintance with a mass of disconnected technical processes. Alchemy in this sense is merely an early phase of the development of systematic chemistry; in Liebig's words, it was "never at any time anything different from chemistry."

Regarding the derivation of the word, there are two main views which agree in holding that it has an Arabic descent, the prefix *al* being the Arabic article. But according to one, the second part of the word comes from the Greek *χυμεία*, pouring, infusion, used in connexion with the study of the juices of plants, and thence extended to chemical manipulations in general; this derivation accounts for the old-fashioned spellings "chymist" and "chymistry." The other view traces it to *khem* or *khamé*, hieroglyph *khmi*, which denotes black earth as opposed to barren sand, and occurs in Plutarch as *χυμεία*; on this derivation alchemy is explained as meaning the "Egyptian art." The first occurrence of the word is said to be in a treatise of Julius Firmicus, an astrological writer of the 4th century, but the prefix *al* there must be the addition of a later copyist. Among the Alexandrian writers alchemy was designated as *ἡ τῆς χρυσοῦ τε καὶ ἀργύρου ποιήσεως τέχνη θεία καὶ ἱερά* or *ἡ ἐπιστήμη ἱερά*. In English, *Piers Plowman* (1362) contains the phrase "experimentis of alconomye," with variants "alkenemye" and "alknamye." The prefix *al* begins to be dropped about the middle of the 16th century.

Origins of Alchemy.—Numerous legends cluster round the origin of alchemy. According to one story, it was founded by the Egyptian god Hermes (Thoth), the reputed inventor of the arts and sciences, to whom, under the appellation Hermes Trismegistus, Tertullian refers as the master of those who occupy themselves with nature; after him later alchemists called their work the "hermetic art," and the seal of Hermes, which they placed upon their vessels, is the origin of the common phrase "hermetically sealed." Another legend, given by Zosimus of Panopolis, an alchemistical writer said to date from the 3rd century, asserts that the fallen angels taught the arts to the women they married (cf. Genesis vi. 2), their instruction being recorded in a book called *Chemā*. A similar story appears in the Book of Enoch, and Tertullian has much to say about the wicked angels who revealed to men the knowledge of gold and silver, of lustrous stones, and of the power of herbs, and who introduced the arts of astrology and magic upon the earth. Again, the Arabic *Kitāb-al-Fihrist*, written by al-Nadīm towards the end of the 10th century, says that the "people who practise alchemy, that is, who fabricate gold and silver from strange metals, state that the first to speak of the science of the work was Hermes the Wise, who was originally of Babylon, but who established himself in Egypt after the dispersion of the peoples from Babel." Another legend, also to be found in Arabic sources, asserts that alchemy was revealed by God to Moses and Aaron. But there is some evidence that, in accordance with the strong and constant tradition among the alchemists, the idea of transmutation did originate in Egypt with the Greeks of Alexandria. In the Leiden museum there are a number of papyri which were found in a tomb at Thebes, written probably in the 3rd century A.D., though their matter is older. Some are in Greek and demotic, and one, of peculiar interest from the chemical point of view, gives a number of receipts, in Greek, for the manipulation of base metals to form alloys which simulate gold and are intended to be used in the manufacture of imitation jewellery. Possibly this is one of the books about gold and silver of which Diocletian decreed the destruction about A.D. 290—an act which Gibbon styles the first authentic event in the history of alchemy (*Decline and Fall*, chap. xiii.). The author of these receipts is not under any delusion that he is transmuting metals; the MS. is merely a workshop manual in which are described processes in daily use for preparing metals for false jewellery, but it argues considerable knowledge of methods of making alloys and colouring metals. It has been suggested by M. P. E. Berthelot that the workers in these processes, which were a monopoly of the priestly caste and were kept strictly secret, though fully aware that their products were not truly gold, were in time led by their success in deceiving the public to deceive themselves also, and to come to believe that they actually had the power of making gold from substances which were not gold. Philosophical sanction and explanation of this belief was then found by bringing it into relation with the theory of the *prima materia*, which was identical in all bodies but received its actual form by the adjunction of qualities expressed by the Aristotelian elements—earth, air, fire and water. Some support for this view is gained from study of the alchemistical writings of the period. Thus, in the treatise known as *Physica et Mystica* and falsely ascribed to Democritus (such false attributions are a constant feature of the literature of alchemy), various receipts are given for colouring and gilding metals, but the conception of transmutation does not occur. This treatise was probably composed at a date not very different from that of the Leiden papyrus. Later, however, as in the *Commentary* on this work written by Synesius to Dioscorus, priest of Serapis at Alexandria, which probably dates from the end of the 4th century, a changed attitude becomes apparent; the more practical parts of the receipts are obscured or omitted, and the processes for preparing alloys and colouring metals, described in the older treatise, are by a mystical interpretation represented as resulting in real transmutation.

But while there are thus some grounds for supposing that the idea of transmutation grew out of the practical receipts of Alexandrian Egypt, the alchemy which embraced it as a leading principle was also strongly affected by Eastern influences such as magic and astrology. The earliest Greek alchemistical writings abound with references to Oriental authorities and traditions. Thus the pseudo-Democritus, who was reputed the author of the *Physica et Mystica*, which itself concludes each of its receipts with a magical formula, was believed to have travelled in Chaldaea, and to have had as his master Ostanes[1] the Mede, a name mentioned several times in the Leiden papyrus, and often by early Christian writers such as Tertullian, St Cyprian and St Augustine. The practices of the Persian adepts also are appealed to in the writings of the pseudo-Democritus, Zosimus and Synesius. The philosopher's egg, as a symbol of creation, is both Egyptian and Babylonian. In the Greek alchemists it appears as the symbol at once of the art and of the universe, enclosing within itself the four elements; and there is sometimes a play of words between *τὸ ὄν* and *τὸ ᾠόν*. The conception of man, the microcosm, containing in himself all the parts of the universe or macrocosm, is also Babylonian, as again probably is the famous identification of the metals with the planets. Even in the Leiden papyrus the astronomical symbols for the sun and moon are used to denote gold and silver, and in the *Meteorologica* of Olympiodorus lead is attributed to Saturn, iron to Mars, copper to Venus, tin to Hermes (Mercury) and electrum to Jupiter. Similar systems of symbols, but elaborated to include compounds, appear in Greek MSS. of the 10th century, preserved in the library of St Mark's at Venice. Subsequently electrum (an alloy of gold and silver) disappeared as a specific metal, and tin was ascribed to Jupiter instead, the sign of mercury becoming common to the metal and the planet. Thus we read in Chaucer (*Chanouns Yemannes Tale*):—

> The bodies sevene eek, lo! hem heer anoon:
> Sol gold is, and Luna silver we threpe,
> Mars yren, Mercurie quik-silver we clepe,
> Saturnus leed and Jupiter is tin,
> And Venus coper, by my fader kin!

Literature of Alchemy.— A considerable body of Greek chemical writings is contained in MSS. belonging to the various great libraries of Europe, the oldest being that at St Mark's, just mentioned. The contents of these MSS. are all of similar composition, and in Berthelot's opinion represent a collection of treatises made at Constantinople in the 8th or 9th century. The treatises are nearly all anterior to the 7th century, and most appear to belong to the 3rd and 4th centuries; some are the work of authentic authors like Zosimus and Synesius, while of others, such as profess to be written by Moses, Democritus, Ostanes, &c., the authorship is clearly fictitious. Some of the same names and the same works can be identified in the lists of the *Kitâb-al-Fihrist*. But the Arabs did not acquire their knowledge of this literature at first hand. The earliest Hellenic culture in the East was Syrian, and the Arabs made their first acquaintance with Greek chemistry, as with Greek philosophy, mathematics, medicine, &c., by the intermediary of Syriac translations. (See ARABIAN PHILOSOPHY and SYRIAC LITERATURE.) Examples of such translations are preserved in MSS. at the British Museum, partly written in Syriac, partly in Arabic with Syriac characters. In Berthelot's opinion, the Syriac portions represent a compilation of receipts and processes undertaken in the Syrian school of medicine at Bagdad under the Abbasids in the 9th or 10th century, and to a large extent constituted by the earlier translations made by Sergius of Resaena in the 6th century. They contain, under the title *Doctrine of Democritus*, a fairly methodical treatise in ten books comprising the *Argyropoeia* and *Chrysopoeia* of the pseudo-Democritus, with many receipts for colouring metals, making artificial precious stones, effecting the *diplosis* or doubling of metals, &c. They give illustrations of the apparatus employed, and their close relationship to the Greek is attested by the frequent occurrence of Greek words and the fact that the signs and symbols of the Greek alchemists appear almost unchanged. The other portion seems of somewhat later date. Another Syriac MS., in the library of Cambridge University, contains a translation of a work by Zosimus which is so far unknown in the original Greek. Berthelot gives reproductions of the British Museum MSS. in vol. ii. of *La Chimie au moyen âge*.

Several alchemistical treatises, written in Arabic, exist in manuscript in the National Library at Paris and in the library of the university of Leiden, and have been reproduced by Berthelot, with translations, in vol. iii. of *La Chimie au moyen âge*. They fall into two groups: those in one are largely composed of compilations from Greek sources, while those in the other have rather the character of original compositions. Of the first group the most interesting and possibly the oldest is the *Book of Crates*; it is remarkable for containing some of the signs used for the metals by the Greek alchemists, and for giving figures of four pieces of apparatus which closely resemble those depicted in Greek MSS., the former being never, and the latter rarely, found in other Arabic MSS. Its concluding words suggest that its production was due to Khalid ben Yezid (died in 708), who was a pupil of the Syrian monk Marianus, and according to the *Kitâb-al-Fihrist* was the first Mussulman writer on alchemy. The second group consists of a number of treatises professing to be written by Jaber, celebrated in Latin alchemy as Geber (*q.v.*). Internal evidence suggests that they are not all from the same hand or of the same date, but probably they are not earlier than the 9th nor later than the 12th century. The Arabic chroniclers record the names of many other writers on alchemy, among the most famous being Rhazes and Avicenna.

But the further development of alchemy took place in the West rather than in the East. With the spread of their empire to Spain the Arabs took with them their knowledge of Greek medicine and science, including alchemy, and thence it passed, strengthened by the infusion of a certain Jewish element, to the nations of western Europe, through the medium of Latin translations. The making of these began about the 11th century, one of the earliest of the translators, Constantinus Africanus, wrote about 1075, and another, Gerard of Cremona, lived from 1114 to 1187. The *Liber de compositione alchemiae*, which professes to be by Morienus—perhaps the same as the Marianus who was the teacher of Khalid—was translated by Robertus Castrensis, who states that he finished the work in 1182, and speaks as if he were making a revelation—"Quid sit alchemia nondum cognovit vestra Latinitas." The earlier translations, such as the *Turba Philosophorum* and other works printed in collections like the *Artis auriferae quam chemiam vocant* (1572), *Theatrum chemicum* (1602), and J. J. Manget's *Bibliotheca chemica curiosa* (1702), are confused productions, written in an allegorical style, but full of phrases and even pages taken literally from the Greek alchemists, and citing by name various authorities of Greek alchemy. They were followed by treatises of a different character, clearer in matter, more systematic in arrangement, and reflecting the methods of the scholastic logic; these are farther from the Greek tradition, for although they contain sufficient traces of their ultimate Greek ancestry, their authors do not know the Greeks as masters and cite no Greek names. So far as they are Latin versions of Arabico-Greek treatises, they must have been much remodelled in the course of translation; but there is reason to suppose that many of them, even when pretending to be translations, are really original compositions. It is curious that although we possess a certain number of works on alchemy written in Arabic, and also many Latin treatises that profess to be translated from Arabic, yet in no case is the existence known of both the Arabic and the Latin version. The Arabic works of Jaber, as contained in MSS. at Paris and Leiden, are quite dissimilar from the Latin works attributed to Geber, and show few if any traces of the positive chemical knowledge, as of nitric acid (*aqua dissolutiva* or *fortis*) or of the mixture of nitric and hydrochloric acids known as *aqua regis* or *regia*, that appears in the latter. The treatises attributed to Geber, in fact, appear to be original works composed not earlier than the 13th century and fathered on Jaber in order to enhance their authority. If this view be accepted, an entirely new light is thrown on the achievements of the Arabs in the history of chemistry. Gibbon asserts that the Greeks were inattentive either to the use or to the abuse of chemistry (*Decline and Fall*, chap. xiii.), and gives the Arabs the credit of the origin and improvement of the science (chap. lii.).[1] But the chemical knowledge attributed to the Arabs has been so attributed largely on the basis of the contents of the Latin Geber, regarded as a translation from the Arabic Jaber. If, then, those contents do not represent the knowledge of Jaber, and if the contents of other Latin translations which there is reason to believe are really made from the Arabic, show little, if any, advance on the knowledge of the Alexandrian Greeks, evidently the part played by the Arabs must be less, and that of the Westerns greater, than Gibbon is prepared to admit.

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[1] An alchemistical work bearing the name of Ostanes speaks of a divine water which cures all maladies—an early appearance of the universal panacea or elixir of life.

The descent of alchemistical doctrine can thus be traced with fair continuity for a thousand years, from the Greeks of Alexandria down to the time when Latin alchemy was firmly established in the West, and began to be written of by historical authors like Albertus Magnus, Roger Bacon and Arnoldus Villanovanus in the 13th century. But side by side with this literary transmission Berthelot insists that there was another mode of transmission, by means of the knowledge of practical receipts and processes traditional among jewellers, painters, workers in glass and pottery, and other handicraftsmen. The chemical knowledge of Egyptian metallurgists and jewellers, he holds, was early transmitted to the artisans of Rome, and was preserved throughout the dark ages in the workshops of Italy and France until about the 13th century, when it was mingled with the theories of the Greek alchemists which reached the West by way of the Arabs. Receipts given in the Leiden papyrus reappear in the *Compositiones ad Tingendo* and the *Mappae Clavicula*, both workshop receipt books, one known in an 8th-century MS. at Lucca, and the other in a 10th-century MS. in the library of Schlettstadt; and again in such works as the *De Artibus Romanorum* of Eraclius and the *Schedula Diversarum Artium* of Theophilus, belonging to the 11th or 12th century.

Theory of Transmutation.—The fundamental theory of the transmutation of metals is to be found in the Greek alchemists, although in details it was modified and elaborated by the Arabs and the Latin alchemists. Regarding all substances as being composed of one primitive matter—the *prima materia*, and as owing their specific differences to the presence of different qualities imposed upon it, the alchemist hoped, by taking away these qualities, to obtain the *prima materia* itself, and then to get from it the particular substance he desired by the addition of the appropriate qualities. The *prima materia* was early identified with mercury, not ordinary mercury, but the "mercury of the philosophers," which was the essence or soul of mercury, freed from the four Aristotelian elements—earth, air, fire and water—or rather from the qualities which they represent. Thus the operator had to remove from ordinary mercury, earth or an earthy principle or quality, and water or a liquid principle, and to fix it by taking away air or a volatile principle. The *prima materia* thus obtained had to be treated with sulphur (or with sulphur and arsenic) to confer upon it the desired qualities that were missing. This sulphur again was not ordinary sulphur, but some principle derived from it, which constituted the philosopher's stone or elixir—white for silver and yellow or red for gold. This is briefly the doctrine that the metals are composed of mercury and sulphur, which persisted in one form or another down to the 17th century. Of course there were numerous variations and refinements. Thus in the *Speculum Naturale* of Vincent of Beauvais (*c.* 1250) it is said that there are four spirits—mercury, sulphur, arsenic and sal ammoniac—and six bodies—gold, silver, copper, tin, lead and iron.[2] Of these bodies the two first are pure, the four last impure. Pure white mercury, fixed by the virtue of white non-corrosive sulphur, engenders in mines a matter which fusion changes into silver, and united to pure clear red sulphur it forms gold, while with various kinds of impure mercury and sulphur the other bodies are produced. Vincent attributes to Rhazes the statement that copper is potentially silver, and any one who can eliminate the red colour will bring it to the state of silver, for it is copper in outward appearance, but in its inmost nature silver. This statement represents a doctrine widely held in the 13th century, and also to be found in the Greek alchemists, that everything endowed with a particular apparent quality possesses a hidden opposite quality, which can be rendered apparent by fire. Later, as in the works attributed to Basil Valentine, sulphur, mercury and salt are held to be the constituents of the metals.

It must be noted that the processes described by the alchemists of the 13th century are not put forward as being miraculous or supernatural; they rather represent the methods employed by nature, which it is the end of the alchemist's art to reproduce artificially in the laboratory. But even among the late Arabian alchemists it was doubted whether the resources of the art were adequate to the task; and in the West, Vincent of Beauvais remarks that success had not been achieved in making artificial metals identical with the natural ones. Thus he says that the silver which has been changed into gold by the projection of the red elixir is not rendered resistant to the agents which affect silver but not gold, and Albertus Magnus in his *De Mineralibus*—the *De Alchemia* attributed to him is spurious—states that alchemy cannot change species but merely imitates them—for instance, colours a metal white to make it resemble silver or yellow to give it the appearance of gold. He has, he adds, tested gold made by alchemists, and found that it will not withstand six or seven exposures to fire. But scepticism of this kind was not universal. Roger Bacon—or more probably some one who usurped his name—declared that with a certain amount of the philosopher's stone he could transmute a million times as much base metal into gold, and on Raimon Lull was fathered the boast, "Mare tingerem si mercurius esset." Numerous less distinguished adepts also practised the art, and sometimes were so successful in their deceptions that they gained the ear of kings, whose desire to profit by the achievements of science was in several instances rewarded by an abundant crop of counterfeit coins.

Later History of Alchemy.—In the earlier part of the 16th century Paracelsus gave a new direction to alchemy by declaring that its true object was not the making of gold but the preparation of medicines, and this union of chemistry with medicine was one characteristic of the iatrochemical school of which he was the precursor. Increasing attention was paid to the investigation of the properties of substances and of their effects on the human body, and chemistry profited by the fact that it passed into the hands of men who possessed the highest scientific culture of the time. Still, belief in the possibility of transmutation long remained orthodox, even among the most distinguished men of science. Thus it was accepted, at least academically, by Andreas Libavius (d. 1616); by F. de la Boë Sylvius (1614–1672), though not by his pupil Otto Tachenius, and by J. R. Glauber (1603–1668); by Robert Boyle (1627–1691) and, for a time at least, by Sir Isaac Newton and his rival and contemporary, G. W. Leibnitz (1646–1716); and by G. E. Stahl (1660–1734) and Hermann Boerhaave (1668–1738). Though an alchemist, Boyle, in his *Sceptical Chemist* (1661), cast doubts on the "experiments whereby vulgar Spagyrists are wont to endeavour to evince their salt, sulphur and mercury to be the true principles of things," and advanced towards the conception of chemical elements as those constituents of matter which cannot be further decomposed. With J. J. Becher (1635–1682) and G. E. Stahl, however, there was a reversion to earlier ideas. The former substituted for the salt, sulphur and mercury of Basil Valentine and Paracelsus three earths—the mercurial, the vitreous and the combustible—and he explained combustion as depending on the escape of this last combustible element; while Stahl's conception of phlogiston—not fire itself, but the principle of fire—by virtue of which combustible bodies burned, was a near relative of the mercury of the philosophers, the soul or essence of ordinary mercury.

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[1] "Some traditionary knowledge might be secreted in the temples and monasteries of Egypt; much useful experience might have been acquired in the practice of arts and manufactures, but the *science* of chemistry owes its origin and improvement to the industry of the Saracens. They first invented and named the alembic for the purposes of distillation, analyzed the substances of the three kingdoms of nature, tried the distinction and affinities of alkalis and acids, and converted the poisonous minerals into soft and salutary remedies. But the most eager search of Arabian chemistry was the transmutation of metals, and the elixir of immortal health: the reason and the fortunes of thousands were evaporated in the crucibles of alchemy, and the consummation of the great work was promoted by the worthy aid of mystery, fable and superstition." It may be noted that the word "alembic" is derived from the Greek ἄμβιξ, "cup," with the Arabic article prefixed, and that the instrument is figured in the MSS. of some of the Greek alchemists.

[2] Cf. Chaucer, *Chanouns Yemannes Tale*, where, however, mercury figures both as a spirit and a body:—

> "The firste spirit quik-silver called is,
> The second orpiment, the thridde ywis
> Sal armoniak, and the ferthe brimstoon."

Perhaps J. B. van Helmont (1577–1644) was the last distinguished investigator who professed actually to have changed mercury into gold, though impostors and mystics of various kinds continued to claim knowledge of the art long after his time. So late as 1782, James Price, an English physician, showed experiments with white and red powders, by the aid of which he was supposed to be able to transform fifty and sixty times as much mercury into silver and gold. The metals he produced are said to have proved genuine on assay; when, however, in the following year he was challenged to repeat the experiments he was unable to do so and committed suicide. In the course of the 19th century the idea that the different elements are constituted by different groupings or condensations of one primal matter—a speculation which, if proved to be well grounded, would imply the possibility of changing one element into another—found favour with more than one responsible chemist; but experimental research failed to yield any evidence that was generally regarded as offering any support to this hypothesis. About the beginning of the 20th century, however, the view was promulgated that the spontaneous production of helium from radium may be an instance of the transformation of one element into another. (See RADIOACTIVITY; also ELEMENT and MATTER.)

See M. P. E. Berthelot, *Les Origines de l'alchimie* (1885); *Collection des anciens alchimistes grecs* (text and translation, 3 vols., 1887–1888); *Introduction à l'étude de la chimie des anciens et du moyen âge* (1889); *La Chimie au moyen âge* (text and translation of Syriac and Arabic treatises on alchemy, 3 vols., 1893). Much bibliographical and other information about the later writers on alchemy is contained in *Bibliotheca Chemica* (2 vols., Glasgow, 1906), a catalogue by John Ferguson of the books in the collection of James Young of Kelly (printed for private distribution). (H. M. R.)

ALCIATI, ANDREA (1492–1550), Italian jurist, was born at Alzano, near Milan, on the 12th of January 1492. He displayed great literary skill in his exposition of the laws, and was one of the first to interpret the civil law by the history, languages and literature of antiquity, and to substitute original research for the servile interpretations of the glossators. He published many legal works, and some annotations on Tacitus. His *Emblems*, a collection of moral sayings in Latin verse, has been greatly admired, and translated into French, Italian and Spanish. Alciati's history of Milan, under the title *Rerum Patriae, seu Historiae Mediolanensis, Libri IV.*, was published posthumously at Milan in 1625. He died at Pavia in 1550.

ALCIBIADES (*c.* 450–404 B.C.), Athenian general and politician, was born at Athens. He was the son of Cleinias and Deinomache, who belonged to the family of the Alcmaeonidae. He was a near relative of Pericles, who, after the death of Cleinias at the battle of Coroneia (447), became his guardian. Thus early deprived of his father's control, possessed of great personal beauty and the heir to great wealth, which was increased by his marriage, he showed himself self-willed, capricious and passionate, and indulged in the wildest freaks and most insolent behaviour. Nor did the instructors of his early manhood supply the corrective which his boyhood lacked. From Protagoras, Prodicus and others he learnt to laugh at the common ideas of justice, temperance, holiness and patriotism. The laborious thought, the ascetic life of his master Socrates, he was able to admire, but not to imitate or practise. On the contrary, his ostentatious vanity, his amours, his debaucheries and his impious revels became notorious. But great as were his vices, his abilities were even greater.

He took part in the battle of Potidaea (432), where his life was saved by Socrates, a service which he repaid at the battle of Delium (424). As the reward of his bravery, the wealthy Hipponicus bestowed upon him the hand of his daughter. From this time he took a prominent part in Athenian politics during the Peloponnesian war. Originally friendly to Sparta, he subsequently became the leader of the war party in opposition to Nicias, and after the peace of 421 he succeeded by an unscrupulous trick in duping the Spartan ambassadors, and persuading the Athenians to conclude an alliance (420) with Argos, Elis and Mantineia (Thuc. v. 56, 76). On the failure of Nicias in Thrace (418–417) he became the chief advocate of the Sicilian expedition, seeing an opportunity for the realization of his ambitious projects, which included the conquest of Sicily, to be followed by that of Peloponnesus and possibly of Carthage (though this seems to have been an afterthought). The expedition was decided upon with great enthusiasm, and Alcibiades, Nicias and Lamachus were appointed joint commanders. But, on the day before the expedition sailed, there occurred the mysterious multilation of the Hermae, and Alcibiades was accused not only of being the originator of the crime, but also of having profaned the Eleusinian mysteries. His request for an immediate investigation being refused, he was obliged to set sail with the charge still hanging over him. Almost as soon as he reached Sicily he was recalled to stand his trial, but he escaped on the journey home and made his way to Sparta. Learning that he had been condemned to death in his absence and his property confiscated, he openly joined the Spartans, and persuaded them to send Gylippus to assist the Syracusans and to fortify Decelea in Attica. He then passed over to Asia Minor, prevailed upon many of the Ionic allies of Athens to revolt, and concluded an alliance with the Persian satrap Tissaphernes. But in a few months he had lost the confidence of the Spartans, and at the instigation of Agis II., whose personal hostility he had excited, an order was sent for his execution. Receiving timely information of this order he crossed over to Tissaphernes (412), and persuaded him to adopt the negative policy of leaving Athens and Sparta to wear themselves out by their mutual struggles. Alcibiades was now bent on returning to Athens, and he used his supposed influence with Tissaphernes to effect his purpose. He entered into negotiations with the oligarch Peisander, but when these led to no result he attached himself to the fleet at Samos which remained loyal to the democracy, and was subsequently recalled by Thrasybulus, although he did not at once return to Athens. Being appointed commander in the neighbourhood of the Hellespont, he defeated the Spartan fleet at Abydos (411) and Cyzicus (410), and recovered Chalcedon and Byzantium. On his return to Athens after these successes he was welcomed with unexpected enthusiasm (407); all the proceedings against him were cancelled, and he was appointed general with full powers. His ill success, however, at Andros, and the defeat at Notium (407) of his lieutenant Antiochus, led the Athenians to dismiss him from his command. He thereupon retired to the Thracian Chersonesus. After the battle of Aegospotami, and the final defeat of Athens, he crossed the Hellespont and took refuge with Pharnabazus in Phrygia, with the object of securing the aid of Artaxerxes against Sparta. But the Spartans induced Pharnabazus to put him out of the way; as he was about to set out for the Persian court his residence was set on fire, and on rushing out on his assassins, dagger in hand, he was killed by a shower of arrows (404). There can be no doubt that his advice to Sparta in connexion with Syracuse and the fortification of Decelea was the real cause of his country's downfall, though it is only fair to him to add that had he been allowed to continue in command of the Sicilian expedition he would undoubtedly have overruled the fatal policy of Nicias and prevented the catastrophe of 413. His belated attempt to repair his fatal treachery only exposed the essential selfishness of his character. Though he must have known that his influence over the Persian satraps was slender in the extreme, he used it with the most flagrant dishonesty as a bait first to Sparta, then to the Athenian oligarchs, and finally to the democracy. Superficial and opportunist to the last, he owed the successes of his meteoric career purely to personal magnetism and an almost incredible capacity for deception.

There are lives of Alcibiades by Plutarch and Cornelius Nepos, and monographs by Hertzberg, *A. der Staatsmann und Feldherr* (1853), and Houssaye, *Histoire d'Alcibiade* (1873); but the best accounts will be found in the histories of Greece by G. Grote (also notes in abridged ed., 1907), Ed. Meyer, and works quoted under Greece, *Ancient History*, sect. "Authorities"; also Peloponnesian War.

ALCIDAMAS, of Elaea, in Aeolis, Greek sophist and rhetorician, flourished in the 4th century B.C. He was the pupil and successor of Gorgias and taught at Athens at the same time as Isocrates, whose rival and opponent he was. We possess two declamations under his name: Περὶ Σοφιστῶν, directed against Isocrates and setting forth the superiority of extempore over written speeches (a recently discovered fragment of another speech against Isocrates is probably of later date); Ὀδυσσεύς, in which Odysseus accuses Palamedes of treachery during the siege of Troy (this is generally considered spurious). According to Alcidamas, the highest aim of the orator was the power of speaking extempore on every conceivable subject. Aristotle (*Rhet.* iii. 3) criticizes his writings as characterized by pomposity of style and an extravagant use of poetical epithets and compounds and far-fetched metaphors. Of other works only fragments and the titles have survived: Μεσσηνιακός, advocating the freedom of the Messenians and containing the sentiment that "all are by nature free"; a *Eulogy of Death*, in consideration of the wide extent of human sufferings; a Τέχνη or instruction-book in the art of rhetoric; and a Φυσικὸς λόλος. Lastly, his Μουσεῖον (a word of doubtful meaning) contained the narrative of the contest between Homer and Hesiod, two fragments of which are found in the Ἀγὼν Ὁμήρου καὶ Ἡσιόδου, the work of a grammarian in the time of Hadrian. A 3rd-century papyrus (Flinders Petrie, *Papyri*, ed. Mahaffy, 1891, pl. xxv.) probably contains the actual remains of a description by Alcidamas.

See the edition by Blass, 1881; fragments in Müller, *Oratores Attici*, ii. (1858); Vahlen, *Der Rhetor Alkidamas* (1864); Blass, *Die attische Beredsamkeit*.

ALCINOUS (Alkinoös), in ancient Greek legend, king of the fabulous Phaeacians, in the island of Scheria, was the son of Nausithous and grandson of Poseidon. His reception and entertainment of Odysseus, who when cast by a storm on the shore of the island was relieved by the king's daughter, Nausicaä, is described in the *Odyssey* (vi.-xiii.). The gardens and palace of Alcinous and the wonderful ships of the Phaeacian mariners were famous in antiquity. Scheria was identified in very early times with Corcyra, where Alcinous was reverenced as a hero. In the Argonautic legend, his abode was the island of Drepane (Apoll. Rhodius iv. 990).

ALCINOUS, the Platonic philosopher, lived probably in the time of the Caesars. He was the author of an Ἐπιτομὴ τῶν Πλάτωνος δογμάτων, an analysis of Plato's philosophy according to later writers. It is rather in the manner of Aristotle, and freely attributes to Plato any ideas of other philosophers which appeared to contribute to the system. He produced in the end a synthesis of Plato and Aristotle with an admixture of Pythagorean or Oriental mysticism, and is closely allied to the Alexandrian school of thought. He recognized a God who is unknowable, and a series of beings (δαίμονες) who hold intercourse with men. He recognized also Ideas and Matter, and borrowed largely from Aristotle and the Stoics.

The Ἐπιτομή has been translated by Pierre Balbi (Rome, 1469) and by Marsilio Ficino; into French by J. I. Combes-Dounous (Paris, 1800), and into English by Thomas Stanley in his *History of Philosophy*. Editions: Heinsius (Leiden, 1630); Fischer (Leipzig, 1783); in Aldine Edition of Apuleius (Venice, 1521; Paris, 1532); Fell (Oxford, 1667). See Ritter, *Geschichte der Philosophie*, iv. 249.

ALCIONIO, PIETRO, or Petrus Alcyonius (*c.* 1487–1527), Italian classical scholar, was born at Venice. After having studied Greek under Marcus Musurus of Candia, he was employed for some time by Aldus Manutius as a corrector of the press, and in 1522 was appointed professor of Greek at Florence through the influence of Giulio de' Medici. When his patron became pope in 1523 under the title of Clement VII., Alcionio followed him to Rome and remained there until his death. Alcionio published at Venice, in 1521, a Latin translation of several of the works of Aristotle, which was shown by the Spanish scholar Sepulveda to be very incorrect. He wrote a dialogue entitled *Medices Legatus, sive de Exilio* (1522), in connexion with which he was charged with plagiarism by his personal enemy, Paulus Manutius. The accusation, which Tiraboschi has shown to be groundless, was that he had taken the finest passages in the work from Cicero's lost treatise *De Gloria*, and had then destroyed the only existing copy of the original in order to escape detection. His contemporaries speak very unfavourably of Alcionio, and accuse him of haughtiness, uncouth manners, vanity and licentiousness.

ALCIPHRON, Greek rhetorician, was probably a contemporary of Lucian (2nd century A.D.). He was the author of a collection of fictitious letters, of which 124 (118 complete and 6 fragments) have been published; they are written in the purest Attic dialect and are considered models of style. The scene is throughout at Athens; the imaginary writers are country people, fishermen, parasites and courtesans, who express their sentiments and opinions on familiar subjects in elegant language. The "courtesan" letters are especially valuable, the information contained in them being chiefly derived from the writers of the New Comedy, especially Menander.

Editions.—*Editio princeps* (44 letters), 1499; Bergler (1715); Seiler (1856); Hercher (1873); Schepers (1905). English translation by Monro and Beloe (1791).

ALCIRA, a town of eastern Spain, in the province of Valencia; on the left bank of the river Júcar, and on the Valencia-Alicante railway. Pop. (1900) 20,572. Alcira is a walled town, surrounded by palm, orange and mulberry groves, and by low-lying rice-swamps, which render its neighbourhood somewhat unhealthy. Silk, fruit and rice are its chief products. It is sometimes identified with the Roman Saetabicula. In the middle ages it was a prosperous Moorish trading-station.

ALCMAEON, of Argos, in Greek legend, was the son of Amphiaraus and Eriphyle. When his father set out with the expedition of the Seven against Thebes, which he knew would be fatal to him, he enjoined upon his sons to avenge his death by slaying Eriphyle and undertaking a second expedition against Thebes. After the destruction of Thebes by the Epigoni, Alcmaeon carried out his father's injunctions by killing his mother, as a punishment for which he was driven mad and pursued by the Erinyes from place to place. On his arrival at Psophis in Arcadia, he was purified by its king Phegeus, whose daughter Arsinoe (or Alphesiboea) he married, making her a present of the fatal necklace and the peplus of Harmonia. But the land was cursed with barrenness, and the oracle declared that Alcmaeon would never find rest until he reached a spot on which the sun had never shone at the time he slew his mother. Such a spot he found at the mouth of the river Achelous, where an island had recently been formed by the alluvial deposit; here he settled and, forgetting his wife Arsinoe, married Callirrhoe, the daughter of the river-god. His new wife longed for the necklace and peplus, and Alcmaeon, returning to Psophis, obtained possession of them, on the pretence that he desired to dedicate them at Delphi. When the truth became known he was pursued and slain by Phegeus and his sons. After his death Alcmaeon was worshipped at Thebes; his tomb was at Psophis in a grove of cypresses. His story was the subject of an old epic and of several tragedies, but none of these has been preserved.

Homer, *Odyssey* xv. 248; Apollodorus iii. 7; Thucydides ii. 68, 102; Pausanias viii. 24, x. 10; Ovid, *Metam.* ix. 400 *et seq.*

ALCMAEONIDAE, a noble Athenian family, claiming descent from Alcmaeon, the great-grandson of Nestor, who emigrated from Pylos to Athens at the time of the Dorian invasion of Peloponnesus. During the archonship of an Alcmaeonid Megacles (? 632 B.C.), Cylon, who had unsuccessfully attempted to make himself "tyrant," was treacherously murdered with his followers. The curse or pollution thus incurred was frequently in later years raked up for political reasons; the Spartans even demanded that Pericles should be expelled as accursed at the beginning of the Peloponnesian war. All the members of the family went into banishment, and having returned in the time of Solon (594) were again expelled (538) by Peisistratus (*q.v.*). Their great wealth enabled them during their exile to enhance their reputation and secure the favour of the Delphian Apollo by rebuilding the temple after its destruction by fire in 548. Their importance is shown by the fact that Cleisthenes, tyrant of Sicyon, gave his daughter Agariste in marriage to the Alcmaeonid Megacles in preference to all the assembled suitors after the undignified behaviour of Hippocleides. Under the statesman Cleisthenes (*q.v.*), the issue of this union, the Alcmaeonids became supreme in Athens about 510 B.C. To them was generally attributed (though Herodotus disbelieves the story—see GREECE, *Ancient History*, sect. "Authorities," II.) the treacherous raising of the shield as a signal to the Persians at Marathon, but, whatever the truth of this may be, there can be little doubt that they were not the only one of the great Athenian families to make treasonable overtures to Persia. Pericles and Alcibiades were both connected with the Alcmaeonidae. Nothing is heard of them after the Peloponnesian war.

See Herodotus vi. 121-131.

ALCMAN, or ALCMAEON (the former being the Doric form of the name), the founder of Doric lyric poetry, to whom was assigned the first place among the nine lyric poets of Greece in the Alexandrian canon, flourished in the latter half of the 7th century B.C. He was a Lydian of Sardis, who came as a slave to Sparta, where he lived in the family of Agesidas, by whom he was emancipated. His mastery of Greek shows that he must have come very early to Sparta, where, after the close of the Messenian wars, the people were able to bestow their attention upon the arts of peace. Alcman composed various kinds of poems in various metres; Parthenia (maidens' songs), hymns, paeans, prosodia (processionals), and love-songs, of which he was considered the inventor. He was evidently fond of good living, and traces of Asiatic sensuousness seem out of place amidst Spartan simplicity. The fragments are scanty, the most considerable being part of a *Parthenion* found in 1855 on an Egyptian papyrus; some recently discovered hexameters are attributed to Alcman or Erinna (*Oxyrhynchus papyri*, i. 1898).

For general authorities see ALCAEUS.

ALCMENE, in ancient Greek mythology, the daughter of Electryon, king of Mycenae, and wife of Amphitryon. She was the mother of Heracles by Zeus, who assumed the likeness of her husband during his absence, and of Iphicles by Amphitryon. She was regarded as the ancestress of the Heracleidae, and worshipped at Thebes and Athens.

See Winter, *Alkmene und Amphitryon* (1876).

ALCOBAÇA, a town of Portugal, in the district of Leiria, formerly included in the province of Estremadura, on the Alcoa and Baça rivers, from which it derives its name. Pop. (1900) 2309. Alcobaça is chiefly interesting for its Cistercian convent, now partly converted into schools and barracks. The monastic buildings, which form a square 725 ft. in diameter, with a huge conical chimney rising above them, were founded in 1148 and completed in 1222. During the middle ages it rivalled the greatest European abbeys in size and wealth. It was supplied with water by an affluent of the Alcoa, which still flows through the kitchen; its abbot ranked with the highest Portuguese nobles, and, according to tradition, 999 monks continued the celebration of mass without intermission throughout the year. The convent was partly burned by the French in 1810, secularized in 1834 and afterwards gradually restored. Portions of the library, which comprised over 100,000 volumes, including many precious MSS., were saved in 1810, and are preserved in the public libraries of Lisbon and Braga. The monastic church (1222) is a good example of early Gothic, somewhat defaced by Moorish and other additions. It contains a fine cloister and the tombs of Peter I. (1357–1367) and his wife, Iñez de Castro.

ALCOCK, JOHN (*c.* 1430–1500), English divine, was born at Beverley in Yorkshire and educated at Cambridge. In 1461 he was made dean of Westminster, and henceforward his promotion was rapid in church and state. In the following year he was made master of the rolls, and in 1470 was sent as ambassador to the court of Castile. He was consecrated bishop of Rochester in 1472 and was successively translated to the sees of Worcester (1476) and Ely (1486). He twice held the office of lord chancellor, and exhibited great ability in the negotiations with James III. of Scotland. He died at Wisbech Castle on the 1st of October 1500. Alcock was one of the most eminent pre-Reformation divines; he was a man of deep learning and also of great proficiency as an architect. Besides founding a charity at Beverley and a grammar school at Kingston-upon-Hull, he restored many churches and colleges; but his greatest enterprise was the erection of Jesus College, Cambridge, which he established on the site of the former convent of St Radigund.

Alcock's published writings, most of which are extremely rare, are: *Mons Perfectionis, or the Hill of Perfection* (London, 1497); *Gallicantus Johannis Alcock episcopi Eliensis ad frates suos curatos in sinodo apud Barnwell* (1498), a good specimen of early English printing and quaint illustrations; *The Castle of Labour*, translated from the French (1536), and various other tracts and homilies. See J. Bass Mullinger's *Hist. of the University of Cambridge*, vol. i.

ALCOCK, SIR RUTHERFORD (1809–1897), British consul and diplomatist, was the son of Dr Thomas Alcock, who practised at Ealing, near London, and himself followed the medical profession. In 1836 he became a surgeon in the marine brigade which took part in the Carlist war, and gaining distinction by his services was made deputy inspector-general of hospitals. He retired from this service in 1837, and seven years later was appointed consul at Fuchow in China, where, after a short official stay at Amoy, he performed the functions, as he himself expressed it, "of everything from a lord chancellor to a sheriff's officer." Fuchow was one of the ports opened to trade by the treaty of 1842, and Mr Alcock, as he then was, had to maintain an entirely new position with the Chinese authorities. In so doing he was eminently successful, and earned for himself promotion to the consulate at Shanghai. Thither he went in 1846 and made it an especial part of his duties to superintend the establishment and laying out of the British settlement, which has developed into such an important feature of British commercial life in China. In 1858 he was appointed consul-general in the newly opened empire of Japan, and in the following year was promoted to be minister plenipotentiary. In those days residence in Japan was surrounded with many dangers, and the people were intensely hostile to foreigners. In 1860 Mr Alcock's native interpreter was murdered at the gate of the legation, and in the following year the legation was stormed by a body of Ronins, whose attack was repulsed by Mr Alcock and his staff. Shortly after this event he returned to England on leave. Already he had been made a C.B. (1860); in 1862 he was made a K.C.B., and in 1863 hon. D.C.L. Oxon. In 1864 he returned to Japan, and after a year's further residence he was transferred to Pekin, where he represented the British government until 1871, when he retired. But though no longer in official life his leisure was fully occupied. He was for some years president of the Royal Geographical Society, and he served on many commissions. He was twice married, first in May 1841 to Henrietta Mary, daughter of Charles Bacon, who died in 1853, and secondly (July 8, 1862) to the widow of the Rev. John Lowder, who died on the 13th of March 1899. He was the author of several works, and was one of the first to awaken in England an interest in Japanese art; his best-known book is *The Capital of the Tycoon*, which appeared in 1863. He died in London on the 2nd of November 1897. (R. K. D.)

ALCOFORADO, MARIANNA (1640–1723), Portuguese authoress, writer of the *Letters of a Portuguese Nun*, was the daughter of a landed proprietor in Alemtejo. Beja, her birthplace, was the chief garrison town of that province, itself the principal theatre of the twenty-eight years' war with Spain that followed the Portuguese revolution of 1640, and her widowed father, occupied with administrative and military commissions, placed Marianna in her childhood in the wealthy convent of the Conception for security and education. She made her profession as a Franciscan nun at sixteen or earlier, without any real vocation, and lived a routine life in that somewhat relaxed house until her twenty-fifth year, when she met Noel Bouton. This man, afterwards marquis de Chamilly, and marshal of France, was one of the French officers who came to Portugal to serve under the great captain, Frederick, Count Schomberg, the re-organizer of the Portuguese army. During the years 1665–1667 Chamilly spent much of his time in and about Beja, and probably became acquainted with the Alcoforado family through Marianna's brother, who was a soldier. Custom then permitted religious to receive and entertain visitors, and Chamilly, aided by his military prestige and some flattery, found small difficulty in betraying the trustful nun. Before long their intrigue became known and caused a scandal, and to avoid the consequences Chamilly deserted Marianna and withdrew clandestinely to France. The letters to her lover which have earned her renown in literature were written between December 1667 and June 1668, and they described the successive stages of faith, doubt and despair through which she passed. As a piece of unconscious psychological self-analysis, they are unsurpassed; as a product of the Peninsular heart they are unrivalled. These five short letters written by Marianna to "expostulate her desertion" form one of the few documents of extreme human experience, and reveal a passion which in the course of two centuries has lost nothing of its heat. Perhaps their dominant note is reality, and, sad reading as they are from the moral standpoint, their absolute candour, exquisite tenderness and entire self-abandonment have excited the wonder and admiration of great men and women in every age, from Madame de Sevigné to W. E. Gladstone. There are signs in the fifth letter that Marianna had begun to conquer her passion, and after a life of rigid penance, accompanied by much suffering, she died at the age of eighty-three. The letters came into the possession of the comte de Guilleragues, director of the *Gazette de France*, who turned them into French, and they were published anonymously in Paris in January 1669. A Cologne edition of the same year stated that Chamilly was their addressee, which is confirmed by St Simon and Duclos, but the name of their authoress remained undivulged. In 1810, however, Boissonade discovered Marianna's name written in a copy of the first edition by a contemporary hand, and the veracity of this ascription has been placed beyond doubt by the recent investigations of Luciano Cordeiro, who found a tradition in Beja connecting the French captain and the Portuguese nun. The letters created a sensation on their first appearance, running through five editions in a year, and, to exploit their popularity, second parts, replies and new replies were issued from the press in quick succession. Notwithstanding that the Portuguese original of the five letters is lost, their genuineness is as patent as the spuriousness of their followers, and though Rousseau was ready to wager they were written by a man, the principal critics of Portugal and France have decided against him. It is now generally recognized that the letters are a verbatim translation from the Portuguese.

The foreign bibliography of the *Letters*, containing almost one hundred numbers, will be found in Cordeiro's admirable study, *Soror Marianna, A Friera Portuguesa*, 2nd ed. (Lisbon, 1891). Besides the French editions, versions exist in Dutch, Danish, Italian and German; and the English bibliography is given by Edgar Prestage in his translation *The Letters of a Portuguese Nun* (*Marianna Alcoforado*), 3rd ed. (London, 1903). The French text of the *editio princeps* was printed in the first edition (1893) of this book. Edmund Gosse in the *Fortnightly Review*, vol. xlix. (old series) p. 506, shows the considerable influence exercised by the *Letters* on the sentimental literature of France and England. (E. Pr.)

ALCOHOL, in commerce, the name generally given to "spirits of wine"; in systematic organic chemistry it has a wider meaning, being the generic name of a class of compounds (hydroxy hydrocarbons) of which ordinary alcohol (specifically ethyl alcohol) is a typical member (see Alcohols).

Etymology.

The word "alcohol" is of Arabic origin, being derived from the particle *al* and the word *kohl*, an impalpable powder used in the East for painting the eyebrows. For many centuries the word was used to designate any fine powder; its present-day application to the product of the distillation of wine is of comparatively recent date. Thus Paracelsus and Libavius both used the term to denote a fine powder, the latter speaking of an *alcohol* derived from antimony. At the same time Paracelsus uses the word for a volatile liquid; *alcool* or *alcool vini* occurs often in his writings, and once he adds "*id est vino ardente*." Other names have been in use among the earlier chemists for this same liquid. *Eau de vie* ("elixir of life") was in use during the 13th and 14th centuries; Arnoldus Villanovanus applied it to the product of distilled wine, though not as a specific name.

Ethyl alcohol.

Ordinary alcohol, which we shall frequently refer to by its specific name, ethyl alcohol, seldom occurs in the vegetable kingdom; the unripe seeds of *Heracleum giganteum* and *H. Sphondylium* contain it mixed with ethyl butyrate. In the animal kingdom it occurs in the urine of diabetic patients and of persons addicted to alcohol. Its important source lies in its formation by the "spirituous" or "alcoholic fermentation" of saccharine juices. The mechanism of alcoholic fermentation is discussed in the article Fermentation, and the manufacture of alcohol from fermented liquors in the article Spirits.

The qualitative composition of ethyl alcohol was ascertained by A. L. Lavoisier, and the quantitative by N. T. de Saussure in 1808. Sir Edward Frankland showed how it could be derived from, and converted into, ethane; and thus determined it to be ethane in which one hydrogen atom was replaced by a hydroxyl group. Its constitutional formula is therefore $CH_3\cdot CH_2\cdot OH$. It may be synthetically prepared by any of the general methods described in the article Alcohols.

Pure ethyl alcohol is a colourless, mobile liquid of an agreeable odour. It boils at 78·3° C. (760 mm.); at −90° C. it is a thick liquid, and at −130° it solidifies to a white mass. Its high coefficient of thermal expansion, coupled with its low freezing point, renders it a valuable thermometric fluid, especially when the temperatures to be measured are below −30° C., for which the mercury thermometer cannot be used. It readily inflames, burning with a blue smokeless flame, and producing water and carbon dioxide, with the evolution of great heat; hence it receives considerable application as a fuel. It mixes with water in all proportions, the mixing being attended by a contraction in volume and a rise in temperature; the maximum contraction corresponds to a mixture of 3 molecules of alcohol and 1 of water. Commercial alcohol or "spirits of wine" contains about 90% of pure ethyl alcohol, the remainder being water. This water cannot be entirely removed by fractional distillation, and to prepare anhydrous or "absolute" alcohol the commercial product must be allowed to stand over some dehydrating agent, such as caustic lime, baryta, anhydrous copper sulphate, &c., and then distilled. Calcium chloride must not be used, since it forms a crystalline compound with alcohol. The quantity of alcohol present in an aqueous solution is determined by a comparison of its specific gravity with standard tables, or directly by the use of an alcoholometer, which is a hydrometer graduated so as to read per cents by weight (degrees according to Richter) or volume per cents (degrees according to Tralles). Other methods consist in determining the vapour tension by means of the vaporimeter of Geissler, or the boiling point by the ebullioscope. In the United Kingdom "proof spirit" is defined as having a specific gravity at 51° of 12/13 (·92308) compared with water at the same temperature. The "quantity at proof" is given by the formula:—

quantity of sample × (degrees over or under proof + 100) divided by 100.

The presence of water in alcohol may be detected in several ways. Aqueous alcohol becomes turbid when mixed with benzene, carbon disulphide or paraffin oil; when added to a solution of barium oxide in absolute alcohol, a white precipitate of barium hydroxide is formed. A more delicate method consists in adding a very little anthraquinone and sodium amalgam; absolute alcohol gives a green coloration, but in the presence of minute traces of water a red coloration appears. Traces of ethyl alcohol in solutions are detected and estimated by oxidation to acetaldehyde, or by conversion into iodoform by warming with iodine and potassium hydroxide. An alternative method consists in converting it into ethyl benzoate by shaking with benzoyl chloride and caustic soda.

Alcohol is extensively employed as a solvent; in fact, this constitutes one of its most important industrial applications. It dissolves most organic compounds, resins, hydrocarbons, fatty acids and many metallic salts, sometimes forming, in the latter case, crystalline compounds in which the ethyl alcohol plays a rôle similar to that of water of crystallization. This fact was first noticed by T. Graham, and, although it was at first contradicted, its truth was subsequently confirmed. In general, gases dissolve in it more readily than in water; 100 volumes of alcohol dissolve 7 volumes of hydrogen, 25 volumes of oxygen and 16 volumes of nitrogen.

Reactions.

Potassium and sodium readily dissolve in ethyl alcohol with the production of alcoholates of the formula $C_2H_5OK(Na)$. These are voluminous white powders. Sulphuric acid converts it into ethyl sulphuric acid (see Ether), and sulphur trioxide gives carbyl sulphate. The phosphorous haloids give the corresponding ethyl haloid. Ethyl chloride (from the phosphorus chlorides and alcohol) is an ethereal liquid boiling at 12·5° C., soluble in alcohol, but sparingly so in water. Oxidation of ethyl alcohol gives acetaldehyde and acetic acid. Chlorine oxidizes it to acetaldehyde, and under certain conditions chloral (*q.v.*) is formed.

Industrial alcohol.

In almost all countries heavy taxes are levied on manufactured alcohol mainly as a source of revenue. In the United Kingdom the excise duty is eleven shillings per proof gallon of alcohol, while the customs duty is eleven shillings and fivepence; the magnitude of these imposts may be more readily understood when one remembers that the proof gallon costs only about sevenpence to manufacture. The great importance of alcohol in the arts has necessitated the introduction of a duty-free product which is suitable for most industrial purposes, and at the same time is perfectly unfit for beverages or internal application.

Methylated spirit.

In the United Kingdom this "denaturized" alcohol is known as methylated spirit as a distinction from pure alcohol or "spirits of wine." It was first enacted in 1855 that methylated spirit, a specific mixture of pure alcohol and wood-naphtha, should be duty-free; the present law is to be found in the Customs and Inland Revenue Act of 1890, and the Finance Act (sect. 8) of 1902. From 1858 to 1861 methylated spirit was duty-free when it was required for manufacturing processes, and the methylation or "denaturizing" was carried out in accordance with a prescribed process. During the next three decades (1861–1891) the law was extended, and methylated spirit was duty-free for all purposes except for use as beverages and internal medicinal applications. This spirit ("unmineralized methylated spirit") consisted of 90 parts of alcohol of 60–66 over-proof (91–95 % of pure alcohol) and 10 parts of wood-naphtha. It was found, however, that certain classes were addicted to drinking this mixture, and since 1891 the sale of such spirit has been confined to manufacturers who must purchase it in bulk from the "methylators." For retail purposes the "ordinary" methylated spirit is mixed with ·357 % of mineral naphtha, which has the effect of rendering it quite undrinkable. The Finance Act of 1902 allows a manufacturer to obtain a license which permits the use of duty-free alcohol, if he can show that such alcohol is absolutely essential for the success of his business, and that methylated spirit is unsuitable. Notwithstanding this permission there have been many agitations on the part of chemical manufacturers to obtain a less restricted use of absolute alcohol, and in 1905 an Industrial Alcohol Committee was appointed to receive evidence and report as to whether any modification of the present law was advisable. In the United States the same question was considered in 1896 by a Joint Select Committee on the use of alcohol in the manufactures and arts. Reference should be made to the reports of these committees for a full account of the use, manufacture and statistics of "denaturized" spirits in various European countries.

In Germany, the use of duty-free spirit is only allowed to state and municipal hospitals, and state scientific institutions, and for the manufacture of fulminates, fuzes and smokeless powders. The duty-free "denaturized" spirits may be divided into two groups—"completely denaturized" and "incompletely denaturized." In the first category there are two varieties:—(1) A mixture of 100 litres of spirit and 2½ litres of a mixture of 4 parts of wood-naphtha and 1 of pyridine bases; this spirit, the use of which is practically limited to heating and lighting purposes, may be mixed with 50 grs. of lavender or rosemary, in order to destroy the noxious odour of the pyridine bases. (2) A mixture of 100 litres of spirit, 1¼ litres of the naphtha-pyridine mixture described above, ¼ litre of methyl violet solution, and from 2 to 20 litres of benzol; this fluid is limited to combustion in motors and agricultural engines. The second category, or "incompletely denaturized" spirits, include numerous mixtures. The "general" mixture consists of 100 litres of spirit, and 5 litres of wood spirit or ½ litre of pyridine. Of the "particular" varieties, we can only notice those used in the colour industry. These consist of 100 litres of spirit mixed with either 10 litres of sulphuric ether, or 1 litre of benzol, or ½ litre of turpentine, or ·025 litre of animal oil.

The German regulations are apparently based on a keen appreciation of the fact that while one particular denaturizing agent may have little or no effect on one industry, yet it would be quite fatal to the success of another; there is consequently a great choice of denaturizing agents, and in certain cases it is sufficient to mix the alcohol with a reagent necessary for the purpose in hand, or even with a certain amount of the final product, it being only necessary to satisfy the state that the spirit is not available as a beverage.

In France, the general denaturizing agent is wood-spirit of at least 58 over-proof, and containing 25 % of acetone and 2·5 % of "*impuretés pyrogenées*"; 10 litres of this spirit denaturizes 100 litres of alcohol. This mixture is supplied to manufacturers and corresponds to the British unmineralized methylated spirit; but the regulations are more stringent. When sold for lighting and heating purposes, it is further admixed with 0·5 % of heavy benzene boiling at 150°–200° C. Provisions are also made for special denaturizing processes as in Germany.

In America the internal revenue tax on denaturized alcohol (formerly duty-free only to scientific institutions) was removed by Congress in 1906 (act of June 7th).

Pharmacology, Toxicology and Therapeutics of Alcohol.—Alcohol is of great medicinal value as a solvent, being used to form solutions of alkaloids, resins, volatile oils, iodoform, &c. In strength of about 10 % and upwards it is an antiseptic. If applied to the skin it rapidly evaporates, thereby cooling the skin and diminishing the amount of sweat excreted. This refrigerant and anhidrotic action is employed to soothe many forms of headache by bathing the forehead with eau de Cologne. If, on the other hand, the alcohol be rubbed into the skin, or if its evaporation be prevented—as by a watch-glass—it absorbs water from the tissues and thus hardens them.

Thoroughly rubbed into the skin alcohol dilates the blood-vessels and produces a mild counter-irritant effect. Many alcoholic liniments are therefore employed for the relief of pain, especially muscular pains, as in lumbago and other forms of so-called "muscular rheumatism." Given internally in small quantities and in sufficient dilution, alcohol causes dilatation of the gastric blood-vessels, increased secretion of gastric juice, and greater activity in the movements of the muscular layers in the wall of the stomach. It also tends to lessen the sensibility of the stomach and so may relieve gastric pain. In a 50 % solution or stronger—as when neat whisky is taken—alcohol precipitates the pepsin which is an essential of gastric digestion, and thereby arrests this process. The desirable effects produced by alcohol on the stomach are worth obtaining only in cases of acute diseases. In chronic disease and in health the use of alcohol as an aid to digestion is without the support of clinical or laboratory experience, the beneficial action being at least neutralized by undesirable effects produced elsewhere. The continued use of large doses of alcohol produces chronic gastritis, in which the continued irritation has led to overgrowth of connective tissue, atrophy of the gastric glands and permanent cessation of the gastric functions.

A single dose of concentrated alcohol (*e.g.* brandy) produces very valuable reflex effects, the heart beating more rapidly and forcibly, and the blood-pressure rising. Hence the immediately beneficial effect produced in the cases of "fainting" or syncope. After absorption, which is very rapid, alcohol exerts a marked action upon the blood. The oxygen contained in that fluid, and destined for consumption by the tissues, is retained by the influence of alcohol in its combination with the haemoglobin or colouring matter of the red blood corpuscles. Hence the diminished oxidation of the tissues, which leads to the accumulation of unused fat and so to the obesity which is so often seen in those who habitually take much alcohol. The drug exerts a noteworthy action upon the body-temperature. As it dilates the blood-vessels of the skin it increases the subjective sensation of warmth. The actual consequence, however, is that more heat than before is necessarily lost from the surface of the body. Alcohol also diminishes the oxidation which is the main source of the body-heat. It follows that the drug is an *antipyretic*, and it is hence largely used in fevers as a means of reducing the temperature. This reduction of the temperature, carried to an undesirable extreme, is the reason why the man who has copiously consumed spirits "to keep out the cold" is often visited with pneumonia. The largest amount of alcohol that can be burnt up within the healthy body in twenty-four hours is 1½ oz., but it must be consumed in great dilution and divided into small doses taken every four hours. Otherwise the alcohol will for the most part leave the body unused in the urine and the expired air. In fever the case is different. The raised temperature appears to facilitate the oxidation of the substance, so that quantities may be taken and completely utilized which would completely intoxicate the individual had his temperature been normal. It follows that alcohol is a food in fever, and its value in this regard is greatly increased by the fact that it requires no primary digestion, but passes without changes, and without needing change, to the tissues which are to use it. According to Sir Thomas Fraser nothing else can compete with alcohol as a food in desperate febrile cases, and to this use must be added its antipyretic power already explained and its action as a soporific. During its administration in febrile cases the drug must be most carefully watched, as its action may prove deleterious to the nervous system and the circulation in certain classes of patient. The state of the pulse is the best criterion of the action of alcohol in any given case of fever. The toxicology of alcohol is treated in other articles. It includes acute alcoholism (*i.e.* intoxication), chronic alcoholism, delirium tremens, and all the countless pathological changes—extending to every tissue but the bones, and especially marked in the nervous system—which alcohol produces. (See DRUNKENNESS; DELIRIUM).

After death the presence of alcohol can be detected in all the body fluids. Its especial affinity for the nervous system is indicated by the fact that, when all traces of it have disappeared elsewhere, it can still be detected with ease in the cerebro-spinal fluid.

ALCOHOLS, in organic chemistry, a class of compounds which may be considered as derived from hydrocarbons by the replacement of one or more hydrogen atoms by hydroxyl groups. It is convenient to restrict the term to compounds in which the hydroxyl group is attached to an aliphatic residue; this excludes such compounds as the hydroxy-benzenes, naphthalenes, &c., which exhibit many differences from the compounds derived from the aliphatic alkyls.

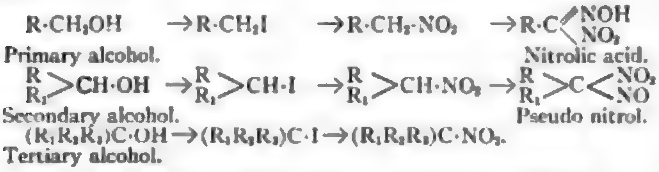
Alcohols are classified on two distinct principles, one depending upon the number of hydroxyl groups present, the other on the nature of the remaining groups attached to the carbon atom which carries the hydroxyl group. Monatomic or monohydric alcohols contain only one hydroxyl group; diatomic, two, known as glycols (*q.v.*); triatomic, three, known as glycerols (*q.v.*); and so on.

The second principle leads to alcohols of three distinct types, known as primary, secondary and tertiary. The genesis and formulation of these types may be readily understood by considering the relation which exists between the alcohols and the parent hydrocarbon. In methane, CH_4, the hydrogen atoms are of equal value, and hence only one alcohol, viz. CH_3OH, can be derived from it. This compound, methyl alcohol, is the simplest primary alcohol, and it is characterized by the grouping $\cdot CH_2OH$. Ethane, C_2H_6, in a similar manner, can only give rise to one alcohol, namely ethyl alcohol, CH_3CH_2OH, which is also primary. Propane, $CH_3CH_2CH_3$, can give rise to two alcohols—a primary alcohol, $CH_3CH_2CH_2OH$ (normal propyl alcohol), formed by replacing a hydrogen atom attached to a terminal carbon atom, and a secondary alcohol, $CH_3\cdot CH(OH)\cdot CH_3$ (isopropyl alcohol), when the substitution is effected on the middle carbon atom. The grouping $CH\cdot OH$ characterizes the secondary alcohols; isopropyl alcohol is the simplest member of this class. Butane, C_4H_{10}, exists in the two isomeric forms—normal butane, $CH_3\cdot CH_2\cdot CH_2\cdot CH_3$, and iso-butane, $CH(CH_3)_3$. Each of these hydro-carbons gives rise to two alcohols: *n*-butane gives a primary and a secondary; and iso-butane a primary, when the substitution takes place in one of the methyl groups, and a tertiary, when the hydrogen atom of the $\vdots CH$ group is substituted. Tertiary alcohols are thus seen to be characterized by the group $\vdots C\cdot OH$, in which the residual valencies of the carbon atom are attached to alkyl groups.

In 1860 Hermann Kolbe predicted the existence of secondary and tertiary alcohols from theoretical considerations. Regarding methyl alcohol, for which he proposed the name *carbinol*, as the simplest alcohol, he showed that by replacing one hydrogen atom of the methyl group by an alkyl residue, compounds of the general formula $R\cdot CH_2\cdot OH$ would result. These are the primary alcohols. By replacing two of the hydrogen atoms, either by the same or different alkyls, compounds of the formula $(R\cdot R_1)CH\cdot OH$ (*i.e.* secondary alcohols) would result; while the replacement of the three hydrogen atoms would generate alcohols of the general formula $(R\cdot R_1\cdot R_2)C\cdot OH$, *i.e.* tertiary alcohols. Furthermore, he exhibited a comparison between these three types of alcohols and the amines. Thus:—

$R\cdot NH_2$	$(R_1R_2)NH$	$(R_1R_2R_3)N$
$R\cdot CH_2OH$	$(R_1R_2)CH\cdot OH$	$(R_1R_2R_3)C\cdot OH$
Primary.	Secondary.	Tertiary.

To distinguish Primary, Secondary and Tertiary Alcohols.—Many reactions serve to distinguish these three types of alcohols. Of chief importance is their behaviour on oxidation. The primary alcohols are first oxidized to aldehydes (*q.v.*), which, on further oxidation, yield acids containing the same number of carbon atoms as in the original alcohol. Secondary alcohols yield ketones (*q.v.*), which are subsequently oxidized to a mixture of two acids. Tertiary alcohols yield neither aldehydes nor ketones, but a mixture of two or more acids. Another method is based upon the different behaviour of the corresponding nitro-alkyl with nitrous acid. The alcohol is first acted upon with phosphorus and iodine, and the resulting alkyl iodide is treated with silver nitrite, which gives the corresponding nitro-alkyl. The nitro-alkyl is then treated with potassium nitrite dissolved in concentrated potash, and sulphuric acid is added. By this treatment a primary nitro-alkyl yields a nitrolic acid, the potassium salt of which forms an intense red solution; a secondary nitro-alkyl forms a pseudo nitrol, which gives an intense blue solution, while the tertiary compound does not act with nitrous acid. The reactions outlined above may be thus represented:—



$$\mathrm{R{\cdot}CH_2OH \rightarrow R{\cdot}CH_2I \rightarrow R{\cdot}CH_2{\cdot}NO_2 \rightarrow R{\cdot}C}\left\langle\begin{matrix}\mathrm{NOH}\\ \mathrm{NO_2}\end{matrix}\right.$$

Primary alcohol. Nitrolic acid.

$$\left.\begin{matrix}\mathrm{R}\\ \mathrm{R_1}\end{matrix}\right\rangle\mathrm{CH{\cdot}OH} \rightarrow \left.\begin{matrix}\mathrm{R}\\ \mathrm{R_1}\end{matrix}\right\rangle\mathrm{CH{\cdot}I} \rightarrow \left.\begin{matrix}\mathrm{R}\\ \mathrm{R_1}\end{matrix}\right\rangle\mathrm{CH{\cdot}NO_2} \rightarrow \left.\begin{matrix}\mathrm{R}\\ \mathrm{R_1}\end{matrix}\right\rangle\mathrm{C}\left\langle\begin{matrix}\mathrm{NO_2}\\ \mathrm{NO}\end{matrix}\right.$$

Secondary alcohol. Pseudo nitrol.

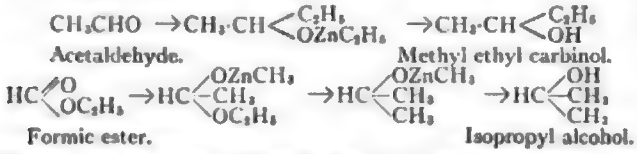
$$\mathrm{(R_1R_2R_3)C{\cdot}OH \rightarrow (R_1R_2R_3)C{\cdot}I \rightarrow (R_1R_2R_3)C{\cdot}NO_2}.$$

Tertiary alcohol.

By heating to the boiling point of naphthalene (218°) tertiary alcohols are decomposed, while heating to the boiling point of anthracene (360°) suffices to decompose secondary alcohols, the primary remaining unaffected. These changes can be followed out by determinations of the vapour density, and so provide a method for characterizing alcohols (see *Compt. Rend.* 1904, 138, p. 984).

Preparation.

Alcohols may be readily prepared from the corresponding alkyl haloid by the action of moist silver oxide (which behaves as silver hydroxide); by the saponification of their esters; or by the reduction of polyhydric alcohols with hydriodic acid, and the subsequent conversion of the resulting alkyl iodide into the alcohol by moist silver oxide. Primary alcohols are obtained by decomposing their sulphuric acid esters (from sulphuric acid and the olefines) with boiling water; by the action of nitrous acid on primary amines; or by the reduction of aldehydes, acid chlorides or acid anhydrides. Secondary alcohols result from the reduction of ketones; and from the reaction of zinc alkyls on aldehydes or formic acid esters.



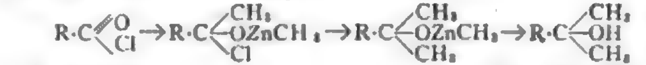
$$\mathrm{CH_3CHO \rightarrow CH_3{\cdot}CH}\left\langle\begin{matrix}\mathrm{C_2H_5}\\ \mathrm{OZnC_2H_5}\end{matrix}\right. \rightarrow \mathrm{CH_3{\cdot}CH}\left\langle\begin{matrix}\mathrm{C_2H_5}\\ \mathrm{OH}\end{matrix}\right.$$

Acetaldehyde. Methyl ethyl carbinol.

$$\mathrm{HC}\left\langle\begin{matrix}\mathrm{O}\\ \mathrm{OC_2H_5}\end{matrix}\right. \rightarrow \mathrm{HC}\left\langle\begin{matrix}\mathrm{OZnCH_3}\\ \mathrm{CH_3}\\ \mathrm{OC_2H_5}\end{matrix}\right. \rightarrow \mathrm{HC}\left\langle\begin{matrix}\mathrm{OZnCH_3}\\ \mathrm{CH_3}\\ \mathrm{CH_3}\end{matrix}\right. \rightarrow \mathrm{HC}\left\langle\begin{matrix}\mathrm{OH}\\ \mathrm{CH_3}\\ \mathrm{CH_3}\end{matrix}\right.$$

Formic ester. Isopropyl alcohol.

Tertiary alcohols may be synthesized by a method devised by A. Butlerow in 1864, who thus discovered the tertiary alcohols. By reacting with a zinc alkyl (methyl or ethyl) on an acid chloride, an addition compound is first formed, which decomposes with water to give a ketone. If, however, a second molecule of a zinc alkyl be allowed to react, a compound is formed which gives a tertiary alcohol when decomposed with water.



$$\mathrm{R{\cdot}C}\left\langle\begin{matrix}\mathrm{O}\\ \mathrm{Cl}\end{matrix}\right. \rightarrow \mathrm{R{\cdot}C}\left\langle\begin{matrix}\mathrm{CH_3}\\ \mathrm{OZnCH_3}\\ \mathrm{Cl}\end{matrix}\right. \rightarrow \mathrm{R{\cdot}C}\left\langle\begin{matrix}\mathrm{CH_3}\\ \mathrm{OZnCH_3}\\ \mathrm{CH_3}\end{matrix}\right. \rightarrow \mathrm{R{\cdot}C}\left\langle\begin{matrix}\mathrm{CH_3}\\ \mathrm{OH}\\ \mathrm{CH_3}\end{matrix}\right.$$

Acid chloride. Tertiary alcohol.

It is interesting to note that, whereas zinc methyl and ethyl give tertiary alcohols, zinc propyl only gives secondary alcohols. During recent years (1900 onwards) many brilliant syntheses have been effected by the aid of magnesium-alkyl-haloids.

Properties.

The alcohols are neutral in reaction, and the lower members possess the property of entering into combination with salts, in which the alcohol plays the rôle of water of crystallization. Sodium or potassium dissolves in them with the formation of alcoholates, the hydrogen of the hydroxyl group being replaced by the metal. With strong acids water is split off and esters are formed. The haloid esters of the paraffin alcohols formed by heating the alcohols with the halogen acids are the monohaloid derivatives of the paraffins, and are more conveniently prepared by the action of the phosphorous haloid on the alcohol. Energetic dehydration gives the olefine hydrocarbons, but under certain conditions ethers (see ETHER) are obtained.

The physical properties of the alcohols exhibit a gradation with the increase of molecular weight. The lower members are colourless mobile liquids, readily soluble in water and exhibiting a characteristic odour and taste. The solubility decreases as the carbon content rises. The normal alcohols containing 1 to 16 carbon atoms are liquids at the ordinary temperatures; the higher members are crystalline, odourless and tasteless solids, closely resembling the fats in appearance. The boiling points of the normal alcohols increase regularly about 10° for each CH_2 increment; this is characteristic of all homologous series of organic compounds. Of the primary, secondary and tertiary alcohols having the same empirical formula, the primary have the highest, and the tertiary the lowest boiling point; this is in accordance with the fairly general rule that a gain in symmetry is attended by a fall in the boiling point.

The following monatomic alcohols receive special treatment under their own headings:—ALCOHOL (ETHYL), ALLYL ALCOHOL, AMYL ALCOHOLS, BENZYL ALCOHOL, BUTYL ALCOHOLS, METHYL ALCOHOL, and PROPYL ALCOHOLS.

ALCOTT, AMOS BRONSON (1799–1888), American educationalist and writer, born on Spindle Hill, in the town of Wolcott, New Haven county, Connecticut, on the 29th of November 1799. His father, Joseph Chatfield Alcox, was a farmer and mechanic whose ancestors, then bearing the name of Alcocke, had settled in eastern Massachusetts in colonial days. The son adopted the spelling "Alcott" in his early youth. Self-educated and early thrown upon his own resources, he began in 1814 to earn his living by working in a clock factory in Plymouth, Conn., and for many years after 1815 he peddled books and merchandise, chiefly in the southern states. He began teaching in Bristol, Conn., in 1823, and subsequently conducted schools in Cheshire, Conn., in 1825–1827, again in Bristol in 1827–1828, in Boston in 1828–1830, in Germantown, now part of Philadelphia, in 1831–1833, and in Philadelphia in 1833. In 1830 he had married Abby May, the sister of Samuel J. May (1797–1871), the reformer and abolitionist. In 1834 he opened in Boston a school which became famous because of his original methods; his plan being to develop self-instruction on the basis of self-analysis, with an ever-present desire on his own part to stimulate the child's personality. The feature of his school which attracted most attention, perhaps, was his scheme for the teacher's receiving punishment, in certain circumstances, at the hands of an offending pupil, whereby the sense of shame might be quickened in the mind of the errant child. The school was denounced in the press, was not pecuniarily successful, and in 1839 was given up, although Alcott had won the affection of his pupils, and his educational experiments had challenged the attention of students of pedagogy. The school is perhaps best described in Miss E. P. Peabody's *A Record of Mr Alcott's School* (1835). In 1840 Alcott removed to Concord, Massachusetts. After a visit to England, in 1842, he started with two English associates, Charles Lane and Henry C. Wright, at "Fruitlands," in the town of Harvard, Massachusetts, a communistic experiment at farm-living and nature-meditation as tending to develop the best powers of body and soul. This speedily came to naught, and Alcott returned (1844) to his home near that of Emerson in Concord, removing to Boston four years later, and again living in Concord after 1857. He spoke, as opportunity offered, before the "lyceums" then common in various parts of the United States, or addressed groups of hearers as they invited him. These "conversations," as he called them, were more or less informal talks on a great range of topics, spiritual, aesthetic and practical, in which he emphasized the ideas of the school of American Transcendentalists led by Emerson, who was always his supporter and discreet admirer. He dwelt upon the illumination of the mind and soul by direct communion with the Creative Spirit; upon the spiritual and poetic monitions of external nature; and upon the benefit to man of a serene mood and a simple way of life. As regards the trend and results of Alcott's philosophic teaching, it must be said that, like Emerson, he was sometimes inconsistent, hazy or abrupt. But though he formulated no system of philosophy, and seemed to show the influence now of Plato, now of Kant, or of German thought as filtered through the brain of Coleridge, he was, like his American master, associate and friend, steadily optimistic, idealistic, individualistic. The teachings of William Ellery Channing a little before, as to the sacred inviolability of the human conscience—anticipating the later conclusions of Martineau—really lay at the basis of the work of most of the Concord transcendentalists and contributors to *The Dial*, of whom Alcott was one. In his last years, living in a serene and beautiful old age in his Concord home, the Orchard House, where every comfort was provided by his daughter Louisa (*q.v.*), Alcott was gratified at being able to become the nominal, and at times the actual, head of a Concord "Summer School of Philosophy and Literature," which had its first session in 1879, and in which —in a rudely fashioned building next his house—thoughtful listeners were addressed during a part of several successive summer seasons on many themes in philosophy, religion and letters. Of Alcott's published works the most important is *Tablets* (1868); next in order of merit is *Concord Days* (1872). His *Sonnets and Canzonets* (1882) are chiefly interesting as an old man's experiments in verse. He left a large collection of personal jottings and memorabilia, most of which remain unpublished. He died in Boston on the 4th of March 1888. Alcott was a Garrisonian abolitionist.

See *A. Bronson Alcott, His Life and Philosophy* (2 vols., Boston, 1893), by F. B. Sanborn and William T. Harris; *New Connecticut: an Autobiographical Poem* (Boston, 1887), edited by F. B. Sanborn; and Lowell's criticism in his *Fable for Critics*. (C. F. R.)

ALCOTT, LOUISA MAY (1832–1888), American author, was the daughter of Amos Bronson Alcott, and though of New England parentage and residence, was born in Germantown, now part of Philadelphia, Pennsylvania, on the 29th of November 1832. She began work at an early age as an occasional teacher and as a writer—her first book was *Flower Fables* (1854), tales originally written for Ellen, daughter of R. W. Emerson. In 1860 she began writing for the *Atlantic Monthly*, and she was nurse in the Union Hospital at Georgetown, D.C., for six weeks in 1862–1863. Her home letters, revised and published in the *Commonwealth* and collected as *Hospital Sketches* (1863, republished with additions in 1869), displayed some power of observation and record; and *Moods*, a novel (1864), despite its uncertainty of method and of touch, gave considerable promise. She soon turned, however, to the rapid production of stories for girls, and, with the exception of the cheery tale entitled *Work* (1873), and the anonymous novelette *A Modern Mephistopheles* (1877), which attracted little notice, she did not return to the more ambitious fields of the novelist. Her success dated from the appearance of the first series of *Little Women: or Meg, Jo, Beth and Amy* (1868), in which, with unfailing humour, freshness and lifelikeness, she put into story form many of the sayings and doings of herself and sisters. *Little Men* (1871) similarly treated the character and ways of her nephews in the Orchard House in Concord, Massachusetts, in which Miss Alcott's industry had now established her parents and other members of the Alcott family; but most of her later volumes, *An Old-Fashioned Girl* (1870), *Aunt Jo's Scrap Bag* (6 vols., 1871–1879), *Rose in Bloom* (1876), &c., followed in the line of *Little Women*, of which the author's large and loyal public never wearied. Her natural love of labour, her wide-reaching generosity, her quick perception and her fondness for sharing with her many readers that cheery humour which radiated from her personality and her books, led her to produce stories of a diminishing value, and at last she succumbed to overwork, dying in Boston on the 6th of March 1888, two days after the death of her father in the same city. Miss Alcott's early education had partly been given by the naturalist Thoreau, but had chiefly been in the hands of her father; and in her girlhood and early womanhood she had fully shared the trials and poverty incident to the life of a peripatetic idealist. In a newspaper sketch entitled "Transcendental Wild Oats," afterwards reprinted in the volume *Silver Pitchers* (1876), she narrated, with a delicate humour, which showed what her literary powers might have been if freed from drudgery, the experiences of her family during an experiment towards communistic "plain living and high thinking" at "Fruitlands," in the town of Harvard, Massachusetts, in 1843.

The story of her career has been fully and frankly told in Mrs Ednah D. Cheney's *Louisa May Alcott: Her Life, Letters and Journals* (Boston, 1889). (C. F. R.)

ALCOVE (through the Span. *alcova*, from the Arab. *al-*, the, and *quobbah*, a vault), an architectural term for a recess in a room usually screened off by pillars, balustrade or drapery.

ALCOY, a town of south-eastern Spain, in the province of Alicante, on the small river Sérpis, and at the terminus of a branch railway connected with the Barcelona-Valencia-Alicante line. Pop. (1900) 32,053. Alcoy is built on high ground at the entrance to a gorge in the Moncabrer range (4547 ft.). It is a thriving industrial town, devoid of any great antiquarian or architectural interest, though founded by the Moors. It owes its prosperity to its manufacture of linen, woolen goods and paper, especially cigarette paper. Many of the factories derive their motive power from the falls of a mountain torrent known as the Salto de las Aguas. Labour disturbances are frequent, for, like Barcelona, Alcoy has become one of the centres of socialistic and revolutionary agitation, while preserving many old-fashioned customs and traditions, such as the curious festival held annually in April in honour of St George, the patron saint of the town.

COCENTAINA (pop. 1900, 7093) is a picturesque and ancient town, 4 m. N.E. by rail. It is surrounded by Roman walls, which were partly rebuilt by the Moors, and it contains an interesting fortified palace, owned by the dukes of Medinaceli.

For an account of the festival of St George of Alcoy, see *Apuntes historicos acerca de las fiestas que celebra cada año la ciudad de Alcoy a su patron San Jorge*, by J. A. Llobet y Vallosera (Alcoy, 1853).

ALCUIN (ALCHUINE), a celebrated ecclesiastic and man of learning in the 8th century, who liked to be called by the Latin name of ALBINUS, and at the Academy of the palace took the surname of FLACCUS, was born at Eboracum (York) in 735. He was related to Willibrord, the first bishop of Utrecht, whose biography he afterwards wrote. He was educated at the cathedral school of York, under the celebrated master Ælbert, with whom he also went to Rome in search of manuscripts. When Ælbert was appointed archbishop of York in 766, Alcuin succeeded him in the headship of the episcopal school. He again went to Rome in 780, to fetch the *pallium* for Archbishop Eanbald, and at Parma met Charlemagne, who persuaded him to come to his court, and gave him the possession of the great abbeys of Ferrières and of Saint-Loup at Troyes. The king counted on him to accomplish the great work which was his dream, namely, to make the Franks familiar with the rules of the Latin language, to create schools and to revive learning. From 781 to 790 Alcuin was his sovereign's principal helper in this enterprise. He had as pupils the king of the Franks, the members of his family and the young clerics attached to the palace chapel; he was the life and soul of the Academy of the palace, and we have still, in the *Dialogue of Pepin* (son of Charlemagne) *and Alcuin*, a sample of the intellectual exercises in which they indulged. It was under his inspiration that Charles wrote his famous letter *de litteris colendis* (Boretius, *Capitularia*, i. p. 78), and it was he who founded a fine library in the palace. In 790 Alcuin returned to his own country, to which he had always been greatly attached, and stayed there some time; but Charlemagne needed him to combat the Adoptianist heresy, which was at that time making great progress in the marches of Spain. At the council of Frankfort in 704 Alcuin upheld the orthodox doctrine, and obtained the condemnation of the heresiarch Felix of Urgel. After this victory he again returned to his own land, but on account of the disturbances which broke out there, and which led to the death of King Æthelred (796), he bade farewell to it for ever. Charlemagne had just given him the great abbey of St Martin at Tours, and there, far from the disturbed life of the court, he passed his last years. He made the abbey school into a model of excellence, and many students flocked to it; he had numerous manuscripts copied, the calligraphy of which is of extraordinary beauty (*v.* Léopold Delisle in the *Mémoires de l'Académie des Inscriptions*, vol. xxxii., 1st part, 1885). He wrote numerous letters to his friends in England, to Arno, bishop of Salzburg, and above all to Charlemagne. These letters, of which 311 are extant, are filled chiefly with pious meditations, but they further form a mine of information as to the literary and social conditions of the time, and are the most reliable authority for the history of humanism in the Carolingian age. He also trained the numerous monks of the abbey in piety, and it was in the midst of these pursuits that he was struck down by death on the 19th of May 804.

Alcuin is the most prominent figure of the Carolingian Renaissance, in which have been distinguished three main periods: in the first of these, up to the arrival of Alcuin at the court, the Italians occupy the chief place; in the second, Alcuin and the Anglo-Saxons are dominant; in the third, which begins in 804, the influence of the Goth Theodulf is preponderant. Alcuin transmitted to the ignorant Franks the knowledge of Latin culture which had existed in England since the time of Bede. We still have a number of his works. His letters have already been mentioned; his poetry is equally interesting. Besides some graceful epistles in the style of Fortunatus, he wrote some long poems, and notably a whole history in verse of the church at York: *Versus de patribus, regibus et sanctis Eboracensis ecclesiae*. We owe to him, too, some manuals used in his educational work; a grammar and works on rhetoric and dialectics. They are written in the form of dialogues, and in the two last the interlocutors are King Charles and Alcuin. He wrote, finally, several theological treatises: a treatise *de Fide Trinitatis*, commentaries on the Bible, &c. The complete works of Alcuin have been edited by Froben: *Alcuini opera*, 1 vol. in 4 parts (Regensburg, 1777); this edition is reproduced in Migne's *Patrolog. lat.* vols. c. and ci. The letters have been published by Jaffé and Dümmler in Jaffé's *Bibliotheca rerum germanicarum*, vol. vi. pp. 132-897 (1873). E. Dümmler has also published an authoritative edition, *Epistolae aevi Carolini*, vol. ii. pp. 1-481, in the *Monumenta Germaniae*, and has edited the poems in the same collection: *Poetae latini aevi Carolini*, vol. i. pp. 169-341.

AUTHORITIES.—Monnier, *Alcuin et Charlemagne* (Paris, 1863); K. Werner, *Alkuin und sein Jahrhundert* (Paderborn, 1876); J. Bass Mullinger, *The Schools of Charles the Great and the Restoration of Education in the 9th Century* (London, 1877); Aug. Molinier, *Les Sources de l'histoire de France*, vol. i. p. 191; G. Monod, *Études critiques sur les sources de l'histoire carolingienne*, part i. (Paris, 1898); C. J. B. Gaskoin, *Alcuin: His Life and his Work* (London, 1903). See further U. Chevalier, *Répertoire des sources, &c., bio-bibliographie*, *s.v.* Alcuin; Wattenbach, *Deutschlands Geschichtsquellen* (Stuttgart and Berlin, 1904), i. p. 186. (C. PF.)

ALCYONE, or HALCYONE, in Greek mythology, daughter of Aeolus and wife of Ceyx. For their presumption in calling themselves Zeus and Hera they were changed into birds—Alcyone into a diver, Ceyx into a kingfisher. According to another story, Ceyx was drowned and his body cast on the shore. His wife found the body, and the gods, out of compassion, changed both her and her husband into kingfishers. By command of Zeus (or Aeolus) the winds ceased to blow during their brooding-time, for seven days before and after the shortest day, that their eggs might not be carried away by the sea. Hence the expression "halcyon days," used in ancient and modern times to denote a period of calm and tranquillity.

Apollonius Rhodius i. 1087; Ovid, *Metam.* xi. 410 et seq.; Hyginus, *Fabulae*, 65.

ALDABRA, the collective name of a group of islands in the Indian Ocean, forming part of the British colony of Seychelles. They lie in 9° 30′ S., 46° E., are 265 m. N.W. of the northern point of Madagascar and 690 m. S.W. of Mahé, the principal island of the Seychelles archipelago. The Comoro Islands lie 220 m. S. by W. of Aldabra. The Aldabra Islands constitute an atoll consisting of an oval ring of land, some 40 m. in circumference and about 1½ m. broad, enclosing a shallow lagoon. Channels divide the ring into four islands. Grande Terre or South Island forms three-fifths of the circumference. The other islands are West Island or Ile Picard, Polymnie and Middle Island. There are in addition several islets in the lagoon, the most important being Ile Michel. The total land area is estimated at about 60 sq. m., the lagoon, 16 m. long and 4 m. wide, covering a somewhat larger area. Pop. (1006) 127. The islands rise from 20 to 80 ft. above the sea, and consist of rugged coral rock and limestone, there being very little soil. The sea-face is generally overhanging cliff, but in a few places are sandy beaches and low sandhills. Dense scrub covers most of the land, but the inner (lagoon) shore is everywhere bounded by mangrove swamps. The flora and fauna of the islands present features of unusual interest. They are chiefly noted as the habitat of the gigantic land tortoise (*Testudo elephantina*), now carefully preserved, and of several rare and peculiar birds, including a rail (*Dryolimnas aldabranus*), an ibis (*Ibis abbottii*) and a dove (*Alectroenas sganzini*). Crustacea are abundant. They include oysters, crabs of great size, and a small mussel, found in enormous numbers. The flora includes mangroves, *Rubiaceae*, *Sapotaceae* and other forms requiring more than pure coralline material for their growth. Writing of the fauna and flora generally, Mr R. Dupont, curator of the Botanic station at Mahé, who visited Aldabra in 1906, says: "The specimens represented, besides being partly peculiar, mostly belong to the Mascarenes, Madagascar and Comoros species. Many species are also common to East Africa and to India. . . . The predominant species are Madagascar plants and birds, which are carried by the currents and the winds. . . . There are comparatively few (10) species of plants which are endemic as far as the flora has been investigated, and it is probable that most of them are also existing in the Comoros, where the flora is not well known. . . . Endemic inferior animals and mammals are practically non-existent, except two bats and one scorpion, which are allied to Madagascar species or introduced. The reptiles (tortoises) are also nearly allied to the Mascarenes and Madagascar species which once existed. With regard to birds and land shells the relation is much closer to the Comoros species, and the latter, of which I have collected seven species besides *Rachis aldabrae*, may serve to point out more than the birds the land connexion of Aldabra with the neighbouring countries." Aldabra, however, although situated in that region of the Indian Ocean which forms part of the site of the Indo-Madagascar continent of the Secondary period, is not a peak of the submerged land. It has been built up from the sunken remains of the old continent by a deposit, in the opinion of Professor A. Voeltzkow, of foraminiferal remains (mostly coccoliths and rhabdoliths). In any case, however Aldabra was formed, there can be no suggestion of its ever having been joined to any other land (Stanley Gardiner). Dupont states that at Aldabra the coral foundation is totally above water. The coral limestone of the atoll has a peculiar vitrified appearance and gives out a ringing sound when struck or simply walked on. The coral is generally reddish, but the colouring ranges from light yellow to chocolate-brown.

Aldabra was visited by Portuguese navigators in 1511. The islands were already known to the Arabs, from whom they get their name. They became in the middle of the 18th century dependencies of the French establishments at Bourbon (Réunion), whence expeditions were made for the capture of the giant tortoises. In 1810 with Mauritius, Bourbon, the Seychelles and other islands, Aldabra passed into the possession of Great Britain. The inhabitants are emigrants from the Seychelles. Goats are bred and coco-nuts cultivated, but fishing is the chief industry. With other outlying islands Aldabra is held under lease from the Seychelles government, the lessees having exclusive trading privileges.

See R. Dupont, *Report on a Visit of Investigation to . . . the Aldabra Group of the Seychelles Islands* (Seychelles, 1907); Dr Abbott in *Proceedings, United States National Museum* (Washington, 1894); A. Voeltzkow in *Abh. der Senckenbergischen Naturforschenden Ges.* vol. xxvi. part iv. (1901); J. S. Gardiner, "The Indian Ocean," *Geo. Journ.* Oct. 1906.

ALDBOROUGH, a village in the Ripon parliamentary division of the West Riding of Yorkshire, England, 16 m. W.N.W. of York, and 1 m. E. of the market town of Boroughbridge, which has a station on a branch of the North-Eastern railway. Aldborough formerly returned two members to parliament, but was disfranchised by the Reform Act of 1832. The place is remarkable from its numerous ancient remains. It was the *Isurium Brigantum* of the Romans, originally perhaps a capital of the Brigantes tribe, and afterwards a Romano-British town of considerable size. Inscriptions, beautiful mosaics and other traces of comfortable houses have been found, with many potsherds, coins and bronze, iron and other objects; and a large part of the town walls, several mosaics and parts of buildings, can be seen. A fine collection is kept in the Museum Isurianum in the grounds of the manor-house.

ALDEBURGH [Aldborough], a market town and municipal borough in the Eye parliamentary division of Suffolk, England, the terminus of a branch of the Great Eastern railway, 99½ m. N.E. by E. from London. Area, 1629 acres. Pop. (1901) 2405. The surrounding district is open and somewhat bleak, but a fine stretch of sand fringes the shallow inlet of the North Sea known as Aldeburgh Bay. To the W. the river Alde broadens as if into an estuary, but its outflow is here prevented by the sand, and it runs south for nearly 10 m. parallel with the shore. The sandbanks have arrested the encroachments of the sea, which submerged a former site of Aldeburgh. The church of St Peter and St Paul is Perpendicular, largely restored, and contains a monument to the poet George Crabbe, born here on the 24th of December 1754. A small picturesque Moot Hall of the 16th century is used for corporation meetings. Slaughden Quay on the Alde admits small vessels, and fishing is carried on. Aldeburgh is governed by a mayor, 4 aldermen and 12 councillors.

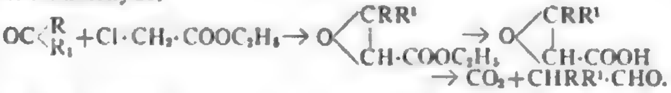
Aldeburgh (Aldburc) takes its name from the river Alde on which it stands. It is not mentioned in pre-Conquest records, but at the Domesday survey most of the land was held by Robert Malet, a Norman. In 1155 the manor was granted to the abbey of St John of Colchester, later to Cardinal Wolsey, and on his disgrace, to Thomas Howard, duke of Norfolk, to whom Elizabeth in 1567 granted a market on Saturday. In the 16th century Aldeburgh was a place of considerable commercial importance, due, no doubt, to its position on the sea-coast. Aldeburgh claims to be a borough by prescription: the earliest charter is that granted by Henry VIII. in 1529. Edward VI. in 1548 raised it to the rank of a free borough, granting a charter of incorporation and a market on Wednesday. Later charters were granted by Philip and Mary in 1553, by Elizabeth in 1558 and 1567, by James I. (who granted two annual fairs) in 1606, and by Charles I. in 1631 and 1637. The corporation included 2 bailiffs, 10 capital and 24 inferior burgesses, until the Municipal Corporations Act 1883. The fairs and markets became so unimportant that they were discontinued about the middle of the 19th century. The town returned two members to Elizabeth's parliament of 1572, and continued to be so represented till the Reform Bill of 1832 disfranchised it. Frequent disastrous incursions of the sea in the 18th century reduced Aldeburgh to a mere fishing village. In recent years it has grown as a seaside resort, with excellent golf-links.

See John Kirby, *The Suffolk Traveller* (2nd ed., 1764); N. F. Hele, *Notes about Aldeburgh* (1870); *Victoria County History—Suffolk.*

ALDEGREVER, or Aldegraf, **HEINRICH** (1502–1558), German painter and engraver, was born at Paderborn, from which he removed in early life to Soest, where he died. From the close resemblance of his style to that of Albrecht Dürer he has sometimes been called the Albert of Westphalia. His numerous engravings, chiefly from his own designs, are delicate and minute, though somewhat hard in style, and entitle him to a place in the front rank of the so-called "Little Masters." There is a good collection in the British Museum. Specimens of his painting are exceedingly rare. Five pictures are in continental galleries, but the genuineness of the works in the Vienna and Munich collections attributed to him is at least doubtful, the only unchallenged example being a portrait of Engelbert Therlaen (1551) in the Berlin Museum.

ALDEHYDES, a class of chemical compounds of the general formula R·CHO (R = an alkyl or an aryl group). The name is derived from *alcohol dehydrogenatum* in allusion to the fact that they may be prepared by the oxidation of alcohols. The lower members of the series are neutral liquids possessing a characteristic smell; they are soluble in water and are readily volatile (formaldehyde, however, is a gas at ordinary temperatures). As the carbon content of the molecule increases, they become less soluble in water, and their smell becomes less marked with the increase in boiling point, the highest members of the series being odourless solids, which can only be distilled without decomposition *in vacuo.*

The aldehydes may be prepared by the careful oxidation of primary alcohols with a mixture of potassium dichromate and sulphuric acid,—$3R{\cdot}CH_2OH + K_2Cr_2O7 + 4H_2SO_4 = K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3R{\cdot}CHO$; by distilling the calcium salts of the fatty acids with calcium formate; and by hydrolysis of the acetals. L. Bouveault (*Bull. soc. chim.*, 1904 [3], 31, p. 1306) prepares aldehydes by the gradual addition of disubstituted formamides (dissolved in anhydrous ether) to magnesium alkyl haloids, the best yields being obtained by the use of diethyl formamide. Secondary reactions take place at the same time, yielding more particularly hydrocarbons of the paraffin series. G. Darzens (*Comptes Rendus*, 1904, 139, p. 1214) prepares esters of disubstituted glycidic acids, by condensing the corresponding ketone with monochloracetic ester, in the presence of sodium ethylate. These esters on hydrolysis yield the free acids, which readily decompose, with loss of carbon dioxide and formation of an aldehyde.

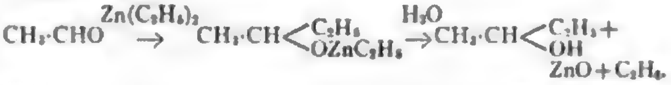


In the *German Patent* 157573 (1904) it is shown that by the action of at least two molecular proportions of an alkyl formate on two molecular proportions of a magnesium alkyl or aryl haloid, a complex addition compound is formed, which readily decomposes into a basic magnesium salt and an aldehyde,

$$C_6H_5MgBr + HCOOR \rightarrow RO{\cdot}CH{\cdot}C_6H_5{\cdot}OMgBr \rightarrow MgBr{\cdot}OR + C_6H_5CHO.$$

The aldehydes are characterized by their great chemical reactivity. They act as reducing agents, silver nitrate in the presence of ammonia being rapidly reduced to the condition of metallic silver. They are easily oxidized to the corresponding fatty acid, in many cases simply by exposure to air. Nascent hydrogen reduces them to primary alcohols, and phosphorus pentachloride replaces the carbonyl oxygen by chlorine. They form many addition compounds, combining with ammonia to form aldehyde ammonias of the type $R{\cdot}CH(OH){\cdot}NH_2$. These are colourless crystalline compounds, which are most readily prepared by passing ammonia gas into an ethereal solution of the aldehyde. With sodium bisulphite they form the so-called bisulphite compounds $R{\cdot}CH(OH){\cdot}SO_3Na$, which are readily resolved into their components by distillation with dilute acids, and are frequently used for the preparation of the pure aldehyde.

With hydrocyanic acid aldehydes form the cyanhydrins $R{\cdot}CH(OH){\cdot}CN$. They react with hydroxylamine and phenylhydrazine, with the formation of aldoximes and hydrazones. (For the isomerism of the aldoximes see Oximes). The hydrazones are crystalline substances which are of value in the characterization of the aldehydes. Both oximes and hydrazones, on boiling with dilute acid, regenerate the parent aldehyde. The hydrazones are best prepared by mixing the aldehyde with phenylhydrazine in dilute acetic acid solution, in the absence of any free mineral acid. Semioxamazid, $NH_2{\cdot}CO{\cdot}CO{\cdot}NH{\cdot}NH_2$, has also been employed for the identification of aldehydes (W. Kerp and K. Unger, *Berichte*, 1897, 30, p. 585). Aldehydes are converted into resins by the action of caustic alkalies. On heating with alcohols to 100° C. they form acetals, and they also form condensation products with para-amido-di-methyl-aniline (A. Calm, *Berichte*, 1884, 17, p. 2939). They react with the zinc alkyls to form addition products, which are decomposed by water with formation of secondary alcohols (K. Thurnlach, *Annalen*, 1882, 213, p. 369) thus:—



$$CH_3{\cdot}CHO \xrightarrow{Zn(C_2H_5)_2} CH_3{\cdot}CH{<}\begin{matrix}C_2H_5\\ OZnC_2H_5\end{matrix} \xrightarrow{H_2O} CH_3{\cdot}CH{<}\begin{matrix}C_2H_5\\ OH\end{matrix} + ZnO + C_2H_6.$$

The reaction is a general one for all aldehydes with zinc methyl and zinc ethyl, but not with the higher zinc alkyls. V. Grignard (*Comptes Rendus*, 1900 et seq.) showed that aldehydes combine with magnesium alkyl iodides (in absolute ether solution) to form addition products, which are decomposed by water with the formation of secondary alcohols, thus from acetaldehyde and magnesium methyl iodide, isopropyl alcohol is obtained.

$$CH_3{\cdot}CHO+CH_3MgI\rightarrow CH_3{\cdot}CH\Big\langle\begin{matrix}CH_3\\OMgI\end{matrix}\xrightarrow{H_2O}(CH_3)_2CH{\cdot}OH+MgI{\cdot}OH.$$

The lower members of the aliphatic series are characterized by their power of polymerization (see FORMALIN, and the account of Acetaldehyde below), and also by the so-called "aldol" condensation, acetaldehyde in this way forming aldol, $CH_3{\cdot}CHOH{\cdot}CH_2{\cdot}CHO$. These aldols generally lose the elements of water readily and pass into unsaturated compounds; aldol itself on distillation at ordinary atmospheric pressure gives crotonaldehyde, $CH_3{\cdot}CH : CH{\cdot}CHO$.

Aldehydes are characterized by the reddish-violet colour which they give with a solution of fuchsine that has been decolorized by sulphurous acid (H. Schiff, *Ann.*, 1866, 140, p. 131). With diazobenzene sulphonic acid in the presence of alkali and a trace of sodium amalgam, a reddish-violet coloration is formed on standing (E. Fischer, *Ber.*, 1883, 16, p. 657). A. Angeli (*Gazz. chim. Ital.*, 1896, 22, ii. 17) has shown that aldehydes in the presence of nitrohydroxylaminic acid form hydroxamic acid. The aldehydes condense readily with acetoacetic ester in the presence of ammonia, to pyridines (see PYRIDINE), whilst O. Doebner and W. v. Miller (*Ber.*, 1892, 25, p. 2864; 1896, 29, p. 59) have shown that in the presence of aniline and sulphuric acid they give substituted quinolines. (See also C. Beyer, *Ber.*, 1887, 20, p. 1908). The chief aldehydes are shown in the following table:—

Name.	Formula.	Boiling Point.	Melting Point.
Formaldehyde	$H{\cdot}CHO$	−21°	
Acetaldehyde	$CH_3{\cdot}CHO$	20·8°	
Propyl aldehyde	$CH_3{\cdot}CH_2{\cdot}CHO$	49°	
n-Butyl "	$CH_3{\cdot}(CH_2)_2{\cdot}CHO$	75°	
iso- " "	$(CH_3)_2CH{\cdot}CHO$	61°	
n-Valeryl "	$CH_3{\cdot}(CH_2)_3{\cdot}CHO$	103°	
iso- " "	$C_4H_9{\cdot}CHO$	92°	
Oenanthyl "	$CH_3{\cdot}(CH_2)_5{\cdot}CHO$	155°	
Capric "	$CH_3{\cdot}(CH_2)_8{\cdot}CHO$	121°	
Lauric "	$CH_3{\cdot}(CH_2)_{10}{\cdot}CHO$		44·5°
Myristic "	$CH_3{\cdot}(CH_2)_{12}{\cdot}CHO$		52·5°
Palmitic "	$CH_3{\cdot}(CH_2)_{14}{\cdot}CHO$		58·5°
Stearic "	$CH_3{\cdot}(CH_2)_{16}{\cdot}CHO$		63·5°
Acrolein, allyl aldehyde	$CH_2 : CH{\cdot}CHO$	52°	
Crotonic "	$CH_3{\cdot}CH : CH{\cdot}CHO$	104°	
Tiglic " (guaiacol)	$CH_3{\cdot}CH{:}C{\cdot}CH_3{\cdot}CHO$	116°	
Propargylic A.	$CH : C{\cdot}CHO$	59°	
Benzaldehyde	$C_6H_5{\cdot}CHO$	179°	
Toluicaldehyde o		200°	
Toluicaldehyde m	$C_6H_4{\cdot}CH_3{\cdot}CHO$	199°	
Toluicaldehyde p		204°	
Cumic "	$C_6H_4{\cdot}C_3H_7{\cdot}CHO$	235°	
Cinnamic "	$C_6H_5{\cdot}CH : CH{\cdot}CHO$	247°	

For formaldehyde see FORMALIN. *Acetaldehyde*, $CH_3{\cdot}CHO$, was first noticed by C. Scheele in 1774 and isolated and investigated by J. v. Liebig (*Annalen*, 1835, 14, p. 133). It is prepared by oxidizing ethyl alcohol with dilute sulphuric acid and potassium bichromate, and is a colourless liquid of boiling point 20·8° C., possessing a peculiar characteristic smell. Its specific gravity is 0·8009 (0° C.). It is miscible in all proportions with alcohol, ether and water. It is readily polymerized, small quantities of hydrochloric acid, zinc chloride, carbonyl chloride, &c. converting it, at ordinary temperatures, into paraldehyde, $(C_2H_4O)_3$, a liquid boiling at 124° C. and of specific gravity 0·998 (15° C.). Paraldehyde is moderately soluble in water, and when distilled with sulphuric acid is reconverted into the ordinary form. Metaldehyde, $(C_2H_4O)_3$, is produced in a similar way to paraldehyde, but at lower temperatures (*e.g.* in presence of a freezing mixture). It is a crystalline solid, which sublimes at 112°–115° C. It is insoluble in water, and is only slightly soluble in alcohol and ether. When heated in a sealed tube at 120° C. it is completely converted into the ordinary form. Paraldehyde is oxidized by dilute nitric acid, with formation of much glyoxal, $(CHO)_2$. (For trichloracetaldehyde see CHLORAL.)

By the action of acetaldehyde on alcohol at 100° C., acetal, $CH_3{\cdot}CH(OC_2H_5)_2$, is produced. It may also be prepared by oxidizing ethyl alcohol with manganese dioxide and sulphuric acid (A. Wurtz). It is a colourless liquid of specific gravity 0·8314 (20°/4°) (J. W. Brühl) and boiling point 104° C. Dilute acids readily transform it into alcohol and aldehyde, and chromic acid oxidizes it to acetic acid. Chlor- and brom-acetals have been described.

Thioaldehydes are also known, and are obtained by leading sulphuretted hydrogen into an aqueous solution of acetaldehyde. By this means a mixture is obtained which by distillation or the action of hydrochloric acid yields trithioaldehyde, $(C_2H_4S)_3$. For the constitution of these substances see E. Baumann and E. Fromm (*Berichte*, 1891, 24, p. 1426). Aldehyde ammonia, $CH_3{\cdot}CH(OH){\cdot}NH_2$, is formed when dry ammonia gas is passed into an ethereal solution of acetaldehyde. It crystallizes in glistening rhombohedra, melting at 70°–80° C., and boiling at 100° C. It is completely resolved into its components when warmed with dilute acids.

The higher aldehydes of the series resemble acetaldehyde in their general behaviour. Unsaturated aldehydes are also known, corresponding to the olefine alcohols; they show the characteristic properties of the saturated aldehydes and can form additive compounds in virtue of their unsaturated nature. The simplest member of the series is acrolein, C_3H_4O or $CH_2 : CH{\cdot}CHO$, which can be prepared by the oxidation of allyl alcohol, or by the abstraction of the elements of water from glycerin by heating it with anhydrous potassium bisulphate. It is also produced by the action of sodium on a mixture of epichlorhydrin and methyl iodide, $C_3H_5OCl+CH_3I+2Na=C_3H_4O+NaI+NaCl+CH_4$. It is a colourless liquid, with a very pungent smell, and attacks the mucous membrane very rapidly. It boils at 52·4° C. and is soluble in water. It oxidizes readily: exposure to air giving acrylic acid, nitric acid giving oxalic acid, bichromate of potash and sulphuric acid giving carbon dioxide and formic acid. It combines with bromine to form a dibromide, from which E. Fischer, by the action of baryta water, obtained the synthetic sugars α- and β-acrose (*Berichte*, 1889, 22, p. 360). Metacrolein, $(C_3H_4O)_3$, is a polymer of acrolein. By passing acrolein vapour into ammonia, acrolein ammonia, C_6H_9NO, is obtained. It is a reddish amorphous mass, insoluble in alcohol, and when distilled yields picoline (methyl pyridine) (A. Baeyer, *Ann.*, 1870, 155, p. 283). Citronellal, rhodinal and geranial are also unsaturated aldehydes (see TERPENES).

The aromatic aldehydes resemble the aliphatic aldehydes in most respects, but in certain reactions they exhibit an entirely different behaviour. They do not polymerize, and in the presence of caustic alkalies do not resinify, but oxidize to alcohols and acids (see BENZALDEHYDE for Cannizzaro's reaction). When heated with alcoholic potassium cyanide they are converted into benzoins (*q.v.*). Vanillin does not give the Cannizzaro reaction, but with alcoholic potash forms vanillic acid, $HOOC(1){\cdot}C_6H_3{\cdot}OCH_3(3){\cdot}OH(4)$, and vanilloin. With ammonia, benzaldehyde does not form an aldehyde ammonia, but condenses to hydrobenzamide, $(C_6H_5CH)_3N_2$, with elimination of water. Cumic aldehyde (cuminol), $(CH_3)_2CH(1)C_6H_4{\cdot}CHO(4)$, is found in Roman caraway oil and in oil of the water hemlock. It is a liquid, boiling at 235° C., and has a specific gravity of 0·973. On distillation with zinc dust it forms cymene (1·4 methyl isopropyl benzene).

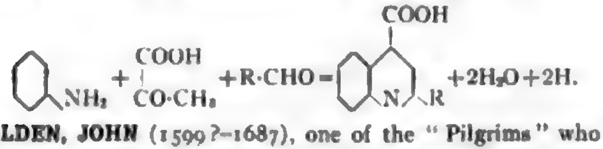
Salicylic aldehyde (ortho-hydroxybenzaldehyde), $HO(1){\cdot}C_6H_4{\cdot}CHO(2)$, an aromatic oxyaldehyde, is a colourless liquid of boiling point 196° C. and specific gravity 1·172 (15°). It is found in the volatile oils of Spiraea, and can be obtained by the oxidation of the glucoside salicin, $(C_{13}H_{18}O_7)$, which is found in willow bark. It is usually prepared by the so-called "Reimer" reaction (*Ber.*, 1876, 9, p. 1268), in which chloroform acts on phenol in the presence of a caustic alkali,

$$C_6H_5OH+CHCl_3+4KHO=3KCl+3H_2O+KO{\cdot}C_6H_4{\cdot}CHO,$$

some para-oxybenaldehyde being formed at the same time. It is volatile (para-oxybenzaldehyde is not) and gives a violet coloration with ferric chloride. For dioxybenzaldehydes and their derivatives see PIPERONAL and VANILLIN.

Cinnamic aldehyde (β-phenyl acrolein), $C_6H_5 \cdot CH:CH \cdot CHO$, an unsaturated aromatic aldehyde, is the chief constituent of cinnamon oil. It is prepared by oxidizing cinnamyl alcohol, or by the action of sodium ethylate on a mixture of benzaldehyde and acetaldehyde. It is a colourless aromatic-smelling oily liquid, which boils at 247° C. and readily oxidizes on exposure.

By condensation of aldehydes with pyruvic acid and naphthylamines, the α-alkyl-naphthoquinoline-γ-carboxylic acids are produced; the same reaction takes place with the aromatic amines generally (O. Doebner, *Ann.* 1894, 281, p. 1),



ALDEN, JOHN (1599?–1687), one of the "Pilgrims" who in 1620 emigrated to America on the "Mayflower" and founded the Plymouth Colony. According to William Bradford's *History of the Plimoth Plantation*, he was hired as a cooper at Southampton, "where the ship victuled," just before the voyage, "and being a hopfull yong man, was much desired." He was one of the first settlers of Duxbury, Massachusetts, where he lived during the greater part of his life, and from 1633 until 1675 he was an "Assistant" to the governor of the colony, frequently serving as acting governor. At the time of his death, at Duxbury, on the 12th of September 1687, he was the last male survivor of the signers of the "Mayflower Compact" of 1620, and with the exception of Mary Allerton was the last survivor of the "Mayflower" company. He is remembered chiefly because of a popular legend, put into verse as *The Courtship of Miles Standish* by Henry W. Longfellow, concerning his courtship of Priscilla Mullins, whom he married in 1623, after having wooed her first on behalf of his friend, Miles Standish.

ALDER, a genus of plants (*Alnus*) belonging to the order Betulaceae, the best-known of which is the common alder (*A. glutinosa*). The genus comprises a few species of shrubs or trees, seldom reaching a large size, distributed through the North Temperate zone, and in the New World passing along the Andes southwards to Chile. The British species *A. glutinosa* is confined to the Old World. This tree thrives best in moist soils, has a shrubby appearance, and grows under favourable circumstances to a height of 40 or 50 ft. It is characterized by its short-stalked roundish leaves, becoming wedge-shaped at the base and with a slightly toothed margin. When young they are somewhat glutinous, whence the specific name, becoming later a dark olive green. As with other plants growing near water it keeps its leaves longer than do trees in drier situations, and the glossy green foliage lasting after other trees have put on the red or brown of autumn renders it valuable for landscape effect. The stout cylindrical male catkins are pendulous, reddish in colour and 2 to 4 in. long; the female are smaller, less than an inch in length and reddish-brown in colour, suggesting young fir-cones. When the small winged fruits have been scattered the ripe, woody, blackish cones remain, often lasting through the winter. The alder is readily propagated by seeds, but throws up root-suckers abundantly. It is important as coppice-wood on marshy ground. The wood is soft, white when first cut and turning to pale red; the knots are beautifully mottled. Under water the wood is very durable, and it is therefore used for piles. The supports of the Rialto at Venice, and many buildings at Amsterdam, are of alder-wood. Furniture is sometimes made from the wood, and it supplies excellent charcoal for gunpowder. The bark is astringent; it is used for tanning and dyeing.

ALDER-FLY, the name given to neuropterous insects of the family *Sialidae*, related to the ant-lions, with long filamentous antennae and four large wings, of which the anterior pair is rather longer than the posterior. The females lay a vast number of eggs upon grass stems near water. The larvae are aquatic, active, armed with strong sharp mandibles, and breathe by means of seven pairs of abdominal branchial filaments. When full-sized they leave the water and spend a quiescent pupal stage on the land before metamorphosis into the sexually mature insect. *Sialis lutaria* is a well-known British example. In America there are two genera, *Corydalis* and *Chauliodes*, which are remarkable for their relatively gigantic size and for the immense length and sabre-like shape of the mandibles.

ALDERMAN (from A.-S. *ealdorman*, compounded of the comparative degree of the adjective *eald*, old, and *man*), a term implying the possession of an office of rank or dignity, and, in modern times, applied to an office-bearer in the municipal corporations and county councils of England and Wales, and in the municipal corporations of Ireland and the United States. Among the Anglo-Saxons, earls, governors of provinces and other persons of distinction received this title. Thus we read of the *aldermannus totius Angliae*, who seems to have corresponded to the officer afterwards styled *capitalis justiciarius Angliae*, or chief-justice of England; the *aldermannus regis*, probably an occasional magistrate, answering to the modern justice of assize, or perhaps an officer whose duty it was to prosecute for the crown; and *aldermannus comitatus*, a magistrate with a middle rank between what was afterwards called the *earl* and the *sheriff*, who sat at the trial of causes with the bishop and declared the common law, while the bishop proceeded according to ecclesiastical law. Besides these, we meet with the titles of *aldermannus civitatis, burgi, castelli, hundredi sive wapentachii*, &c. In England, before the passing of the Municipal Corporations Act, their functions varied according to the charters of the different boroughs. By the Municipal Corporations Act 1835, and other acts, consolidated by the Municipal Corporations Act 1882, the aldermen are elected by the councillors for six years, one-half going out every three years. The number of councillors in each borough varies according to its magnitude. One-fourth of the municipal council consists of aldermen and three-fourths of councillors. In the counties, too, the number of aldermen is one-third of the number of councillors, except in London, where it is one-sixth. In the municipal corporations of Scotland there is no such title as alderman, the office-bearers of corresponding rank there being termed bailies. The corporation of the city of London was not included in the Borough Reform Act, and the antiquated system remains there in full force. The court of aldermen consists of twenty-six, twenty-five of whom are elected for life by the freemen of the respective wards, who return two persons, one of whom the court of aldermen elect to supply the vacancy. The city is divided into twenty-six wards; twenty-four of these send up one alderman each, the other two combine to choose a twenty-fifth. The twenty-sixth alderman serves for the independent borough of Southwark (*q.v.*) and is appointed by the other aldermen, who generally select the senior from among themselves when a vacancy occurs. The lord mayor is elected from such of the aldermen as have served the office of sheriff; of these the Common Hall, which consists of the freemen of the different wards, select two, and the aldermen elect one of these to the mayoralty. The court of aldermen has the power of appointment to certain offices, exercises judicial functions in regard to licensing and in disputes connected with the ward election, has some power of disposal over the city cash and possesses magisterial control over the city, each alderman being a judge and magistrate for the whole city, and by virtue of his office exercising the functions of a justice of the peace. The aldermen are members of the court of common council, the legislative body of the corporation, which consists in all 232 members, the remainder being elected annually by the freemen. In the United States aldermen form as a rule a legislative rather than a judicial body, although in some cities they hold courts and possess very considerable magisterial powers.

ALDERNEY (Fr. *Aurigny*), one of the Channel Islands, the northernmost of the principal members of the group, belonging to England. It lies in 49° 43′ N. and 2° 12′ W., 9 m. W. of Cape La Hague on the coast of Normandy. The harbour, on the north coast in the bay of Braye, is 25 m. from St Peter

Port, Guernsey, by way of which outer communications are principally carried on, and 55 m. S. by E. of Portland Bill, the nearest point of England. The length of the island from N. E. to S. W. is 3½ m., its average breadth 1 m., its area 1962 acres, and its population (1901) 2062.

The strait between the island and Cape La Hague, called the Race of Alderney (French *Raz Blanchard*), confined by numerous rocks and reefs off either coast, is rendered very dangerous in stormy weather by conflicting currents. Through this difficult channel the scattered remnant of the French fleet under Tourville escaped after the defeat of La Hogue in 1692. To the west is the narrower and also dangerous channel of the Swinge (*Singe*), between Alderney and the uninhabited islets of Burhou, Ortach and others. West of these again are the Casquets, a group of rocks to which attaches a long record of shipwreck. Rocks and reefs fringe all the coasts of Alderney. The island itself is a level open tableland, which on the south-west and south falls abruptly to the sea in a majestic series of cliffs. The greatest elevation of the land is about 300 ft. Towards the north-west, north and east the less rocky coast is indented by several bays, with open sandy shores, of which those of Crabby, Braye, Corblets and Longy are the most noteworthy. South-west of Longy Bay, where the coast rises boldly, there is a remarkable projecting block of sandstone, called La Roche Pendante (Hanging Rock) overhanging the cliff. Sandstone (mainly along the north-east coast), granite and porphyry are the chief geological formations. There are a few streams, but water is obtained mainly from wells. Trees are scarce. The town of St Anne stands almost in the centre of the island overlooking and extending towards the harbour. Here are the court-house, a gateway commemorating Albert, prince-consort, the clock tower, which belonged to the ancient parish church, and the modern church (1850), in Early English style, an excellent example of the work of Sir Gilbert Scott. The church is a memorial to the family of Le Mesurier, in which the hereditary governorship of the island was vested until the abolition of the office in 1825. There is a chain of forts round the north coast from Clanque Fort on the west to Fort Essex on the east; the largest is Fort Albert, above Braye Bay. In 1847 work was begun on a great breakwater west of the harbour, the intention being to provide a harbour of refuge, but although a sum exceeding one and a half million sterling was spent the scheme was unsuccessful. The soil of Alderney is light, fertile and well cultivated; grain and vegetables are grown and early potatoes are exported. A large part of the island is under grass, affording pasture for cattle. The well-known term "Alderney cattle," however, has lost in great measure its former signification of a distinctive breed. Alderney is included in the bailiwick of Guernsey. It has a court consisting of a judge and six jurats, attorney-general, *prévot*, *greffierô* and *sergent;* but as a judicial court it is subordinate to that of Guernsey, and its administrative powers are limited to such matters as the upkeep of roads.

For its relations to the constitution of the bailiwick, and for the history of the island, see CHANNEL ISLANDS.

ALDERSHOT, an urban district in the Basingstoke parliamentary division of Hampshire, England, 34 m. S.W. by W. of London, on the London & South-Western and the South-Eastern & Chatham railways. It was a mere village till 1855, when Aldershot camp was established. Pop. (1891) 25,595; (1901) 30,974. Its germ is to be found in the temporary camp on Chobham Ridges, formed in 1853 by Lord Hardinge, the commander-in-chief, the success of which convinced him of the necessity of giving troops practical instruction in the field and affording the generals opportunities of manœuvring large bodies of the three arms. He therefore advised the purchase of a tract of waste land whereon a permanent camp might be established. His choice fell on Aldershot, a spot also recommended by strategic reasons, being situated on the flank of any army advancing upon London from the south. Nothing came of Lord Hardinge's proposal till the experience of the Crimean campaign fully endorsed his opinion. The lands at Aldershot, an extensive open heath country, sparsely dotted by fir-woods and intersected by the Basingstoke canal, were then acquired by the crown. Wooden huts were erected in 1855, and permanent buildings to replace them were begun in 1881. Under the Barracks Act 1890, and the Military Works Act of 1897 and 1899, large sums were provided for completing the work. The former division of North and South camps and permanent barracks no longer obtains. North camp is now named Marlborough Lines, with a field artillery barrack and five infantry barracks called after Marlborough's victories. South camp is now named Stanhope Lines, after Mr Stanhope, who was secretary of state for war when the Barracks Act 1890 was passed and the reconstruction commenced in earnest. They contain barracks for the Royal Engineers and Army Service Corps, the general parade, which stretches east and west, and five infantry barracks called after battles (other than those of Wellington), of the wars with France, 1793–1815. There are also barracks for the Royal Army Medical Corps. The old permanent barracks (which were built for the most part about 1857) have been renamed Wellington Lines, with cavalry and artillery barracks; and three infantry barracks called after Wellington's victories in the Peninsula. For the sick there are the Connaught Hospital in the Marlborough Lines, the Cambridge Hospital in Stanhope Lines, and the Union Hospital in Wellington Lines, besides the Louise Margaret Hospital for women and children and the isolated infection hospital.

The drainage of the station is all modern, and the sewage is disposed of on a sewage farm under the direction of the war department. The water supply is partly from the Aldershot Water Company, and partly from springs and reservoirs collecting water from a reserved area of war department property.

Most of the barracks can accommodate not only the units they are constructed for, but also detachments going through courses of instruction. The total of men, women and children for whom quarters are provided is at times as high as 24,000.

Besides the regimental buildings there are a large number of buildings for garrison purposes, such as quarters and offices for general, staff and departmental officers, with the warrant and non-commissioned officers employed under them; the supply depot with abattoir and bakery; the ordnance stores; barrack stores for furniture and bedding, shops and stores for R. E. services; the balloon establishment; the detention barracks; fire brigade stations; five churches; recreation grounds for officers and men; schools; and especially the military technical schools of army cooking, gymnastics, signalling, ballooning and of mounted infantry, Army Service Corps, Royal Army Medical Corps and veterinary duties. The work of these schools is, however, only a small part of the military training afforded at Aldershot; of greater importance is the field and musketry training, for the carrying out of which a considerable extent of land is essential. The land required for these purposes extends at present over an area about 9¼ m. in extreme length by 7¾ m. in extreme width. In addition to this there is the land at Sandhurst and the Staff College (Camberley) about 6½ m. distant, and at Woolmer Forest, 12 m. distant. The musketry practice of the troops at Aldershot is carried out at the Ash ranges, 2 m. east of the barracks, while the Pirbright ranges, alongside those of the National Rifle Association at Bisley, are utilized by the Household Cavalry and Guards, who are encamped there in succession. Suitable grounds in the vicinity of the barracks, of which Caesar's Camp, the Long Valley and Laffan's Plain are best known, are utilized for company, battalion and brigade training of infantry, while the mounted branches work over a wider area, and the engineers carry out their practices where most convenient. For the field-days of the combined arms, the whole of the war department property is available. Aldershot is the headquarters of the "Aldershot Army Corps," which is the largest organized force maintained in the United Kingdom.

Besides the troops in barracks, during the drill season there is often a considerable force in camp, both regular troops from other stations and militia and volunteer units, so that, including the regular garrison, sometimes as many as 40,000 troops have been concentrated at the station for training and manœuvres.

ALDHELM (*c.* 640–709), bishop of Sherborne, English scholar, was born before the middle of the 7th century. He is said to have been the son of Kenten, who was of the royal house of Wessex, but who was certainly not, as Aldhelm's early biographer Faritius asserts, the brother of King Ine. He received his first education in the school of an Irish scholar and monk, Maildulf, Mældubh or Meldun (d. *c.* 675), who had settled in the British stronghold of Bladon or Bladow on the site of the town called Mailduberi, Maldubesburg, Meldunesburg, &c., and finally Malmesbury,[1] after him. In 668 Pope Vitalian sent Theodore of Tarsus to be archbishop of Canterbury, and about the same time came the African scholar Hadrian, who became abbot of St Augustine's at Canterbury. Aldhelm was one of his disciples, for he addresses him as the "venerable preceptor of my rude childhood." He must, nevertheless, have been thirty years of age when he began to study with Hadrian. His studies included Roman law, astronomy, astrology, the art of reckoning and the difficulties of the calendar. He learned, according to the doubtful statements of the early lives, both Greek and Hebrew. He certainly introduces many Latinized Greek words into his works. Ill-health compelled him to leave Canterbury, and he returned to Malmesbury, where he was a monk under Maildulf for fourteen years, dating probably from 661, and including the period of his studies with Hadrian. When Maildulf died, Aldhelm was appointed in 675, according to a charter of doubtful authenticity cited by William of Malmesbury, by Leutherius, bishop of Dorchester from 671 to 676, to succeed to the direction of the monastery, of which he became the first abbot. He introduced the Benedictine rule, and secured the right of the election of the abbot to the monks themselves. The community at Malmesbury increased, and Aldhelm was able to found two other monasteries to be centres of learning at Frome and at Bradford on Avon. The little church of St Lawrence at Bradford dates back to his time and may safely be regarded as his. At Malmesbury he built a new church to replace Maildulf's modest building, and obtained considerable grants of land for the monastery. His fame as a scholar rapidly spread into other countries. Artwil, the son of an Irish king, submitted his writings for Aldhelm's approval, and Cellanus, an Irish monk from Peronne, was one of his correspondents. Aldhelm was the first Englishman, so far as we know, to write in Latin verse, and his letter to Acircius (Aldfrith or Eadfrith, king of Northumbria) is a treatise on Latin prosody for the use of his countrymen. In this work he included his most famous productions, 101 riddles in Latin hexameters. Each of them is a complete picture, and one of them runs to 83 lines. That his merits as a scholar were early recognized in his own country is shown by the encomium of Bede (*Eccl. Hist.* v. 18), who speaks of him as a wonder of erudition. His fame reached Italy, and at the request of Pope Sergius I. (687–701) he paid a visit to Rome, of which, however, there is no notice in his extant writings. On his return, bringing with him privileges for his monastery and a magnificent altar, he received a popular ovation. He was deputed by a synod of the church in Wessex to remonstrate with the Britons of Domnonia (Devon and Cornwall) on their differences from the Roman practice in the shape of the tonsure and the date of Easter. This he did in a long and rather acrimonious letter to their king Geraint (Geruntius), and their ultimate agreement with Rome is referred by William of Malmesbury to his efforts. In 705, or perhaps earlier, Hæddi, bishop of Winchester, died, and the diocese was divided into two parts. Sherborne was the new see, of which Aldhelm reluctantly became the first bishop. He wished to resign the abbey of Malmesbury which he had governed for thirty years, but yielding to the remonstrances of the monks he continued to direct it until his death. He was now an old man, but he showed great activity in his new functions. The cathedral church which he built at Sherborne, though replaced later by a Norman church, is described by William of Malmesbury. He was on his rounds in his diocese when he died in the church of Doulting on the 25th of May 709. The body was taken to Malmesbury, and crosses were set up by the pious care of his friend, Bishop Ecgwine of Worcester, at the various halting-places. He was buried in the church of St Michael. His biographers relate miracles due to his sanctity worked during his lifetime and at his shrine.

Aldhelm wrote poetry in Anglo-Saxon also, and set his own compositions to music, but none of his songs, which were still popular in the time of Alfred, have come down to us. Finding his people slow to come to church, he is said to have stood at the end of a bridge singing songs in the vernacular, thus collecting a crowd to listen to exhortations on sacred subjects. Aldhelm wrote in elaborate and grandiloquent Latin, which soon came to be regarded as barbarous. Much admired as he was by his contemporaries, his fame as a scholar therefore soon declined, but his reputation as a pioneer in Latin scholarship in England and as a teacher remains.

Aldhelm's works were collected in J. A. Giles's *Patres eccl. Angl.* (Oxford, 1844), and reprinted by J. P. Migne in his *Patrologiae Cursus*, vol. 89 (1850). The letter to Geraint, king of Domnonia, was supposed to have been destroyed by the Britons (W. of Malmesbury, *Gesta Pontificum*, p. 361), but was discovered with others of Aldhelm's in the correspondence of St Boniface, archbishop of Mainz. A long letter to Eahfrid, a scholar just returned from Ireland (first printed in *Usserii Veterum Epistt. Hiber. Sylloge*, 1632), is of interest as casting light on the relations between English and Irish scholars. Next to the riddles, Aldhelm's best-known work is *De Laude Virginitatis sive de Virginitate Sanctorum*, a Latin treatise addressed about 705 to the nuns of Barking,[2] in which he commemorates a great number of saints. This was afterwards turned by Aldhelm into Latin verse (printed by Delrio, Mainz, 1601). The chief source of his *Epistola ad Acircium sive liber de septenario, et de metris, aenigmatibus ac pedum regulis* (ed. A. Mai, *Class. Auct. vol.* v.) is Priscian. For the riddles included in it, his model was the collection known as *Symposii aenigmata*. The acrostic introduction gives the sentence, "Aldhelmus cecinit millenis versibus odas," whether read from the initial or final letters of the lines. His Latin poems include one on the dedication of a basilica built by Bugge (or Eadburga), a royal lady of the house of Wessex.

AUTHORITIES.—Faritius (d. 1117), an Italian monk of Malmesbury, afterwards abbot of Abingdon, wrote a *Vita S. Aldhelmi* (MS. Cotton, Faustina, B. 4), printed by Giles and Migne, also in *Original Lives of Anglo-Saxons* (Caxton Soc., 1854); but the best authority is William of Malmesbury, who in the fifth book, devoted to St Aldhelm, of the *Gesta Pontificum* proposes to fill up the outline of Faritius, using the church records, the traditions of Aldhelm's miracles preserved by the monks of Malmesbury, and the lost "Handboc" or commonplace book of King Alfred. His narrative is divided into four parts: the birth and attainments of Aldhelm, the religious houses he had established and endowed, the miracles recorded of him, and the history of the abbey down to the writer's own time (see *De Gestis Pontificum*, ed. N. E. S. A. Hamilton, 1870, for the Rolls Series, pp. 330–443). The life by John Capgrave in his *Legenda Nova* (1516) is chiefly an abridgment of Malmesbury's narrative. Consult also L. Bönhoff, *Aldhelm von Malmesbury* (Dresden, 1894); T. D. Hardy, *Descriptive Catalogue* (1862), vol. i. pp. 389–396; T. Wright, *Biog. Brit. Lit.* (A.-S. Period, 1842); G. F. Browne, bishop of Bristol, *St Aldhelm; his Life and Times* (1903); and W. B. Wildman, *Life of S. Ealdhelm, first Bishop of Sherborne* (1905), containing many interesting local details. For some poems attributed to Aldhelm, and printed in Dümmler's edition of the letters of St Boniface and Lul in *Monumenta Germaniae Historica* (epistt. tom. iii.), see H. Bradley in *Eng. Hist. Review*, xv. p. 291 (1900), where they are attributed to Aldhelm's disciple Æthilwald. The very varied sources and the chronology of Aldhelm's work are discussed in "Zu Aldhelm und Baeda," by Max Manitius, in *Sitzungsberichte der kaiserlichen Akad. der Wissenschaften* (Vienna, 1886).

An excellent account of his ecclesiastical importance is given by W. Bright in *Chapters on Early English Church History* (Oxford, 1878). For his position as a writer of Latin verse consult A. Ebert, *Allgemeine Geschichte d. Literatur des Mittelalters im Abendlande*, vol. i. new edition (1889); M. Manitius, *Geschichte der christlich-lateinischen Poesie &c.* (Stuttgart, 1891), pp. 487-496; also H. Hahn, *Bonifaz und Lul ihre angelsächsischen Korrespondenten*, chap. i. (Leipzig, 1883). The two last-named works contain many further bibliographical references.

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[1] For the disputed etymology of Malmesbury, which some connect with Aldhelm's name, see Bishop Browne, *St Aldhelm: his Life and Times*, p. 73.

[2] Cuthburga, sister of King Ine of Wessex, and therefore related to Aldhelm, left her husband Aldfrith, king of Northumbria, to enter the nunnery at Barking. She afterwards founded the nunnery of Wimborne, of which she became abbess.

ALDINE PRESS, the printing office started by Aldus Manutius at the end of the 15th century in Venice, from which were issued the celebrated Aldine editions of the classics of that time. (See Manutius.) The Aldine Press is famous in the history of typography (*q.v.*), among other things, for the introduction of italics.

ALDINI, GIOVANNI (1762–1834), Italian physicist, born at Bologna on the 10th of April 1762, was a brother of the statesman Count Antonio Aldini (1756–1826) and nephew of L. Galvani, whose treatise on muscular electricity he edited with notes in 1791. He became professor of physics at Bologna in 1798, in succession to his teacher Sebastiano Canterzani (1734–1819). His scientific work was chiefly concerned with galvanism and its medical applications, with the construction and illumination of lighthouses, and with experiments for preserving human life and material objects from destruction by fire. He wrote in French and English in addition to his native Italian. In recognition of his merits, the emperor of Austria made him a knight of the Iron Crown and a councillor of state at Milan, where he died on the 17th of January 1834. He left by will a considerable sum to found a school of natural science for artisans at Bologna.

ALDRED, or Ealdred (d. 1069), English ecclesiastic, became abbot of Tavistock about 1027, in 1044 was made bishop of Worcester, and in 1060 archbishop of York. He had considerable influence over King Edward the Confessor, and as his interests were secular rather than religious he took a prominent part in affairs of state, and in 1046 led an unsuccessful expedition against the Welsh. In 1050 he was largely instrumental in restoring Sweyn, the son of Earl Godwin, to his earldom, and about the same time went to Rome "on the king's errand." In 1054 he was sent to the emperor Henry III. to obtain that monarch's influence in securing the return to England of Edward, son of Edmund Ironside, who was in Hungary with King Andrew I. In this mission he was successful and obtained some insight into the working of the German church during a stay of a year with Hermann II., archbishop of Cologne. After his return to England he took charge of the sees of Hereford and Ramsbury, although not appointed to these bishoprics; and in 1058 made a pilgrimage to Jerusalem, being the first English bishop to take this journey. Having previously given up Hereford and Ramsbury, Aldred was elected archbishop of York in 1060, and in 1061 he proceeded to Rome to receive the pallium. On his arrival there, however, various charges were brought against him by a synod, and Pope Nicholas II. not only refused his request but degraded him from the episcopate. The sentence was, however, subsequently reversed, and Aldred received the pallium and was restored to his former station. It is stated by Florence of Worcester that Aldred crowned King Harold II. in 1066, although the Norman authorities mention Stigand as the officiating prelate. After the battle of Hastings Aldred joined the party who sought to bestow the throne upon Edgar the Ætheling, but when these efforts appeared hopeless he was among those who submitted to William the Conqueror at Berkhampstead. Selected to crown the new king he performed the ceremony on Christmas Day 1066, and in 1068 performed the same office at the coronation of Matilda, the Conqueror's wife. But though often at court, he seems to have been no sympathiser with Norman oppression, and is even said to have bearded the king himself. He died at York on the 11th of September 1069 and was buried in his own cathedral. Aldred did much for the restoration of discipline in the monasteries and churches under his authority, and was liberal in his gifts for ecclesiastical purposes. He built the monastic church of St Peter at Gloucester, and rebuilt a large part of that of St John at Beverley. At his instigation, Folcard, a monk of Canterbury, wrote the *Life of St John of Beverley*.

See *The Anglo-Saxon Chronicle*, edited by C. Plummer (Oxford, 1892–1899); Florence of Worcester, *Chronicon ex Chronicis*, edited by B. Thorpe (London, 1848–1849); William of Malmesbury, *De Gestis Pontificum Anglorum*, edited by N. E. S. A. Hamilton (London, 1870); W. H. Dixon, *Fasti Eboracenses*, vol. i., edited by J. Raine (London, 1863); T. Stubbs, *Chronica Pontificum Ecclesiae Eboracensis*, edited by J. Raine (London, 1879–1894); E. A. Freeman, *History of the Norman Conquest*, vols. ii., iii., iv. (Oxford, 1867–1879).

ALDRICH, HENRY (1647–1710), English theologian and philosopher, was born in 1647 at Westminster, and was educated at the collegiate school there, under Dr Busby. In 1662 he entered Christ Church, Oxford, and in 1689 was made dean in succession to the Roman Catholic, John Massey, who had fled to the continent. In 1692 he was vice-chancellor of the University. In 1702 he was appointed rector of Wem in Shropshire, but continued to reside at Oxford, where he died on the 14th of December 1710. He was buried in the cathedral without any memorial at his own desire. Aldrich was a man of unusually varied gifts. A classical scholar of fair merits, he is best known as the author of a little book on logic (*Compendium Artis Logicae*), a work of little value in itself, but used at Oxford (in Mansel's revised edition) till long past the middle of the 19th century. Aldrich also composed a number of anthems and church services of high merit, and adapted much of the music of Palestrina and Carissimi to English words with great skill and judgment. To him we owe the well-known catch, "Hark, the bonny Christ Church bells." Evidence of his skill as an architect may be seen in the church and campanile of All Saints, Oxford, and in three sides of the so-called Peckwater Quadrangle of Christ Church, which were erected after his designs. He bore a great reputation for conviviality, and wrote a humorous Latin version of the popular ballad—

A soldier and a sailor,
A tinker and a tailor, &c.

Another specimen of his wit is furnished by the following epigram of the five reasons for drinking:—

Si bene quid memini, causae sunt quinque bibendi;
Hospitis adventus, praesens sitis atque futura,
Aut vini bonitas, aut quaelibet altera causa.

The translation runs:—

If on my theme I rightly think,
There are five reasons why men drink:—
Good wine; a friend; because I'm dry;
Or lest I should be by and by;
Or—any other reason why.

ALDRICH, NELSON WILMARTH (1841–), American politician, was born at Foster, Rhode Island, on the 6th of November 1841. His first political service was as a member (1869–1875) and president (1871–1872) of the Providence common council. He was a member of the lower house of the Rhode Island legislature in 1875 and 1876, and speaker in the latter year. By this time he had become a power in Republican state politics, and in 1878 and 1880 was elected to Congress. Early in his second term he was chosen United States senator, and was re-elected in 1886, 1892, 1898 and 1905. In the Senate he was looked upon as the special representative of the high protective industries and moneyed interests, and he took a prominent part in all legislation dealing with the tariff, banking and the merchant marine.

ALDRICH, THOMAS BAILEY (1836–1907), American author, was born in Portsmouth, New Hampshire, on the 11th of November 1836. When he was but a child his father moved to New Orleans, but after ten years the boy was sent back to Portsmouth—the "Rivermouth" of several of his stories—to prepare for college. This period of his life is partly described in his *Story of a Bad Boy* (1870), of which "Tom Bailey" is the juvenile hero.[1] His father's death in 1852 compelled Aldrich to abandon the idea of college and enter a business office in New York. Here he soon became a constant contributor to the newspapers and magazines, and the intimate friend of the young poets, artists and wits of the metropolitan Bohemia of the early 'sixties, among whom were E. C. Stedman, R. H. Stoddard, Bayard Taylor and Walt Whitman. From 1856 to 1859 he was on the staff of the *Home Journal*, then edited by N. P. Willis, while during the Civil War he was himself editor of the *New York Illustrated News*. In 1865 he moved to Boston and was editor for ten years for Ticknor and Fields—then at the height of their prestige—of the eclectic weekly *Every Saturday*, discontinued in 1875. From 1881 to 1890 he was editor of the *Atlantic Monthly*. Meanwhile Aldrich had written much, both in prose and verse. His genius was many-sided, and it is surprising that so busy an editor and so prolific a writer should have attained the perfection of form for which he was remarkable. His successive volumes of verse, chiefly *The Ballad of Babie Bell* (1856), *Pampinea, and Other Poems* (1861), *Cloth of Gold* (1874), *Flower and Thorn* (1876), *Friar Jerome's Beautiful Book* (1881), *Mercedes and Later Lyrics* (1883), *Wyndham Towers* (1889), and the collected editions of 1865, 1882, 1897 and 1900, showed him to be a poet of lyrical skill, dainty touch and felicitous conceit, the influence of Herrick being constantly apparent. He repeatedly essayed the long narrative or dramatic poem, but seldom with success, save in such earlier work as *Garnaut Hall*. But no American poet has shown more skill in describing some single picture, mood, conceit or episode. His best things are such lyrics as "Hesperides," "When the Sultan goes to Ispahan," "Before the Rain," "Nameless Pain," "The Tragedy," "Seadrift," "Tiger Lilies," "The One White Rose," "Palabras Cariñosas," "Destiny," or the eight-line poem "Identity," which did more to spread Aldrich's reputation than any of his writing after *Babie Bell*. Beginning with the collection of stories entitled *Marjorie Daw and Other People* (1873), Aldrich applied to his later prose work that minute care in composition which had previously characterized his verse—taking a near, new or salient situation, and setting it before the reader in a pretty combination of kindly realism and reticent humour. In the novels, *Prudence Palfrey* (1874), *The Queen of Sheba* (1877), and *The Stillwater Tragedy* (1880), there is more rapid action; but the Portsmouth pictures in the first are elaborated with the affectionate touch shown in the shorter humourous tale, *A Rivermouth Romance* (1877). In *An Old Town by the Sea* (1893) the author's birthplace was once more commemorated, while travel and description are the theme of *From Ponkapog to Pesth* (1883). Aldrich died at Boston on the 19th of March 1907.

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[1] This book has been translated into French as *Education et récréation*, and into German as a specimen of American humour.

His Life was written by Ferris Greenslet (1908).

ALDRINGER (Altringer, Aldringen), **JOHANN,** Count von (1588–1634), Austrian soldier, was born at Diedenhofen (Thionville) in Lorraine. After travelling as page to a nobleman in France, Italy and the Netherlands, he went to the university of Paris. In 1606 he entered the service of Spain, in which he remained until 1618, when he joined the imperial army. Here he distinguished himself in the field and in the cabinet. Made a colonel in 1622, two years later he was employed on the council of war and on diplomatic missions. At the bridge of Dessau in 1626 he performed very distinguished service against Ernst von Mansfeld. He and his constant comrade Matthias Gallas (*q.v.*) were ennobled on the same day, and in the course of the Italian campaign of 1630 the two officers married the two daughters of Count d'Arco. Aldringer served as Count Rambold Collalto's major-general in this campaign and was present at the taking of Mantua. The plunder of the duke of Mantua's treasures made Gallas and Aldringer wealthy men. Back in Germany in 1631, he served after Breitenfeld as Tilly's artillery commander, and, elevated to the dignity of count of the Empire, he was present at the battle of the Lech, where he was wounded. When Tilly died of his wounds Aldringer succeeded to the command. Made field-marshal after the assault of the Alte Veste near Nuremberg, at which he had been second in command under Wallenstein, duke of Friedland (with whom he was a great favourite), he was next placed at the head of the corps formed by Maximilian I. of Bavaria to support Wallenstein. In this post his tact and diplomatic ability were put to a severe test in the preservation of harmony between the two dukes. Finally Count Aldringer was won over by the court party which sought to displace the too successful duke of Friedland. After Wallenstein's death Aldringer commanded against the Swedes on the Danube, and at the defence of Landshut he fell (July 22, 1634). His great possessions descended to his sister, and thence to the family of Clary and Aldringen.

See Brohm, *Johann von Aldringen* (Halle, 1882), and Hermann Hallwich, *Johann von Aldringen* (Leipzig, 1885); also *Allgemeine Deutsche Biographie*, s.v. Gallas, correcting earlier biography of Aldringer in the same work.

ALDROVANDI, ULISSI (1522–1605), Italian naturalist, was born of noble parentage at Bologna on the 11th of September 1522. He was apprenticed to a merchant in Brescia, but a commercial career being distasteful to him, he turned his attention to law and medicine, studying first in his native town and afterwards at Padua. In 1550 he was accused of heresy, but succeeded in clearing himself before the Inquisition. In 1553 he took his doctor's degree in medicine at Bologna, and in the following year was appointed professor of philosophy and also lecturer on botany at the university. In 1560 he was transferred to the chair of natural history. At his instance the senate of Bologna established in 1568 a botanical garden, of which he was appointed the first director. About the same time he became inspector of drugs, and in that capacity published in 1574 a work entitled *Antidotarii Bononiensis Epitome*, which formed the model for many subsequent pharmacopoeias. He was also instrumental in founding the public museum of Bologna, which contains, especially in the natural history department, a large number of specimens collected by him. The results of his various researches were embodied in a *magnum opus*, which was designed to include everything that was known about natural history. The first three volumes, comprising his ornithology, were published in 1599, and a fourth, treating of insects, appeared in 1602. After his death a number of other volumes were compiled from his manuscript materials, under the editorship of several of his pupils, to whom the task was entrusted by the senate of Bologna. The work was enriched by a large number of illustrations prepared at great expense, the author having, it is said, employed several celebrated artists for thirty years. Among these were Lorenzo Benini of Florence and Christopher Coriolanus of Nuremberg. It has been said, indeed, that the cost of the undertaking was so great as to exhaust its author's means, and that he died penniless and blind in the public hospital of Bologna. This, however, is probably incorrect, at least as regards the allegation of poverty. Published records of the senate of Bologna show that it liberally supported Aldrovandi in his undertaking, doubling his salary soon after his appointment as professor, and bestowing on him from time to time sums amounting in all to 40,000 crowns. If, therefore, he died in the public hospital, he probably went there for the better treatment of his disease. His death occurred on the 10th of May 1605. Aldrovandi was chiefly remarkable for laborious and patient research. He seems to have been totally destitute of the critical faculty, and hardly any attempt is made in his great work to classify facts or to distinguish between the true and the fabulous, the important and the trivial. Much is thus included that is of no scientific value, but it also contains much information of very great interest to the naturalist.

ALE, an old word for a fermented liquor obtained chiefly from malt. In England "ale" is nowadays practically synonymous with "beer." Before the introduction of hops into England from Flanders in the 16th century ale was the name exclusively applied to malt liquor, the term beer being gradually introduced to describe liquor brewed with an infusion of hops. This distinction does not apply at the present time, except in so far as the term ale is not applied to black beers (stout and porter) nor to lager beer. In the United States, however, it is customary to confine the designation beer to the article obtained by the bottom fermentation process. In former times the Welsh and Scots had two distinct kinds of ale, called common and spiced ales, the relative values of which were appraised by law in the following terms: "If a farmer have no mead, he shall pay two casks of spiced ale, or four casks of common ale, for one cask of mead." There are numerous varieties of English ales, such as mild ale, which is a full, sweetish beer, of a dark colour and with relatively little hop; pale ale, which is relatively dry, of light colour and of a more pronounced hop flavour than the mild ale;

and bitter and stock ales, the latter term being generally reserved for superior beers, such as are used for bottling. The terms pale, bitter, stock, light, &c., are to be regarded as trade distinctions and not as exact definitions of quality or type. (See BEER and BREWING.)

Parish Ales.—In old England an "ale" was synonymous with a parish festival or merry-making at which ale was the chief drink. The word was generally used in composition. Thus there were leet-ales (that held on leet or manorial court day); lamb-ales (that held at lamb-shearing); Whitsun-ales, clerk-ales, church-ales and so on. The word *bridal* is really bride-ale, the wedding feast. Bid-ales, once very common throughout England, were "benefit" feasts to which a general invitation was given, and all the neighbours attending were expected to make some contribution to help the object of the "benefit." (See "Bidding-Weddings" under BRIDE.) These parish festivals were of much ecclesiastical and social importance in medieval England. The chief purpose of church-ales and clerk-ales, at least, was to facilitate the collection of parish-dues, or to make an actual profit for the church from the sale of the liquor by the church wardens. These profits kept the parish church in repair, or were distributed as alms to the poor. At Sygate, Norfolk, on the gallery of the church is inscribed—

God speed the plough
And give us good ale enow . . .
Be merry and glade,
With good ale was this work made.

On the beam of a screen in the church of Thorpe-le-Soken, Essex, is the following inscription in raised Gothic letters, on a scroll held by two angels—"This cost is the bachelers made by ales thesn be ther med." The date is about 1480. The feast was usually held in a barn near the church or in the churchyard. In Tudor times church-ales were held on Sundays. Gradually the parish-ales were limited to the Whitsun season, and these still have local survivals. The colleges of the universities used formerly to brew their own ales and hold festivals known as college-ales. Some of these ales are still brewed and famous, like "chancellor" at Queen's College, and "archdeacon" at Merton College, Oxford, and "audit ale" at Trinity, Cambridge.

See Brand's *Popular Antiquities of Great Britain* (Wm. Carew Hazlitt's edition, 1905).

ALEANDRO, GIROLAMO (HIERONYMUS ALEANDER) (1480–1542), Italian cardinal, was born at Motta, near Venice, on the 13th of February 1480. He studied at Venice, where he became acquainted with Erasmus and Aldus Manutius, and at an early age was reputed one of the most learned men of the time. In 1508 he went to Paris on the invitation of Louis XII. as professor of *belles lettres*, and held for a time the position of rector in the university. Entering the service of Eberhard, prince-bishop of Liége, he was sent by that prelate on a mission to Rome, where Pope Leo X. retained him, giving him (1519) the office of librarian of the Vatican. In the following year he went to Germany to be present as papal nuncio at the coronation of Charles V., and was also present at the diet of Worms, where he headed the opposition to Luther, advocating the most extreme measures to repress the doctrines of the reformer. His conduct evoked the fiercest denunciations of Luther, but it also displeased more moderate men and especially Erasmus. The edict against the reformer, which was finally adopted by the emperor and the diet, was drawn up and proposed by Aleandro. After the close of the diet the papal nuncio went to the Netherlands, where he kindled the flames of persecution, two monks of Antwerp, the first martyrs of the Reformation, being burnt in Brussels at his instigation. In 1523 Clement VII., having appointed him archbishop of Brindisi and Oria, sent him as nuncio to the court of Francis I. He was taken prisoner along with that monarch at the battle of Pavia (1525), and was released only on payment of a heavy ransom. He was subsequently employed on various papal missions, especially to Germany, but was unsuccessful in preventing the German princes from making a truce with the reformers, or in checking to any extent the progress of the new doctrines. He was created cardinal in 1536 by Paul III. (at the same time as Reginald Pole) and died at Rome on the 1st of February 1542.

Aleandro compiled a *Lexicon Graeco-Latinum* (Paris, 1512), and wrote Latin verse of considerable merit inserted in M. Tuscanus's *Carmina Illustrium Poetarum Italiorum.* The Vatican library contains a volume of manuscript letters and other documents written by him in connexion with his various missions against Luther. They were utilized by Pallavicino in his *Istoria del Concilio Tridentino* (i. 23-28), who gives a very partial account of the Worms conference.

Aleandro, who is sometimes called "the elder," must be distinguished from his grand-nephew, also called Girolamo Aleandro (1574–1629). The younger Aleandro was a very distinguished scholar, and wrote *Psalmi poenitentiales versibus elegiacis expressi* (Treves, 1593), *Gaii, veteris juris consulti Institutionum fragmenta, cum commentario* (Venice, 1600), *Explicatio veteris tabulae marmoreae solis effigie symbolisque exculptae* (Rome, 1616).

ALEARDI, ALEARDO, COUNT (1812–1878), Italian poet, was born at Verona on the 4th of November 1812, and thus soon after his birth became an Austrian subject. Inspired from his cradle with a hatred of the foreigner, he found himself disqualified for the position in the public service to which his rank would have entitled him, and unable to publish his patriotic verses. *Arnaldo da Rocca*, a narrative poem, nevertheless appeared in 1842, and the revolutionary year 1848 made an opening for his *Lettere a Maria.* He took an active part in the popular uprising, and was for some time imprisoned. In 1856 he produced the finest of his pieces, an ode to the maritime cities of Italy, and in 1858 a poem on his own misfortunes. After the expulsion of the Austrians from Lombardy he returned to Verona, published his poems in a collected edition (1862), became professor at the Academy of Fine Art, member of the Italian parliament and eventually senator. He died on the 17th of July 1878. Aleardi's warmth of patriotic feeling hardly finds adequate expression in his poetry; it is his merit to excel in description, but his fault to substitute description for action.

ALE-CONNER, an officer appointed yearly at the court-leet of ancient English manors for the assize of ale and ale-measures. The *gustatores cervisiae*—called in different localities by the different names "ale-tasters," "ale-founders," and "ale-conners"—were sworn to examine beer and ale, to take care that they were good and wholesome and were sold at proper prices. In London four ale-conners, whose duty it is to examine the measures used by beer and liquor sellers to guard against fraud, are still chosen annually by the liverymen in common hall assembled on Midsummer Day. Since ale and beer have become excisable commodities the custom of appointing ale-tasters has in most places fallen into disuse. (See also ADULTERATION.)

ALECSANDRI, or ALEXANDRI, **VASILE** (1821–1890), Rumanian lyric poet, was born at Bacau in Moldavia on the 21st of July 1821. His father was the Spatar Alecsandri, of Jewish and Italian origin, who had settled in Moldavia in the 18th century. Vasile was educated first in Jassy and afterwards (1834–1839) in Paris. In 1839 he started on a long journey through the Carpathian Mountains, and was the first to collect Rumanian popular songs, no doubt influenced by Western examples. He first published his collection in 1844. His *Doine şi Lacrimioare*, lyrical poems, appeared at Paris in 1852, and in 1852–1853 he produced at Jassy a fuller collection of popular ballads and songs. He then adapted some French plays for the newly founded Rumanian theatre, and wrote some original pieces. His connexion with the revolutionary movement of 1848 compelled him to seek shelter in the west of Europe, and he visited England, where a beautifully illuminated edition of his poems was printed in the original Rumanian language. In 1867 he published some fugitive pieces, written in a lighter vein, and entitled *Pastele*; these were followed in 1871 by the *Legende* of similar character. More serious are his dramatic writings which began with *Despot Voda* and culminated in *Ovid.* In later life Alecsandri took an active part in politics; he became minister for foreign affairs from 1859 to 1860, and in 1885 was appointed Rumanian minister in Paris. He died on the 26th of August 1890 at his country seat, Mirceşti. His best title to fame consists in the fact that he gave the first impetus to the collection of Rumanian popular songs and first drew attention to their inimitable charm.

See L. Şainsanu, *Autorii Români moderni* (1891), pp. 90 and 318. A complete edition of Alecsandri's writings in nine volumes was published at Bucharest in 1875 seq. (M. G.)

ALEMAN, LOUIS (*c.* 1390–1450), French cardinal, was born of a noble family at the castle of Arbent near Bugey about the year 1390. He was successively bishop of Maguelonne (1418), archbishop of Arles (1423) and cardinal priest of St Cecilia (1426). He was a prominent member of the council of Basel, and, together with Cardinal Julian, led the party which maintained the supremacy of general councils over the pope's authority. In 1440 Aleman obtained the support of the emperor Sigismund and of the duke of Milan to his views, and proclaiming the deposition of Pope Eugenius IV., placed the tiara upon the head of Amadeus VIII., duke of Savoy (henceforward known as antipope Felix V.). Eugenius retorted by excommunicating the antipope and depriving Aleman of all his ecclesiastical dignities. In order to make an end of the schism, Felix V. finally abdicated on Aleman's advice, and Nicholas V., who had succeeded in 1447, restored the cardinal to all his honours and employed him as legate to Germany in 1449. On his return he retired to his diocese of Arles, where he devoted himself zealously to the instruction of his people. He died on the 16th of September 1450, and was beatified by Pope Clement VII. in 1527.

See U. Chevalier, *Répert. des sources hist.* (Paris, 1905), p. 130.

ALEMÁN, MATEO (1547–1609?), Spanish novelist and man of letters, was born at Seville in 1547. He graduated at Seville University in 1564, studied later at Salamanca and Alcalá, and from 1571 to 1588 held a post in the treasury; in 1594 he was arrested on suspicion of malversation, but was speedily released. In 1599 he published the first part of *Guzmán de Alfarache*, a celebrated picaresque novel which passed through not less than sixteen editions in five years; a spurious sequel was issued in 1602, but the authentic continuation did not appear till 1604. In 1608 Alemán emigrated to America, and is said to have carried on business as a printer in Mexico; his *Ortografía castellana* (1609), published in that city, contains ingenious and practical proposals for the reform of Spanish spelling. Nothing is recorded of Alemán after 1609, but it is sometimes asserted that he was still living in 1617. He married, unhappily, Catalina de Espinosa in 1571, and was constantly in money difficulties, being imprisoned for debt at Seville at the end of 1602. He is the author of a life (1604) of St Antony of Padua, and versions of two odes of Horace bear witness to his taste and metrical accomplishment. His chief title to remembrance, however, is *Guzmán de Alfarache*, which was translated into French in 1600, into English in 1623 and into Latin in 1623.

See J. Hazañas y la Rua, *Discursos leidos en la Real Academia Sevillana de Buenas letras el 25 de marzo de 1892* (Sevilla, 1892); J. Gestoso y Perez, *Nuevos datos para ilustrar las biografías del Maestro Juan de Malara y de Mateo Alemán* (Sevilla, 1896). (J. F.-K.)

ALEMBERT, JEAN LE ROND D' (1717–1783), French mathematician and philosopher, was born at Paris in November 1717. He was a foundling, having been exposed near the church of St Jean le Rond, Paris, where he was discovered on the 17th of November. It afterwards became known that he was the illegitimate son of the chevalier Destouches and Madame de Tencin. The infant was entrusted to the wife of a glazier named Rousseau who lived close by. He was called Jean le Rond from the church near which he was found; the surname Alembert was added by himself at a later period. His father, without disclosing himself, having settled an annuity on him, he was sent at four years of age to a boarding-school. In 1730 he entered the Mazarin College under the Jansenists, who soon perceived his exceptional talent, and, prompted perhaps by a commentary on the Epistle to the Romans which he produced in the first year of his philosophical course, sought to direct it to theology. His knowledge of the higher mathematics was acquired by his own unaided efforts after he had left the college. This fact naturally led to his crediting himself with many discoveries which he afterwards found had been already established, often by more direct and elegant processes than his own.

On leaving college he returned to the house of his foster-mother, where he continued to live for thirty years. Having studied law, he was admitted as an advocate in 1738, but did not enter upon practice. He next devoted himself to medicine, but his natural inclination proved too strong for him, and within a year he resolved to give his whole time to mathematics. In 1741 he received his first public distinction in being admitted a member of the Academy of Sciences, to which he had previously presented several papers, including a *Mémoire sur le calcul intégral* (1739). In his *Mémoire sur le réfraction des corps solides* (1741) he was the first to give a theoretical explanation of the phenomenon which is witnessed when a body passes from one fluid to another more dense in a direction not perpendicular to the surface which separates the two fluids. In 1743 he published his *Traité de dynamique*, a work famous as developing the mechanical principle, known as "Alembert's Principle," first enunciated in 1742 (see MECHANICS). In 1744 Alembert applied this principle to the theory of the equilibrium and the motion of fluids (*Traité de l'équilibre et du mouvement des fluides*), and all the problems before solved by geometricians became in some measure its corollaries. This discovery was followed by that of the calculus of partial differences, the first trials of which were published in his *Réflexion sur la cause générale des vents* (1747). This work was crowned by the Academy of Berlin, and was dedicated to Frederick the Great, who made several unsuccessful attempts to induce him to settle in Berlin. In 1763 he visited Berlin, and on that occasion finally refused the office of president of the Academy of Berlin, which had been already offered to him more than once. In 1747 he applied his new calculus to the problem of vibrating chords, the solution of which, as well as the theory of the oscillation of the air and the propagation of sound, had been given but incompletely by the geometricians who preceded him. In 1749 he furnished a method of applying his principles to the motion of any body of a given figure; and in 1754 he solved the problem of the precession of the equinoxes, determined its quantity and explained the phenomenon of the nutation of the earth's axis. In 1752 he published an *Essai d'une nouvelle théorie sur la résistance des fluides*, which contains a large number of original ideas and new observations. In 1746 and 1748 he published in the *Memoirs* of the Academy of Berlin "Recherches sur le calcul intégral," a branch of mathematical science which is greatly indebted to him. In his *Recherches sur différents points importants du système du monde* (1754–1756) he perfected the solution of the problem of the perturbations of the planets, which he had presented to the academy some years before.

Alembert's association with Diderot in the preparation of the *Dictionnaire Encyclopédique* led him to take a somewhat wider range than that to which he had previously confined himself. He wrote for that work the *Discours préliminaire* on the rise, progress and affinities of the various sciences, which he read to the French Academy on the day of his admission as a member, the 18th of December 1754. He also wrote several literary articles for the first two volumes of the Encyclopaedia, and to the remaining volumes he contributed mathematical articles chiefly. One of the few exceptions was the article on "Geneva," which involved him in a somewhat keen controversy in regard to Calvinism and the suppression of theatrical performances within the town. During the time he was engaged on the Encyclopaedia he wrote a number of literary and philosophical works which extended his reputation and also exposed him to criticism and controversy, as in the case of his *Mélanges de Philosophie, d'Histoire, et de Littérature*. His *Essai sur la société des gens de lettres avec les grands* was a worthy vindication of the independence of literary men, and a thorough exposure of the evils of the system of patronage. He broke new ground and showed great skill as a translator in his *Traduction de quelques morceaux choisis de Tacite*. One of his most important works was the *Élements de Philosophie* published in 1759, in which he discussed the principles and methods of the different sciences. He maintained that the laws of motion were necessary, not contingent. A treatise, *Sur la destruction des Jésuites* (1765), involved him in a fresh controversy, his own share in which was rendered very easy by the violence and extravagance of his adversaries. The list of his more noteworthy literary works is completed by the mention of the *Histoire des membres de l'Académie française*, containing biographical notices of all the members of the Academy who died between 1700 and 1772, the year in which he himself became secretary. Alembert was much interested in music both as a science and as an art, and wrote *Éléments de musique théorique et pratique* (1779), which was based upon the system of J. P. Rameau with important modifications and differences.

Alembert's fame spread rapidly throughout Europe and procured for him more than one opportunity of quitting the comparative retirement in which he lived in Paris for more lucrative and prominent positions. The offer of Frederick the Great has already been mentioned. In 1762 he was invited by Catherine of Russia to become tutor to her son at a yearly salary of 100,000 francs. On his refusal the offer was repeated with the additional inducement of accommodation for as many of his friends as he chose to bring with him to the Russian capital. Alembert persisted in his refusal, and the letter of Catherine was ordered to be engrossed in the minutes of the French Academy. In 1755, on the recommendation of Pope Benedict XIV., he was admitted a member of the Institute of Bologna. A legacy of £200 from David Hume showed the esteem in which he was held by that philosopher.

Alembert continued to the end to lead the quiet and frugal life dictated by his limited means as well as his simple tastes. His later years were saddened by circumstances connected with a romantic attachment he had formed for Mademoiselle de Lespinasse, whose acquaintance he made at the house of Madame du Deffand, a noted resort of literary men and savants. She nursed him assiduously during an illness he had in 1765, and from that period till her death in 1776 they lived in the same house without any scandal. On her part there seems to have been from first to last nothing more than warm friendship, but his feelings towards her were of a stronger kind and her death deeply affected him. He never recovered his elasticity of spirits, though he continued to occupy himself with his favourite pursuits, and to frequent the society of his brother philosophers. After the death of Voltaire (1778), whose friend and correspondent he had been for more than thirty years, he was regarded as the leader of the philosophical party in the Academy. He died at Paris on the 29th of October 1783.

The chief features of Alembert's character were benevolence, simplicity and independence. Though his income was never large, and during the greater part of his life was very meagre, he contrived to find means to support his foster-mother in her old age, to educate the children of his first teacher, and to help various deserving students during their college career. His cheerful conversation, his smart and lively sallies, a singular mixture of malice of speech with goodness of heart, and of delicacy of wit with simplicity of manners, rendered him a pleasing and interesting companion; and if his manner was sometimes plain almost to the extent of rudeness, it probably set all the better an example of a much-needed reform to the class to which he belonged. The controversy as to the nature of his religious opinions, arising as it did chiefly out of his connexion with the Encyclopaedia, has no longer any living interest now that the Encyclopaedists generally have ceased to be regarded with unqualified suspicion by those who count themselves orthodox. It is to be observed, moreover, that as Alembert confined himself chiefly to mathematical articles, his work laid him less open to charges of heresy and infidelity than that of some of his associates. The fullest revelation of his religious convictions is given in his correspondence with Voltaire, which was published along with that with Frederick the Great in Bossange's edition of his works.

The scientific works of Alembert have never been published in a collected form. The most important of them have been mentioned above, with the exception of the *Opuscules mathématiques* (1761–1780), 8 vols. 4to. His literary and philosophical works were collected and edited by Bastien (Paris, 1805, 18 vols. 8vo). A better edition by Bossange was published at Paris in 1821 (5 vols. 8vo). The best account of the life and writings of Alembert is contained in Condorcet's *Éloge*, presented to the Academy and published in 1784.

ALEMBIC (Arab. *al*, definite article, *anbiq*, a still; cognate to the Gr. ἄμβιξ, a cup), an apparatus for distillation, used chiefly by the alchemists, and now superseded by the retort and the worm-still. It varied considerably in form and construction, but consisted essentially of three parts—a vessel containing the material to be distilled and called, from its gourd-like shape, the cucurbit or mattrass; a vessel to receive and condense the vapour, called the head or capital; and a receiver for the spirit, connected by a pipe with the capital. The entire apparatus was sometimes constructed of glass, but it was more usual to make the cucurbit of copper or earthenware, and the capital alone of glass.

ALEMTEJO (*i.e.* "Beyond the Tagus"), an ancient province of central and southern Portugal; bounded on the N. by Beira, E. by Spanish Estremadura and Andalusia, S. by Algarve and W. by the Atlantic Ocean and Portuguese Estremadura. Pop. (1900) 416,105; area 9219 sq. m. Alemtejo is traversed by several mountain ranges, whose height does not generally rise much above 2000 ft. The low and sandy coast has a length of less than 25 m. and includes no harbour, except at the unimportant town of Villa Nova de Milfontes (pop. 1900, 825), which overlooks the Mira estuary. The principal rivers are the Tagus, which divides Alemtejo from Beira; its tributary the Zatas, or Sorraia, fed by a whole system of lesser affluents; the Guadiana, which, crossing the Spanish frontier, flows southwards through the province; the Sado, which rises in the Serra de Monchique, and flows to the north; and the Mira, which waters the valley between the Caldeirão and Monchique ranges. There are several extensive plains, notably those of Alemtejo, lying south-west of the Serra de Portalegre; of Beja, between the Sado and Guadiana; and of Ourique, farther south between the same rivers. Some portions of these plains are fruitful, others marshy, while large tracts are mere desolate wastes.

The climate in the lower parts of the country is exceedingly hot and is rendered unhealthy in summer by the stagnant marshes. Towards the Spanish frontier the soil is fertile, and in the south the country is covered by extensive forests of oak, pine, chestnut, cork and ilex, especially on the sides of the Mezquita and Caldeirão ranges. In the more fertile parts, grapes, figs, citrons, pomegranates and other fruits are produced. Wheat, maize and rice are grown, and some attention is given to the rearing of mules, asses, goats, cattle and sheep; while the Alter breed of horses, named after the villages of Alter do Chão and Alter Pedroso (3971), near Portalegre, is often accounted the best in the kingdom. Agriculture, however, is in a backward state, the sparse population being mostly concentrated in the towns, leaving extensive districts uncultivated and almost uninhabited. Droves of swine are fed on the waste lands, growing to a great size and affording excellent hams. The mineral wealth of Alemtejo is little exploited, although there are copper and iron mines and marble quarries. Medicinal springs exist at Aljustrel (3700), Castello de Vide (5192), Mértola (3873), Portalegre, Vimieiro (1838) and elsewhere. Chief among the local industries are the preparation of exceptionally fine olive oil, and the manufacture of cloth, pottery and leather. Alemtejo is traversed by three very important main lines of railway, the Madrid-Cáceres-Lisbon, Madrid-Badajoz-Lisbon and Lisbon-Faro; while the two last are connected by a branch line from Casa Branca to Evora and Elvas. For administrative purposes the province is divided into the districts of Portalegre in the north, Evora in the central region and Beja in the south; but the titles of these new districts have not superseded the ancient name of Alemtejo in ordinary usage. The chief towns Beja (8885), Elvas (13,981), Estremoz (7920), Evora (16,020) and Portalegre (11,820) are described in separate articles.

ALENÇON, COUNTS AND DUKES OF. The first line of the counts of Alençon was founded by Yves, lord of Bellesme, who in the middle of the 10th century possessed and fortified the town of Alençon. His successors, involved in all the wars of the kings of England in Normandy, were alternately deprived and repossessed of their domains, according to the fluctuations of fortune between the rival parties. Mabille, countess of Alençon and heiress of this family (d. 1082), married Roger of Montgomery, and from them descended a second house of Alençon which became extinct in the person of Robert IV.; the county of Alençon was then joined to the royal domain. It was successively granted as an appanage to Peter, son of St Louis (1268), and to Charles, count of Valois, brother of Philip the Fair (1293). The third house of Alençon sprang from Charles, second son of the count of Valois, who was killed at the battle of Crécy in 1346. The countship of Alençon was raised to a peerage in 1367 and into a dukedom in 1414. John, 1st duke of Alençon, was killed at Agincourt on the 25th of October 1415, after having with his own hand slain the duke of York. His son, also named John, was dispossessed of his duchy by the king of England, but reconquered it in 1449. In 1524 the dukedom of Alençon reverted to the crown, in consequence of the death of the duke Charles IV. without issue of his marriage with Margaret, sister of Francis I. It was given as a jointure to Catherine de' Medici in 1559, and as an appanage to her son Francis in 1566. It was pawned by Henry IV. to the duke of Württemberg, and subsequently it passed to Gaston, duke of Orleans, by grant of Louis XIII.; to Elizabeth of Orleans, duchess of Guise; to Charles, duke of Berry, grandson of Louis XIV. (1710); and to Monsieur (Louis XVIII.), brother of Louis XVI.

The title of duc d'Alençon was given to Ferdinand of Orleans, son of the duc de Nemours, and grandson of Louis-Philippe. (M. P.*)

ALENÇON, a town of north-western France, capital of the department of Orne, 36 m. N. of Le Mans on a branch line of the Western railway. Pop (1906) 14,378. Alençon, a clean, regularly built town with broad handsome streets, is situated in a wide and fertile plain, on the Sarthe at its confluence with the Briante. The only remains of the ancient castle of Alençon are two towers of the 15th century, which serve as a prison, and a third of the 14th century known as the Tour Couronnée, to which they are united. Notre-Dame, the chief church, dates from the 15th century. It is remarkable for a porch ornamented in the richest Gothic style, and for its stained windows of the 16th century. Alençon has a large circular corn-market and a cloth-market. The manufacture of the *point d'Alençon* lace has greatly diminished. The weaving and bleaching of cloth, which is of less importance than formerly, the manufacture of vehicles, and tanning are carried on; there is a large trade in the horses of the district, and granite is worked in the neighbourhood. Alençon is the seat of a prefect and a court of assizes. It has tribunals of first instance and of commerce, a board of trade-arbitrators, a lycée, training-colleges and a chamber of arts and manufactures.

ALENIO, GIULIO (1582–1649), Italian Jesuit missionary, was born at Brescia. He entered the Society of Jesus and was sent to the East. He landed at Macao in 1610, and while waiting a favourable opportunity to penetrate into China busied himself for three years in teaching mathematics. His thirty years' residence in China was marked by unceasing zeal and considerable success. He adopted the dress and manners of the country, was the first Christian missionary in Kiang-si, and built several churches in Fo-Kien. He wrote in Chinese a *Life of Christ* (Pekin, 1635-1637, 8 vols.; often reprinted, *e.g.* in 1887 in 3 vols., and used even by Protestant missionaries) and a cosmography (*Iche fang woi ki Hang-chow*, 1623, 6 vols.), which was translated into Manchu under the title *The True Origin of 10,000 Things*, a copy of which was sent from Pekin to Paris in 1789. Alenio died at Fu-chow in 1649.

For bibliography see de Backer and Sommervogel, *Bibl. de la Cie. de Jésus*, i. 158-160.

ALEPPO (native *Haleb*). (1) A vilayet of Asiatic Turkey, comprising N. Syria and N.W. Mesopotamia, with an extension N. of Taurus to the neighbourhood of Gorun. It comprises three sanjaks, Aleppo, Marash and Urfa. About half is mountain, but there are fertile plains of great extent N. of Antakia, S. of Marash and around the city of Aleppo (see below). The only seaport of importance is Alexandretta (*q.v.*). The exports are, on the average, over one million sterling, and imports about double in value. The settled population is barely a million; but there is a considerable unsettled element in the S.E. which cannot well be estimated. The Christians, mainly Jacobite Syrian, but including also Armenians of several denominations (*e.g.* those of Marash and Zeitun), Maronites and Greeks, form about one-fifth. There are some 20,000 Jews, resident chiefly in the provincial capital; and of the Moslem majority the bulk is Arab, Turkoman and Ansarieh. In the N.W. and N. is a considerable Kurdish population.

(2) The provincial capital (anc. *Khalep*; Gr. *Chalybon-Beroea*), situated on a plateau in the valley of the Kuwaik (anc. *Chalus*) about 10 m. above its dissipation in the great salt-marsh of Matkh. Pop. about 130,000, three-quarters Moslem. Aleppo is about midway between the sea and the Euphrates, a little nearer the latter.

The modern city stands on both banks of the Kuwaik, and the older portions are contained within a Saracenic wall, 3½ m. in circuit with seven gates. The European residents and Christians live outside in the Kitab and new Azizieh quarters, and the Jews in that of Bahsita. A modern citadel occupies the N.W., the medieval castle on its mound (partly artificial and not a strong position, according to Istakhri) being almost deserted but still forbidden to visitors. There are two mosques of special interest—the *Umawi* (or *Zakaria*) on the site of a church ascribed to the empress Helena and containing a tomb reputed to be that of the Baptist's father, and the *Kakun*. Many minor ones serve the needs of a population traditionally fanatical. Gardens extend for miles along the river, and the bazaars and khans are unusually large. The climate is cold, dry and healthy, despite the prevalence of the famous "Aleppo button," a swelling which appears either on the face or on the hands, and breaks into an ulcer which lasts a year and leaves a permanent scar. It has been ascribed to a fly, to the water and to other causes; but it is not peculiar to Aleppo, being rife also at Aintab, Bagdad, &c.

The attempt made by the British Euphrates expedition in 1841 to connect Aleppo with the sea by steamer through the nearest point on the Euphrates, Meskiné, failed owing to the obstructed state of the stream and the insecurity of the riparian districts. The latter drawback has been minimized by the continued success of the Aleppo administration in inducing the Anazeh Bedouins to become *fellahin*; but river traffic has not been resumed. A railway, however, connects southward with the Beirut-Damascus line at Rayak. Aleppo is an important consular station for all European powers, the residence of the Greek and Armenian Patriarchs of Antioch, and of Jacobite and Maronite bishops, and a station of Roman Catholic and Protestant missions. It is the emporium of N. Syria, and manufactures textiles in silk, cotton and wool, carpets and leather commodities, besides being the centre of a large district growing cereals, pistachios and fruit. The Turks regard it as one of the strongholds of their dominion and faith, and a future capital of their empire should they be forced into Asia. As a centre from which good natural roads lead N., N.E., W. and S., Aleppo would make a good capital.

History and Remains.—The site lies high (1400 ft.) on eight hillocks in a fertile oasis plain, beyond which stretch on the S. and S.E. grassy steppes merging ere long into desert, and on the other quarters rather sterile downs. It has superseded Antioch as the economic centre of N. Syria, and Palmyra as the great road-station for eastern caravans. But it is rather a revived than a new capital; *Khalep* was a very ancient Syrian and probably "Hittite" city of importance, known from Babylonian, Assyrian and Egyptian records. Seleucus Nicator gave it a Macedonian name, Beroea; but Chalcis, some distance S., was the capital of the province, Chalcidice (later, Kinnasrin), in which it lay, and the centre of that hellenized region, now a vast field of ruins, which stretches W. to the Orontes. Khalep-Beroea, we may infer, remained a native town and a focus of Aramaic influence, a fact which will explain the speedy oblivion of its Macedonian name and the permanent revival of its ancient title, even by Greeks.

As *Beroea* we hear of the place in Seleucid wars and dissensions. There Menelaus, the fomenter of war with the Asmoneans, was put to death by Lysias in 164 B.C., "as the manner is in that place" (*Macc.* ii. 13. 4), being thrown into a lofty tower full of cinders. There Heracleon, the court favourite and murderer of Antiochus Grypus, was born and made himself a principality (96 B.C.); and there the son of the latter king besieged his brother Philip in the last struggle for the heritage of Seleucus. As *Chalybon*, the town is called by Ptolemy head of a district, *Chalybonitis;* but we continue to hear of it as Beroea up to the Arab conquest, *e.g.* in the history of Julian's eastward march in A.D. 363, and in that of the Persian raid of 540. It was occupied in 611 by Chosroes II. Overwhelmed by the Saracen flood in A.D. 638, Beroea disappears, and as Moslem society settles down *Halep* emerges again as the great gathering-place of caravans passing from Asia Minor and Syria to Mesopotamia, Bagdad and the Persian and Indian kingdoms. Like Antioch it suffered from earthquakes, and late in the 12th century, after a terrible shock, had to be rebuilt by Nur ed-Din. But neither earthquakes nor the plague, to which it was also peculiarly liable, could divert trade and prosperity from it. It belonged to the Eastern Caliphate (the *Hamdanids*) until temporarily reoccupied by John Zimisces, emperor of Byzantium and a native of neighbouring Hierapolis (*q.v.*), A.D. 974, after an abortive attempt by Nicephorus thirteen years earlier. Thirteen years later it recognized and received the Fatimites, and passed under various Moslem dynasties, forming part of the Seljuk dominion from 1090 to 1117. The crusading princes of Antioch never held the place, though they attacked it in 1124; and Saladin, who took it in 1183, made it a stronghold against them and the northern capital of himself and his successors until the Tatar invasion of 1260. Thereafter the Mamelukes took and kept possession, despite the renewed Tatar inroad of 1401, until the final conquest by the Ottomans in 1517. Under the strong hand of the latter the trade of Aleppo with the East revived. One of the first provincial factories and consulates of the British Turkey (Levant) Company was established there in the reign of James I.; and a British agent had been in residence there even in Elizabeth's time. As the eastern outpost of the company's operations, it was connected with the western outpost of the East India Company in Bagdad by a private postal service, and its name became very familiar in England from the part that its merchants (largely Jewish) bore in the transmission of Eastern products to Europe (cf., *e.g.* Shakespeare, *Macb.* i. 3. 7; *Oth.* v. 2. 352). Through it passed the silks of Bambyce, called *bombazines*, the light textiles of Mosul (*mosulines—muslins*) and many other commodities for the wealthy and luxurious. The first blow was struck at this trade by the discovery of the Cape route to India; the second by the opening of a land route through Egypt to the Red Sea; the third and final one by the making of the Suez Canal. Long ere this last event, however, Aleppo had been declining from internal causes. In the latter part of the 18th century and the first years of the 19th it was constantly the scene of bloody dissensions between two rival parties, one led by the local janissaries, the other by the *sherifs* (religious); and the Ottoman governors took the side, now of one, now of the other, in order to plunder a distracted city, too far removed from the centre to be controlled by the sultans, and too near the rebellious *pashalik* of Acre and the unsettled district of Lebanon not to be affected by the disorders natural to a frontier province. This state of things led to the suspension of the British consulate by the Turkey Company in 1791; and it was not revived till 1800, after which date till 1825 it was maintained jointly by the East India Company. In 1803 Jezzar of Acre advanced as near as Hamah; but his death occurred in the following year; and after a sanguinary rising in 1805, Aleppo settled down, but was not at peace, even after a local janissary massacre in 1814, till Mahmud II. had dealt finally with the corps at headquarters (1826). Meanwhile there had been a frightful earthquake in 1822, and a visitation of cholera in the following year. More cholera in 1827 and 1832 and another earthquake in 1830 had left the place a wreck, with only half its former population, when Mehemet Ali of Cairo invaded and took Syria. Aleppo shared, and to some extent headed, the Syrian discontent with Egyptian rule, and was strongly held by troops whose huge barracks are still one of the sights of the city. Ready to rise behind Ibrahim Pasha in 1839, it was only prevented by the news of Nezib. Tumults and massacres of Christians occurred in 1850 and 1862, accompanied by great destruction of property; but on the whole, since the consolidation of Ottoman rule over Syria by Abdul Mejid's ministers, Aleppo has been reviving, although its trade is more local than of old.

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ALES (ALESIUS), **ALEXANDER** (1500–1565), Scottish divine of the school of Augsburg, whose family name was ALANE, was born at Edinburgh on the 23rd of April 1500. He studied at St Andrews in the newly-founded college of St Leonard's, where he graduated in 1515. Some time afterwards he was appointed a canon of the collegiate church, and at first contended vigorously for the scholastic theology as against the doctrines of the Reformers. His views were entirely changed, however, on the execution of Patrick Hamilton, abbot of Fern, in 1528. He had been chosen to meet Hamilton in controversy, with a view to convincing him of his errors, but the arguments of the Scottish proto-martyr, and above all the spectacle of his heroism at the stake, impressed Alesius so powerfully that he was entirely won over to the cause of the Reformers. A sermon which he preached before the Synod at St Andrews against the dissoluteness of the clergy gave great offence to the provost, who cast him into prison, and might have carried his resentment to the extremest limit had not Alesius contrived to escape to Germany in 1532. After travelling in various countries of northern Europe, he settled down at Wittenberg, where he made the acquaintance of Luther and Melanchthon, and signed the Augsburg confession. Meanwhile he was tried in Scotland for heresy and condemned without a hearing. In 1533 a decree of the Scottish clergy prohibiting the reading of the New Testament by the laity, drew from Alesius a defence of the right of the people, in the form of a letter to James V. A reply to this by John Cochlaeus, also addressed to the Scottish king, occasioned a second letter from Alesius, in which he not only amplifies his argument with great force, but enters into more general questions connected with the Reformation. In August 1534 he and a few others were excommunicated at Holyrood by the deputy of the archbishop of St Andrews. When Henry VIII. broke with the church of Rome Alesius was induced to go to England, where he was very cordially received (August 1535) by the king and his advisers Cranmer and Thomas Cromwell. After a short residence at Lambeth he was appointed, through the influence of Cromwell, then chancellor of the university, to lecture on theology at Cambridge; but when he had delivered a few expositions of the Hebrew psalms, he was compelled by the opposition of the papal party to desist. Returning to London he supported himself for some time by practising as a physician. In 1537 he attended a convocation of the clergy, and at the request of Cromwell conducted a controversy with Stokesley, bishop of London, on the nature of the sacraments. His argument was afterwards published under the title *Of the Auctorite of the Word of God concerning the number of the Sacraments.* In 1539 Alesius was compelled to flee for the second time to Germany, in consequence of the enactment of the statute of the Six Articles. He was appointed to a theological chair in the university of Frankfort-on-Oder, where he was the first professor who taught the reformed doctrines. In 1543 he quitted Frankfort for a similar position at Leipzig, his contention that it was the duty of the civil magistrate to punish fornication, and his sudden departure, having given offence to the authorities of the former university. He was in England again for a short time during Edward VI.'s reign, and was commissioned by Cranmer to make a Latin version of the First Prayer-Book (1549) for the information of Bucer, whose opinion was desired. He died at Leipzig on the 17th of March 1565.

Alesius was the author of a large number of exegetical, dogmatic and polemical works, of which over twenty are mentioned by Bale in his *List of English Writers*. (See also the British Museum catalogue.) In his controversial works he upholds the synergistic views of the Scottish theologian John Major. He displayed his interest in his native land by the publication of a *Cohortatio ad Concordiam Pietatis, missa in Patriam suam* (1544), which had the express approval of Luther, and a *Cohortatio ad Pietatis Concordiam ineundam* (1559).

The best early account of Alesius is the *Oratio de Alexandro Alesio* of Jacob Thomasius (April 1661), printed in the latter's *Orationes* (No. XIV., Leipzig, 1683): the best modern account is by Dr A. W. Ward in the *Dictionary of National Biography*. See also A. F. Mitchell's introduction to Gau's *Richt Vay* (Scottish Text Society, 1888).

ALESIA, the ancient name for a hill in central France, now Alise-Ste-Reine (department Côte d'Or), where in 52 B.C. Caesar besieged the Gaulish national leader Vercingetorix within enormous entrenchments, forced him to surrender, and thus practically ended his conquest of Gaul. The siege-works have been excavated by Napoleon III. and others, down to the present day. The site seems to have been inhabited also during the Roman empire, but its importance is limited to Caesar's siege.

ALESSANDRI, ALESSANDRO (ALEXANDER AB ALEXANDRO) (1461–1523), Italian jurist, was born at Naples about the year 1461. He studied law at Naples and Rome, and afterwards practised for a time as advocate in both cities. He is said to have been royal proto-notary at Naples in 1490. Dissatisfied, according to his own account, with the corrupt administration of justice, he at length quitted the bar and devoted himself entirely to literary pursuits, especially to the study of philology and antiquities. A sinecure appointment, which he owed to the favour of the pope, enabled him to lead a life of learned leisure at Rome, where he died on the 2nd of October 1523. His work entitled *Dies Geniales* appeared at Rome in 1522, and was constructed after the model of the *Noctes Atticae* of Aulus Gellius, and the *Saturnalia* of Macrobius. It consists of a confused mass of heterogeneous materials relating to philology, antiquities, law, dreams, spectres, &c., and is characterized by considerable credulity.

ALESSANDRIA, a city and episcopal see of Piedmont, Italy, capital of a province which bears its name, situated on the river Tanaro, 57 m. E. by S. of Turin by rail. Pop. (1901) 71,298, of which about half reside in the actual town: the rest are distributed over the suburbs. Alessandria was founded in 1168 by the inhabitants of the district in order to defend themselves against the marquis of Monferrato and the town of Pavia, at whose request it was besieged in 1174 by Frederick Barbarossa for six months, but without success. The Lombard League now included it among the allied cities and named it Alessandria, after Pope Alexander III. The traditional account of its foundation by the Lombard League has been disproved by F. Graf, *Die Gründung Alessandrias: ein Beitrag zur Geschichte des Lombardenbundes* (1888). After falling into various hands, it was ceded to Savoy by the peace of Utrecht in 1713, and its citadel was begun in 1728. During the French occupation (1800–1814), which began after the battle of Marengo, it was still more strongly fortified; the works were entirely destroyed by the Austrians in 1815, but were afterwards reconstructed, and Alessandria is still an important fortress and the headquarters of the second army corps. The citadel is on the left bank of the Tanaro, the town being on the right bank. It is regularly built and contains few buildings of architectural interest, but is a flourishing and important commercial town, not merely owing to its own manufactures (which are miscellaneous) but for the products of the district, and one of the greatest railway centres in Italy. Lines diverge from it to Turin via Asti, to Valenza (and thence to Vercelli, Mortara—for Novara or Milan—and Pavia), to Tortona, to Novi, to Acqui and to Brà.

ALESSI, GALEAZZO (1512–1572), Italian architect, was born at Perugia, and was probably a pupil of Caporali. He was an enthusiastic student of ancient architecture, and his style gained for him a European reputation. Genoa is indebted to him for a number of its most magnificent palaces, and specimens of his skill may be seen in the churches of San Paolo and Santa Vittoria at Milan, in certain parts of the Escurial, and in numerous churches and palaces throughout Sicily, Flanders and Germany.

See Rossi, *Di Galeazzo Alessi memorie* (Perugia, 1873).

ALETHIOLOGY (from the Gr. ἀλήθεια, truth), an uncommon expression for the doctrine of truth, used by Sir William Hamilton in his philosophic writings when treating of the rules for the discrimination of truth and error.

ALETRIUM (mod. *Alatri*), a town of the Hernici, about 6 m. due N. of Frusino, Italy, mentioned in 306 B.C. for its fidelity to Rome. In Cicero's time it was a *municipium*, and continued in this position throughout the imperial period. It is chiefly remarkable for its finely preserved fortifications constructed of tetrahedral and polygonal blocks of local limestone well jointed, with maximum dimensions of about 3 by 1½ ft.; the outer circuit of the city wall measures about 2½ m. It is almost entirely an embanking wall, as is the rule in the cities of this part of Italy, with a maximum height, probably, of about 30 ft. Two of the gates (of which there were perhaps five) are still to some extent preserved, and three posterns are to be found. In the centre of the city rises a hill (1647 ft.) which was adopted as the citadel. Remains of the fortifications of three successive periods can be traced, of which the last, perhaps a little more recent than that of the city wall, is the best preserved. In the first two periods the construction is rough, while in the third the blocks are very well and finely jointed, and the faces smoothed; they are mostly polygonal in form and are much larger (the maximum about 10 by 6 ft.) than those of the city wall. A flat surface was formed partly by smoothing off the rock and partly by the erection of huge terrace walls which rise to a height of over 50 ft., enclosing a roughly rectangular area of 235 by 115 yds. Two approaches to the citadel were constructed, both passing through the wall; the openings of both are rectangular. The architrave of the larger, known as Porta di Civita, measures about 17 ft. in length, 5 ft. in height, 6 ft. in thickness; while that of the smaller is decorated with three *phalli* in relief. Later, though probably in ancient times, a ramp was added on the northern side. In the centre of the *arx* was a building on the site of the present cathedral, of which only a small portion is preserved. Remains of a high-pressure aqueduct, which supplied the town with water and was constructed with other public buildings (*Corp. Inscr. Lat.* x., Berlin, 1883, p. 5807) by L. Betilienus Varus, may still be traced. A temple was excavated in 1889 about ½ m. to the north of the town, and many fragments of the painted terra-cottas with which it was decorated were found. A reconstruction of it has been erected in the Museo di Villa Giulia at Rome. The present town (pop. in 1901, 15,322) has a picturesque aspect, and contains many buildings in the Gothic style.

See R. Bassel, *Centralblatt der Bauverwaltung*, 1881, 121, p. 134; H. Winnefeld, *Römische Mitteilungen*, 1889, 126; G. Fiorelli in *Notizie degli Scavi*, 1882, 417. (T. As.)

ALEURITES (Gr. ἀλευρίτης, pertaining to ἄλευρον, ground meal, from ἀλεῖν, to grind), a genus of trees belonging to the natural order Euphorbiaceae. *Aleurites moluccana*, or *triloba*, is widely cultivated throughout the tropical and sub-tropical parts of the world for its fruit, which is about the size of a walnut, and contains several seeds which are rich in oil. The oil is extracted and used for food and light; it is known in India as *kekuna*, and the tree as the "candle-nut." In the Sandwich Islands the nuts are strung upon strips of wood and used as torches. The oil is exported to Europe for candle-making. *A. cordata* flourishes in China, where it is known as the varnish-tree, on account of the lac contained in its seeds.

ALEUTIAN ISLANDS (possibly from Chukchi *aliat*, "island"), a chain of small islands situated in the Northern Pacific Ocean, and extending about 1200 m. westward from the extremity of the Alaskan peninsula toward the peninsula of Kamchatka; they constitute part of the District of Alaska, U.S.A. The islands, of which an alternative collective name is the Catherine Archipelago, comprise four groups—the Fox, Andreanof, Rat and Near Islands. They are all included between 52° and 55° N. lat. and 172° E. and 163° W. long.

The axis of the archipelago near the mainland of Alaska has a S.W. trend, but near the 129th meridian its direction changes to the N.W. This change of direction corresponds to a curve in the line of volcanic fissures which have contributed their products to the building of the islands. Such curved chains are repeated about the Pacific Ocean in the Kurile Islands, the Japanese chain, the Philippines, &c. The general elevation is greatest in the eastern islands and least in the western. The island chain is really a western continuation of the Aleutian Range on the mainland.

The great majority of the islands bear evident marks of volcanic origin, and there are numerous volcanic cones on the north side of the chain, some of them active; many of the islands, however, are not wholly volcanic, but contain crystalline or sedimentary rocks, and also amber and beds of lignite. The coasts are rocky and surf-worn and the approaches are exceedingly dangerous, the land rising immediately from the coasts to steep, bold mountains.

The climate of the islands is oceanic, with moderate and fairly uniform temperatures and heavy rainfall. Fogs are almost constant. The summers are much cooler than on the mainland at Sitka (*q.v.*), but the winter temperature of the islands and of south-eastern Alaska is very nearly the same. The mean annual temperature for Unalaska, the most important island of the group, is about 38° F.; being about 30° for January and about 52° for August. The highest and lowest temperatures recorded on the islands are 78° and 5°. The average annual amount of rainfall is about 80 in., and Unalaska, with about 250 rainy days per year, is said to be the rainiest place within the territory of the United States. The growing season lasts about 135 days, from early in May till late in September, but agriculture is limited to the raising of a few vegetables. With the exception of some stunted willows the islands are practically destitute of trees, but are covered with a luxuriant growth of herbage, including grasses, sedges and many flowering plants. On the less mountainous islands the raising of sheep and reindeer is believed to be practicable. The principal occupations of the natives have always been fishing and hunting, and the women weave basketry of exquisite fineness. From the end of the 18th century the Russian fur traders had settlements here for the capture of the seal and the sea otter and the blue and the Arctic fox. Under the American régime seal fishing off the Aleutians save by the natives has never been legal, but the depletion of the Pribilof herd, the almost complete extinction of the sea otter, and the rapid decrease of the foxes and other fur animals, have threatened the Aleuts (as the natives are commonly called) with starvation. In recent years enterprising traders have raised foxes by culture and by especially protecting certain small islands, and this has furnished employment to whole communities of natives. Fish and sea-fowl are extremely abundant.

The natives are rather low in stature, but plump and well shaped, with short necks, swarthy faces, black eyes and long black hair. They are a branch of the Esquimauan family, but differ greatly from the Eskimo of the mainland in language, habits, disposition and mental ability. They were good fighters until they were cowed by the treatment of the Russians, who practically reduced them to slavery. Sporadic efforts to Christianize the Aleuts were made in the latter half of the 18th century, but little impression was made before the arrival in 1824 of Father Ivan Venyaminov, who in 1840 became the first Greek bishop of Alaska. While the missionaries of the Greek Church have nominally converted the natives to Christianity, white adventurers have more effectually converted them to various bad habits. In dress and mode of life they have adopted outwardly civilized customs. From the position of the Aleutian islands, stretching like a broken bridge from Asia to America, some ethnologists have supposed that by means of them America was first peopled. Raised shore-lines, occasional earthquakes, and slow measurable elevation of the land about active volcanoes, indicate that elevation is now in progress, but the geological evidence shows no sign of former submergence of a connecting isthmus. There is granite at the core of the Shaler range of mountains in southern Unalaska.

It is stated that before the advent of the Russians there were 25,000 Aleuts on the archipelago, but that the barbarities of the traders eventually reduced the population to one-tenth of this number. The number of Aleuts in 1890 was reported as 968; the total population of the archipelago in 1900 was 2000.

The principal settlements are on the Unalaska Island. Of these Iliuliuk (also called Unalaska), the oldest, settled in 1760–1775, has a custom house, a Russian-Greek Church, and a Methodist Mission and orphanage, and is the headquarters for a considerable fleet of United States revenue cutters which patrol the sealing grounds of the Pribilofs; adjacent is Dutch Harbor (so named, it is said, because a Dutch vessel was the first to enter it), which is an important port for Bering Sea commerce. The volcano Makushin (5691 ft.) is visible from Iliuliuk, and the volcanic islets Bogoslof and Grewingk, which rose from the sea in 1796 and 1883 respectively, lie about 30 m. W. of the bay. The latter is still active; in 1906 a new cone rose between the two earlier islets, and in 1907 still another: these were nearly demolished by an explosive eruption on the 1st of September 1907. The population of Unalaska Island in 1900 was 575 Aleuts and 66 whites. The Commander Islands group near the Asiatic coast is geographically, but since the acquisition of the Russian possessions in America not politically, a part of the Aleutian system.

In 1741 the Russian government sent out Vitus Bering, a Dane, and Alexei Chirikov, a Russian, in the ships "Saint Peter" and "Saint Paul" on a voyage of discovery in the Northern Pacific. After the ships were separated by a storm, Chirikov discovered several eastern islands of the Aleutian group, and Bering discovered several of the western islands, finally being wrecked and losing his life on the island of the Commander group that now bears his name. The survivors of Bering's party reached Kamchatka in a boat constructed from the wreckage of their ship, and reported that the islands were rich in fur-bearing animals. Siberian fur hunters at once flocked to the Commander Islands and gradually moved eastward across the Aleutian Islands to the mainland. In this manner Russia gained a foothold on the north-western coast of North America. The Aleutian Islands consequently belonged to Russia until that country in 1867 transferred to the United States all its possessions in America. During his third and last voyage in 1778, Captain James Cook surveyed the eastern portion of the Aleutian archipelago, accurately determined the position of some of the more important islands and corrected many errors of former navigators. Some preliminary surveys have been made by the United States government with a view to establishing a naval station on the island Kiska, in the western part of the Aleutian Chain.

ALEXANDER (ALEXANDER OF BATTENBERG) (1857–1893), first prince of Bulgaria, was the second son of Prince Alexander of Hesse and the Rhine by his morganatic marriage with Julia, countess von Hauke. The title of princess of Battenberg, derived from an old residence of the grand-dukes of Hesse, was conferred, with the prefix *Durchlaucht* or "Serene Highness," on the countess and her descendants in 1858. Prince Alexander, who was born on the 5th of April 1857, was nephew of the tsar Alexander II., who had married a sister of Prince Alexander of Hesse; his mother, a daughter of Count Moritz von Hauke, had been lady-in-waiting to the tsaritsa. In his boyhood and early youth he was frequently at St Petersburg, and he accompanied his uncle, who was much attached to him, during the Bulgarian campaign of 1877. When Bulgaria under the Berlin Treaty was constituted an autonomous principality under the suzerainty of Turkey, the tsar recommended his nephew to the Bulgarians as a candidate for the newly created throne, and

Prince Alexander was elected prince of Bulgaria by unanimous vote of the Grand Sobranye (April 29, 1879). He was at that time serving as a lieutenant in the Prussian life-guards at Potsdam. Before proceeding to Bulgaria, Prince Alexander paid visits to the tsar at Livadia, to the courts of the great powers and to the sultan; he was then conveyed on a Russian warship to Varna, and after taking the oath to the new constitution at Tirnova (July 8, 1879) he repaired to Sofia, being everywhere greeted with immense enthusiasm by the people. (For the political history of Prince Alexander's reign, see Bulgaria.) Without any previous training in the art of government, the young prince from the outset found himself confronted with difficulties which would have tried the sagacity of an experienced ruler. On the one hand he was exposed to numberless humiliations on the part of the representatives of official Russia, who made it clear to him that he was expected to play the part of a *roi fainéant*; on the other he was compelled to make terms with the Bulgarian politicians, who, intoxicated with newly won liberty, prosecuted their quarrels with a crude violence which threatened to subvert his authority and to plunge the nation in anarchy. After attempting to govern under these conditions for nearly two years, the prince, with the consent of the tsar Alexander III., assumed absolute power (May 9, 1881), and a suspension of the ultra-democratic constitution for a period of seven years was voted by a specially convened assembly (July 13). The experiment, however, proved unsuccessful; the Bulgarian Liberal and Radical politicians were infuriated, and the real power fell into the hands of two Russian generals, Sobolev and Kaulbars, who had been specially despatched from St Petersburg. The prince, after vainly endeavouring to obtain the recall of the generals, restored the constitution with the concurrence of all the Bulgarian political parties (September 18, 1883). A serious breach with Russia followed, which was widened by the part which the prince subsequently played in encouraging the national aspirations of the Bulgarians. The revolution of Philippopolis (September 18, 1885), which brought about the union of Eastern Rumelia with Bulgaria, was carried out with his consent, and he at once assumed the government of the revolted province. In the anxious year which followed, the prince gave evidence of considerable military and diplomatic ability. He rallied the Bulgarian army, now deprived of its Russian officers, to resist the Servian invasion, and after a brilliant victory at Slivnitza (November 19) pursued King Milan into Servian territory as far as Pirot, which he captured (November 27). Although Servia was protected from the consequences of defeat by the intervention of Austria, Prince Alexander's success sealed the union with Eastern Rumelia, and after long negotiations he was nominated governor-general of that province for five years by the sultan (April 5, 1886). This arrangement, however, cost him much of his popularity in Bulgaria, while discontent prevailed among a certain number of his officers, who considered themselves slighted in the distribution of rewards at the close of the campaign. A military conspiracy was formed, and on the night of the 20th of August the prince was seized in the palace at Sofia, and compelled to sign his abdication; he was then hurried to the Danube at Rakhovo, transported on his yacht to Reni, and handed over to Russian authorities, by whom he was allowed to proceed to Lemberg. He soon, however, returned to Bulgaria, owing to the success of the counter-revolution led by Stamboloff, which overthrew the provisional government set up by the Russian party at Sofia. But his position had become untenable, partly owing to an ill-considered telegram which he addressed to the tsar on his return; partly in consequence of the attitude of Prince Bismarck, who, in conjunction with the Russian and Austrian governments, forbade him to punish the leaders of the military conspiracy. He therefore issued a manifesto resigning the throne, and left Bulgaria on the 8th of September 1886. He now retired into private life. A few years later he married Fräulein Loisinger, an actress, and assumed the style of Count Hartenau (February 6, 1889). The last years of his life were spent principally at Gratz, where he held a local command in the Austrian army. Here, after a short illness, he died on the 23rd of October 1893. His remains were brought to Sofia, where they received a public funeral, and were eventually deposited in a mausoleum erected in his memory. Prince Alexander possessed much charm and amiability of manner; he was tall, dignified and strikingly handsome. His capabilities as a soldier have been generally recognized by competent authorities. As a ruler he committed some errors, but his youth and inexperience and the extreme difficulty of his position must be taken into consideration. He was not without aptitude for diplomacy, and his intuitive insight and perception of character sometimes enabled him to outwit the crafty politicians by whom he was surrounded. His principal fault was a want of tenacity and resolution; his tendency to unguarded language undoubtedly increased the number of his enemies.

See Drandar, *Le Prince Alexandre de Battenberg en Bulgarie* (Paris, 1884); Koch, *Furst Alexander von Bulgarien* (Darmstadt, 1887); Matveyev, *Bulgarien nach dem Berliner Congress* (Petersburg, 1887); Bourchier, "Prince Alexander of Battenberg," in *Fortnightly Review*, January 1894. (J. D. B.)

ALEXANDER I., king of Epirus about 342 B.C., brother of Olympias the mother of Alexander the Great, and son-in-law of Philip of Macedon, whose daughter Cleopatra he married (336). In 332 he crossed over to Italy to assist the Tarentines against the Lucanians, Bruttians and Samnites. He gained considerable successes and made an arrangement with the Romans for a joint attack upon the Samnites; but the Tarentines, suspecting him of the design of founding an independent kingdom, turned against him. Although the advantage at first rested with Alexander, he gradually lost it, and his supporters dwindled away. In 330 (or earlier) he was defeated at Pandosia and slain by a Lucanian emigrant.

See Justin viii. 6, ix. 6, xii. 2; Livy viii. 3, 17, 24; Aulus Gellius xvii. 21; and article Macedonian Empire.

ALEXANDER II., king of Epirus, succeeded his father Pyrrhus, 272 B.C. He attacked Antigonus Gonatas and conquered the greater part of Macedonia, but was in turn driven out of both Epirus and Macedonia by Demetrius the son of Antigonus. He subsequently recovered his kingdom by the aid of the Acarnanians and Aetolians. He died about 260 (Polybius ii. 45, ix. 34; Plutarch, *Pyrrhus*, 9; Justin xviii. 1, xxvi. 2, xxviii. 1).

See Thirlwall, *History of Greece*, vol. viii.; Droysen, *Hellenismus*; B. Niese, *Gesch. d. griech. u. maked. Staaten*; J. Beloch, *Griech. Gesch.* vol. iii.

Youth.

ALEXANDER III., known as The Great[1] (356–323 B.C.), king of Macedon, was the son of Philip II. of Macedon, and Olympias, an Epirote princess. His father was pre-eminent for practical genius, his mother a woman of half-wild blood, weird, visionary and terrible; and Alexander himself is singular among men of action for the imaginative splendours which guided him, and among romantic dreamers for the things he achieved. He was born in 356 B.C., probably about October (Hogarth, pp. 284 ff.). The court at which he grew up was the focus of great activities, for Philip, by war and diplomacy, was raising Macedon to the headship of the Greek states, and the air was charged with great ideas. To unite the Greek race in a war against the Persian empire was set up as the ultimate mark for ambition, the theme of idealists. The great literary achievements of the Greeks in the 5th century lay already far enough behind to have become invested with a classical dignity; the meaning of Hellenic civilization had been made concrete in a way which might sustain enthusiasm for a body of ideal values, authoritative by tradition. And upon Alexander in his fourteenth year this sum of tradition was brought to bear through the person of the man who beyond all others had gathered it up into an organic whole: in 343–342 Aristotle (*q.v.*) came to Pella at Philip's bidding to direct the education of his son. We do not know what faculty the master-thinker may have had for captivating this ardent spirit; at any rate Alexander carried with him through life a passion for Homer, however he may have been disposed to greyer philosophic theory. But his education was not all from books. The coming and going of envoys from many states, Greek and Oriental, taught him something of the actual conditions of the world. He was early schooled in war. At the age of sixteen he commanded in Macedonia during Philip's absence and quelled a rising of the hill-tribes on the northern border; in the following year (338) he headed the charge which broke the Sacred Band at Chaeronea. Then came family dissensions such as usually vex the polygamous courts of the East. In 337 Philip repudiated Olympias for another wife, Cleopatra, Alexander went with his mother to her home in Epirus, and, though he soon returned and an outward reconciliation between father and son was contrived, their hearts were estranged. The king's new wife was with child; her kinsmen were in the ascendant; the succession of Alexander was imperilled. Some negotiations which Pixodarus, the satrap of Caria, opened with the Macedonian court with a view to effecting a marriage alliance between his house and Philip's, brought Alexander into fresh broils. In 336 Philip was suddenly assassinated whilst celebrating at Aegae the marriage of his daughter to Alexander I. of Epirus in the presence of a great concourse from all the Greek world. It is certain that the hand of the assassin was prompted by some one in the background; suspicion could not fail to fall upon Alexander among others. But guilt of that sort would hardly be consistent with his character as it appears in those early days.

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[1] The use of the surname is proved as far back as the 1st century B.C. (Nepos, *De Reg.* 2).

Accession.

Leader of the Hellenes.

Alexander was not the only claimant to the vacant throne, but, recognized by the army, he soon swept all rivals from his path. The newly born son of Philip by Cleopatra, and Alexander's cousin Amyntas, were put to death, and Alexander took up the interrupted work of his father. That work was on the point of opening its most brilliant chapter by an invasion of the great king's dominions; the army was concentrated and certain forces had already been sent on to occupy the opposite shore of the Hellespont. The assassination of Philip delayed the blow, for it immediately made the base, Macedonia, insecure, and in such an enterprise, plunging into the vast territories of the Persian empire, a secure base was everything. Philip's removal had made all the hill-peoples of the north and west raise their heads and set the Greek states free from their fears. A demonstration in Greece, led by the new king of Macedonia, momentarily checked the agitation, and at the diet at Corinth Alexander was recognized as captain-general (ἡγεμὼν αὐτοκράτωρ) of the Hellenes against the barbarians, in the place of his father Philip. In the spring of 335 he went out from Macedonia northwards, struck across the Balkans, probably by the Shipka Pass, frustrating the mountain warfare of its tribes by a precision of discipline which, probably, no other army of the time could have approached, and traversed the land of the Triballians (Rumelia) to the Danube. To gratify his own imagination or strike the imagination of the world he took his army over the Danube and burnt a settlement of the Getae upon the other side. Meanwhile the Illyrians had seized Pelion (Pliassa), which commanded the passes on the west of Macedonia, and from the Danube Alexander marched straight thither over the hills. He had hardly restored Macedonian prestige in this quarter when he heard that Greece was aflame. Thebes had taken up arms. By a forced march he took the Thebans completely by surprise, and in a few days the city, which a generation before had won the headship of Greece, was taken. There were to be no half-measures now; the city was wiped out of existence with the exception of its temples and the house which had been Pindar's. Greece might now be trusted to lie quiet for some time to come. The Panhellenic alliance (from which Sparta still stood aloof) against the barbarians was renewed. Athens, although known to be hostile at heart to the cities of Macedonian power, Alexander treated all through with eager courtesy.

Invasion of Asia Minor.

Battle of Granicus.

In the spring of 334, Alexander crossed with an army of between 30,000 and 40,000 men, Macedonians, Illyrians, Thracians and the contingents of the Greek states, into Asia. The place of concentration was Arisbe on the Hellespont. Alexander himself first visited the site of Troy and there went through those dramatic acts of sacrifice to the Ilian Athena, assumption of the shield believed to be that of Achilles and offerings to the great Homeric dead, which are significant of the poetic glamour shed, in the young king's mind, over the whole enterprise, and which men will estimate differently according to the part they assign to imagination in human affairs. To meet the invader the great king had in Asia Minor an army slightly larger, it would seem, than Alexander's, gathered under the satraps of the western provinces at Zeleia. He had also, what was more serious, command of the Aegean. Alexander could communicate with his base only by the narrow line of the Hellespont, and ran the risk, if he went far from it, of being cut off altogether. To draw him after them, while avoiding a conflict, was sound strategy for the Persian generals. It was urged upon them by their colleague the Rhodian Memnon. But strategic considerations were cancelled by the Persian barons' code of chivalry, and Alexander found them waiting for him on the banks of the Granicus. It was a cavalry mêlée, in which the common code of honour caused Macedonian and Persian chieftains to engage hand to hand, and at the end of the day the relics of the Persian army were in flight, leaving the high-roads of Asia Minor clear for the invader. Alexander could now accomplish the first part of the task belonging to him as captain-general to the Hellenes, that liberation of the Greek cities of Asia Minor, for which Panhellenic enthusiasts had cried out so long. He first went to take possession of the old Lydian capital Sardis, the headquarters of the Persian government on this side of the Taurus, and the strong city surrendered without a blow. And now in all the Greek cities of Aeolis and Ionia the oligarchies or tyrants friendly to Persia fell, and democracies were established under the eye of Alexander's officers. Only where the cities were held by garrisons in the Persian service, garrisons composed mainly of Greek mercenaries, was the liberator likely to meet with any resistance. From Ephesus indeed the garrison fled upon the news of Granicus, but Miletus required a siege. The Persian fleet in vain endeavoured to relieve it, and Miletus did not long hold out against Alexander's attack. It was at Halicarnassus that Alexander first encountered stubborn resistance, at Halicarnassus where Memnon and the satraps of Caria had rallied what land-forces yet belonged to Persia in the west. When winter fell, Alexander had captured indeed the city itself, but the two citadels still held out against his blockade.

Meanwhile Alexander was making it plain that he had come not merely as captain-general for a war of reprisals, but to take the Persian's place as king of the land. The conquered provinces were organized under Macedonian governors and in Caria a dethroned princess of the native dynasty, Ada, was restored to power. In the winter, whilst Parmenio advanced upon the central plateau to make the occupation of Phrygia effective, Alexander himself passed along the coast to receive the submission of the Lycians and the adherence of the Greek cities of the Pamphylian sea-board. The hills inland were the domain of fighting tribes which the Persian government had never been able to subdue. To conquer them, indeed, Alexander had no time, but he stormed some of their fortresses to hold them in check, and marched through their territory when he turned north from Pamphylia into the interior. The point of concentration for next year's campaign had been fixed at Gordium, a meeting-place of roads in Northern Phrygia. The story of Alexander's cutting the fatal "Gordian knot" on the chariot of the ancient Phrygian king Gordius is connected with his stay in this place.

Extension of Alexander's power.

Whilst Alexander had been grounding his power in Asia Minor, he had run a narrow risk of losing his base in Europe. He had after the siege of Miletus disbanded the Graeco-Macedonian fleet, surrendering for the time all attempts to challenge the command of the Aegean. Memnon the Rhodian, now in supreme command of the Persian fleet, saw the European coasts exposed and set out to raise Greece, where discontent always smouldered in Alexander's rear. But Memnon died at the critical moment whilst laying siege to

Mytilene and the great plan collapsed. A Persian fleet still held the sea, but it effected little, and presently fresh Graeco-Macedonian squadrons began to hold it in check. It was, however, the need to ensure command of the sea and free all lines of communication behind him that determined Alexander's plan for the next campaign. If he mastered the whole coast-line of the Levant, the enemy's fleet would find itself left in the air. The Syrian coast was accordingly his immediate objective when he broke up from Gordium for the campaign of 333. He was through the Cilician Gates before the Persian king, Darius III., had sent up a force adequate to hold them. His passage through Cilicia was marked by a violent fever that arrested him for a while in Tarsus, and meantime a great Persian army was waiting for him in northern Syria under the command of Darius himself. In the knot of mountains which close in about the head of the Gulf of Alexandretta, Alexander, following hard by the coast, marched past the Persian army encamped on the plains to the east. To cut Alexander's communications with the rear, Darius now committed the error of entangling his large force in the mountain defiles. Alexander turned, and near the town of Issus fought his second pitched battle, sending Darius and the relic of his army in wild flight back to the east.[1] It was an incident which did not modify Alexander's plan. He did not press the pursuit far, although the great king's camp with his harem fell into his hands. The chivalrous courtesy which he showed to the captive princesses was a favourite theme for later rhetoricians. He went on his way to occupy Syria and Phoenicia. It is now that we get definite evidence as to the reach of Alexander's designs; for Darius opened negotiations in which he ultimately went so far as to offer a partition of the empire, all west of the Euphrates, to be Alexander's. Alexander refused the bargain and definitely claimed the whole.[2] The conquest of the Phoenician coast was not to be altogether easy, for Tyre shut its gates and for seven months Alexander had to sit before it—one of those obstinate sieges which mark the history of the Semitic races. When it fell, Alexander had the old Tyrian people scattered to the winds, 30,000 sold as slaves. Gaza offered a resistance equally heroic, lasting two months, and here too the old population was dispersed. The occupation of the rest of Syria and Palestine proceeded smoothly, and after the fall of Gaza Alexander's way lay open into Egypt.[3] Egypt was the last of the Mediterranean provinces to be won, and here no defence was made. To the native Egyptians Alexander appeared as a deliverer from the Persian tyranny, and he sacrificed piously to the gods of Memphis. The winter (332–331) which Alexander spent in Egypt saw two memorable actions on his part. One was the expedition (problematic in its motive and details) to the oracle of Zeus Ammon (Oasis of Siwa), where Alexander was hailed by the priest as son of the god, a belief which the circle of Alexander, and perhaps Alexander himself, seem hereafter to have liked to play with in that sort of semi-serious vein which still allowed him in the moments of every-day commonplace to be the son of Philip. The other action was the foundation of Alexandria at the Canopic mouth of the Nile, the place destined to be a new commercial centre for the eastern Mediterranean world which Alexander had now taken in possession, to rise to an importance which the founder, although obviously acting with intention, can hardly have foreseen (E. Keller, *Alex. d. Grosse nach der Schlacht bei Issus*, 1904).

Battle of Issus.

In the spring of 331 Alexander could at last leave the Mediterranean to strike into the heart of the Persian empire, for by his occupation of the coasts the Persian command of the sea had inevitably collapsed. Returning through Syria, and stopping at Tyre to make final arrangements for the conquered provinces, he traversed Mesopotamia and struck the Tigris some four marches above the site of Nineveh. It was near Nineveh that Darius was waiting with the immense host which a supreme effort could muster from all parts of the empire. The happy coincidence of a lunar eclipse gives us the 20th of September 331 as the exact day upon which the Macedonian army crossed the Tigris. Alexander came within sight of the Persian host without having met with any opposition since he quitted Tyre. He had now to settle the most serious problem which had yet faced him, for in the plains the Persian army was formidable by sheer bulk. But the day showed the Macedonian army equal to the task. The last army gathered by an Achaemenian king was shattered in the battle called popularly after the city of Arbela some 60 m. distant, or more precisely after the village of Gaugamela hard by. Darius fled eastwards into Media and again Alexander waited till he had secured the provinces to the south. He followed the Tigris into Babylonia, the central seat of the empire and its richest region, and from Babylon went on to seize the fabulous riches which the Persian kings had amassed in their spring residence, Susa. Thence he at last ascended upon the Iranian plateau. The mountain tribes on the road (the Oxii, Pers, Huzha), accustomed to exact blackmail even from the king's train, learnt by a bitter lesson that a stronger hand had come to wield the empire. Alexander entered Persis, the cradle of the Achaemenian house, and came upon fresh masses of treasure in the royal city, Persepolis. He destroyed the royal palace by fire, an act which has been variously estimated by historians. Ostensibly a solemn revenge for the burning of Greek temples by Xerxes, it has been justified as a symbolical act calculated to impress usefully the imagination of the East, and condemned as a senseless and vainglorious work of destruction.

Invasion of Persia.

Battle of Arbela.

With the spring of 330 Alexander was prepared for further pursuit. Darius fled northwards from Ecbatana upon his approach. At Ecbatana new masses of treasure were seized, but when once the necessary measures which its disposal and the occupation of the Median capital entailed were taken, Alexander continued the pursuit. It was an exciting chase of king by king, in which each covered the ground by incredible exertions, shedding their slower-going followers as they went, past Rhagae (Rai) and the Caspian gates, till early one morning Alexander came in sight of the broken train which still clung to the fallen king. He had become a puppet in the hands of his cousin Bessus and the Persian magnates with him (see Darius III.), and at this extremity they stabbed him and allowed Alexander to become master only of his corpse (summer 330).

The pursuit had brought Alexander into that region of mountains to the south of the Caspian which connects western Iran with the provinces to the east of the great central desert. To conquer this remaining portion of the empire, Alexander now went on through the mountain belt, teaching the power of his arms to the hillsmen, Tapyri and Mardi, till he came, passing through Zadracarta (Asterabad), to Parthia and thence to Aria. In these further provinces of Iran the Macedonian invader had for the first time to encounter a serious national opposition, for in the west the Iranian rule had been merely the supremacy of an alien power over native populations indifferent or hostile. Here the ruling race was at home. In Asia Alexander learnt that Bessus had taken the diadem as Darius' successor in Bactria, but so soon as he marched against him Aria rose in his rear, and Alexander had to return in all haste to bring the revolt under. Nor did he, when this was accomplished, again strike directly at Bactria, but made a wide turning movement through Seistan over Kandahar into the Kabul valley. It was on the way, in Seistan at Prophthasia (mod. *Farrah* ?), that the alienation between Alexander and his Macedonian followers, which becomes sensible in the latter part of his career, first showed itself in an ugly form. Alexander had come to merge the characters of Macedonian king and Hellenic captain-general, with which he had set out, in that of Oriental despot (Spieker. *Hof u. Hofordnung Al. d. Gr.*, 1904). He wore on occasions of state the Persian dress. (According to pseudo-Plutarch, *de fort. Al.* i. 8, it was the simpler *Persian* dress, not the Median.) A discontent began to work among the

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[1] See Bauer, "Die Schlacht bei Issus" in *Jahreshefte d. österr. archäol. Instit.* ii. pp. 105 f.; A. Janke. *Auf Alex. d. grossen Pfaden*; Gruhn, *Das Schlachtfeld von Issus*; Lammert in *Berl. Philol. Wochenschr.* (1905), col. 1596 f.

[2] Pridik, *De Alex. Mag. epist. commercio* (Dorpat, 1893); Schwartz, art. "Curtius" in Pauly-Wissowa, col. 1884.

[3] The story of Alexander's visit to Jerusalem rests on no better authority than a later Jewish romance.

Macedonians, and at Prophthasia the commander of the Macedonian cavalry Philotas, the son of Parmenio, and certain others were arraigned before the army on the charge of conspiring against the king's life. They were condemned and put to death. Not satisfied with procuring this, Alexander had Parmenio himself, who had been left in command in Media, put to death by secret orders. It is perhaps the worst crime, because the most cold-blooded and ungenerous, which can be laid to his charge. By the winter of 329–328 Alexander had reached the Kabul valley at the foot of the Paropamisadae (Hindu Kush).

The ordinarily received chronology makes Alexander reach the Kabul valley in the winter of 330–329. That to fit the actions and distances covered by Alexander into such a scheme, assuming that he went by Seistan and Kandahar, would involve physical impossibilities has been pointed out by Count Yorck v. Wartenburg and Mr D. G. Hogarth. Kaerst and Beloch continue to give the ordinary chronology untroubled.

Invasion of Northern India.

In the spring of 328 Alexander crossed the Hindu Kush into Bactria and followed the retreat of Bessus across the Oxus and into Sogdiana (Bokhara). Here Bessus was at last caught and treated with the barbaric cruelty which the rule of the old Persian monarchy prescribed for rebels. Till the spring of 327 Alexander was moving to and fro in Bactria and Sogdiana, beating down the recurrent rebellions and planting Greek cities. Just as in 335 he had crossed the Danube, so he now made one raid across the frontier river, the Jaxartes (Sir Daria), to teach the fear of his name to the outlying peoples of the steppe (summer 328). And meanwhile the rift between Alexander and his European followers continued to show itself in dark incidents—the murder of Clitus at Maracanda (Samarkand), when Alexander struck down an old friend, both being hot with wine; the claim that Alexander should be approached with prostration (*proskynesis*), urged in the spring of 327, and opposed boldly by the philosopher Callisthenes, Aristotle's nephew, who had come in the king's train; the conspiracy of the pages at Bactria, which was made an occasion for putting Callisthenes to death. It was now that Alexander completed the conquest of the provinces north of the Hindu Kush by the reduction of the last mountain strongholds of the native princes. In one of them he captured Roxana, the daughter of Oxyartes, whom he made his wife. Before the summer of 327 he had once more crossed the Hindu Kush on his way to India (for the campaigns in the N.E. see F. von Schwarz, *Alex. d. Grossen Feldzuge in Turkestan*, 1893, v.).

Whilst the heavier troops moved down the Kabul valley to Pencelaotis (Chārsadda) under Perdiccas and Hephaestion, Alexander with a body of lighter-armed troops and cavalry pushed up the valleys which join the Kabul from the north—through the regions now known as Bajour, Swat and Buner, inhabited by Indian hill peoples, as fierce then against the western intruder as their Pathan successors are against the British columns. The books give a number of their "cities" reduced by Alexander—walled mountain villages which can in some cases be identified more or less certainly with places where the clans are established to-day. The crowning exploit was the reduction of Aornus,[1] a stronghold perched on a precipitous summit above the Indus, which it was said that Heracles had failed to take. How much of the story of Alexander's discovery of the sacred mountain of the Nysa and the traces of Dionysus is due to the invention of Aristobulus and Clitarchus (Arrian did not find it in Ptolemy) we cannot say. Meantime Perdiccas and Hephaestion had built a bridge over the Indus, and by this in the spring of 326 Alexander passed into the Punjab (at Ohind, 16 m. above Attock, according to Foucher, *Notes sur la géogr. anc. du Gandhâra*, 1902). The country into which he came was dominated by three principalities, that of Ambhi (Gr. *Omphis*, Curt. viii. 12. 6) between the Indus and the Hydaspes (*Jhelum*, *Jehlam*), centred in the great city of Takkasila (Gr. *Taxila*), that of the Paurara rajah (Gr. *Porus*) between the Hydaspes and Acesines (*Chenab*), and that of Abhisara (Gr. *Abisares*) between the same two rivers higher up, on the confines of Kashmir (Stein, *Rajatarangini*, transl. bk. i. 180, v. 217). The kings of Taxila and Porus were at enmity, and for this cause the invader could reckon upon Omphis as a firm ally. Porus was prepared to contest the passage of the Hydaspes with all his strength. Abisares preferred to play a double game and wait upon events. Alexander reached the Hydaspes just as the rains broke, when the river was already swollen. Porus held the opposite bank with a powerful army, including 200 elephants. Alexander succeeded in taking a part of his forces across the river higher up during a night of torrential rain, and then he fought the fourth and last of his pitched battles in Asia, the one which put to proof more shrewdly than any of the others the quality of the Macedonian army as an instrument of war, and yet again emerged victorious. Porus fell sorely wounded into his hands.[2] Porus had saved his honour, and now Alexander tried, and not in vain, to gain him as a friend. When he continued his progress eastwards across the Acesines, Porus was an active ally. Alexander moved along close under the hills. After crossing the Hydraōtes (Rāvī) he once more came into contact with hostile tribes, and the work of storming petty towns began again. Then the Hyphasis (Beas) was reached, and here the Macedonian army refused to go any farther. It was a bitter mortification to Alexander, before whose imagination new vistas had just opened out eastwards, where there beckoned the unknown world of the Ganges and its splendid kings. For three days the will of king and people were locked in antagonism; then Alexander gave way; the long eastward movement was ended; the return began.

The return.

Alexander left the conquered portion of India east of the Indus to be governed under Porus, Omphis of Taxila, and Abisares, the country west of the Indus under Macedonian governors, and set out to explore the great river to its mouth (for the organization of the Indian provinces, see especially Niese, vol. i. pp. 500 f.). The fleet prepared on the Hydaspes sailed in October, while a land army moved along the bank. The confluence of the Hydaspes and Acesines passed, the Macedonians were once more in a region of hostile tribes with towns to be stormed. It was at one of these, a town of the Malli, that a memorable incident occurred, such as characterized the personality of Alexander for all succeeding time. He leapt from the wall with only three companions into the hostile town, and, before the army behind him could effect an entrance, lay wounded almost to death.[3] He recovered and beat down the resistance of the tribes, leaving them annexed to the Macedonian satrapy west of the Indus. Below the confluence of the Punjab rivers into the single stream of the Indus the territory of loose tribes was succeeded by another group of regular principalities, under the rajahs called by the Greeks Musicanus, Oxycanus and Sambus. These opposed a national resistance to the Macedonians, the fires of which were fanned by the Brahmins, but still the strong arm of the western people prevailed. The rajah of Patala at the apex of the Indus delta abandoned his country and fled. It was the high summer of 325 when Alexander reached Patala. From here he explored both arms of the delta to the ocean, now seen by the Macedonians for the first time. He had determined that the Indus fleet should be used to explore this new world and try to find a waterway between the Indus and the Persian Gulf. A great part of the land-forces had been already sent off under Craterus in the earlier summer to return west by Kandahar and Seistan; the fleet was to sail under the Greek Nearchus from the Indus mouth with the winter monsoon; Alexander himself with the rest of the land-forces set out in October to go by the coast of Baluchistan, through the appalling sand-wastes of the Mekran.[1]

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[1] The best opinion now confirms Abbott's identification of Aornus with Mahāban—Deane, *Journ. R. Asiat. Soc.* (Oct. 1896), p. 673; Stein, *Report of an Archaeological Tour with the Buner Field Force* (Lahore, 1898), pp. 45-48.

[2] Beside V. Smith (cited below) see Schubert, "Die Porusschlacht," in *Rhein. Mus.* lvi., 1901, p. 543.

[3] There seems nothing to fix the exact spot of this town; the common identification with Multan is, according to Raverty and V. Smith, certainly wrong.

He would seem to have kept down to the coast until the headland of Ras Malan was reached, scattering before him the bands of Arabitae and Oritae who were the inhabitants of this well-provisioned tract. For the 150 miles between Ras Malan and Pasni Alexander was compelled by the natural barriers to march inland, and it was here that his troops sank under the horrors of heat and thirst and sand. The coast once regained, the way was easy; no such desert had to be traversed, when Alexander again struck inland for the chief city of the Gedrosians (Pura), and thence made his way into Carmania. Here the spent troops rested; here the army of Craterus joined them, and Nearchus came to announce his safe arrival at the entrance of the Persian Gulf.[2]

The machine of empire had not functioned altogether smoothly while the king had been absent, and on Alexander's re-appearance many incapables and rogues in high office had to be replaced by better men. In Carmania, in Persis, complaints from the provinces continued to reach him, as well as the news of disorders in Macedonia and Greece. New orders and appointments served to bring the empire into hand again, and at Susa in the spring of 324 Alexander rested, the task of conquering and compassing the Achaemenian realm achieved. The task of its internal reorganization now began to occupy him—changes, for instance, in the military system which tended to assimilate Macedonians and Orientals. The same policy of fusion was furthered by the great marriage festival at Susa, when Alexander took two more wives from the Persian royal house, married a number of his generals to Oriental princesses, and even induced as many as he could of the rank-and-file to take Asiatic wives. This policy did not allay the discontent of the Macedonian army, and when Alexander in the summer of 324 moved to the cooler region of Media, an actual mutiny of the Macedonians broke out on the way at Opis on the Tigris. It was occasioned by the discharge of the Macedonian veterans, and only the personal magnetism of Alexander and his threat to entrust himself altogether to the Orientals availed to quell it. At Ecbatana the death of Hephaestion for a time plunged Alexander into a passion of mourning. But by the winter (324–323) he was again active, bringing the hill-tribes on the S.W. border of Media, the Cossaei, into subjection. In the spring of 323 he moved down to Babylon, receiving on the way embassies from lands as far as the confines of the known world, for the eyes of all nations were now turned with fear or wonder to the figure which had appeared with so superhuman an effect upon the world's stage. The embassy from Rome, however, is almost certainly a later, and an inevitable, invention. The exploration of the waterways round about the empire was Alexander's immediate concern, the discovery of the presumed connexion of the Caspian with the Northern Ocean, the opening of a maritime route from Babylon to Egypt round Arabia. The latter enterprise Alexander designed to conduct in person; under his supervision was prepared in Babylon an immense fleet, a great basin dug out to contain 1000 ships, and the water-communications of Babylonia taken in hand. Innovations were carried out in the tactical system of the army which were to modify considerably the methods of future battle-fields. At last all was ready; the 20th of the month Daesius (? June 5) was fixed for the king's setting forth. On the 15th and 16th Alexander caroused deep into the night at the house of the favourite Medius. On the 17th he developed fever; for a time he treated it as a momentary impediment to the expedition; but on the 27th his speech was gone, and the Macedonian army were suffered to pass man by man through his chamber to bid him farewell. On the 28th (? June 13) Alexander died.[3]

Illness and death.

His son by Roxana, the so-called ALEXANDER "AEGUS," was born a few months later. He and his uncle Philip, as joint kings, were placed under the guardianship of Perdiccas, Peithon and Antipater in succession. After the death of Antipater (319) Roxana fled with him to Epirus, and was afterwards taken back to Macedonia, together with Olympias, by Polyperchon. All three fell into the hands of Cassander; Alexander and his mother were in 310–309 put to death by order of Cassander (Justin xiv. 6, xv. 2). The meaningless surname of *Aegus*, still given in some books to this Alexander, is derived simply from a modern misreading of the text of the Astronomical Canon, ΑΙΓΟΥ for ΑΛΛΟΥ.

Character and policy.

Alexander the Great is one of the instances of the vanity of appealing from contemporary disputes to "the verdict of posterity"; his character and his policy are estimated to-day as variously as ever. Certain features—the high physical courage, the impulsive energy, the fervid imagination—stand out clear; beyond that disagreement begins. That he was a great master of war is admitted by most of those who judge his character unfavourably, but even this has been seriously questioned (*e.g.* by Beloch, *Griech. Gesch.* iii. (i.), p. 66). There is a dispute as to his real desings. That he aimed at conquering the whole world and demanded to be worshipped as a god is the traditional view. Droysen denies the former, and Niese maintains that his ambition was limited by the bounds of the Persian empire and that the claim to divine honours is fabulous (*Historische Zeitschr.* lxxix., 1897, 1 f.). It is true that our best authority, Arrian, fails to substantiate the traditional view satisfactorily; on the other hand those who maintain it urge that Arrian's interests were mainly military, and that the other authorities, if inferior in trustworthiness, are completer in range of vision. Of those, again, who maintain the traditional view, some, like Niebuhr and Grote, regard it as convicting Alexander of mad ambition and vainglory, whilst to Kaerst Alexander only incorporates ideas which were the timely fruit of a long historical development. The policy of fusing Greeks and Orientals again is diversely judged. To Droysen and Kaerst it accords with the historical conditions; to Grote and to Beloch it is a betrayal of the prerogative of Hellenism.

Some notion of the personal appearance of Alexander may be got from the literature and the surviving monuments. He is described as of an athletic frame, though not taller than the common, and a white and ruddy complexion. The expression of his eyes had something "liquid and melting" (*τῶν ὀμμάτων τὴν διάχυσιν καὶ ὑγρότητα*), and the hair which stood up over his forehead gave the suggestion of a lion. He had a way of carrying his head somewhat aslant. (See especially Plut. *Alex.* 4; *de Alex. fort.* ii. 2.) The greatest masters of the time executed portraits of him, Lysippus in sculpture, Apelles in painting and Pyrgoteles in graven gems. Among surviving monuments, we have no completely certified portraits except the Tivoli herm (now in the Louvre) and the coins struck by his successors. The herm is a dry work and the head upon the coins shows various degrees of idealization. There are, however, a considerable number of works which can make out a better or worse claim either to be portraits of Alexander or to reproduce his type, and a large field of discussion is therefore open as to their values and classification (F. Kopp, *Über das Bildnis Alexanders d. Grossen* (1892); K. J. Ujfalvy, *Le Type physique d'Alexandre le Grand* (1902); T. Schreiber, *Studien über das Bildnis Alexanders d. Grossen* (1903); J. J. Bernoulli, *Die erhaltenen Darstellungen Alexanders d. Grossen* (1905). Alexander shaved clean, and set the fashion in this respect for the Graeco-Roman world for the next 500 years.

BIBLIOGRAPHY.—The campaigns and life of Alexander did not lack contemporary historians, some of them eye-witnesses and even associates. They included the philosopher Callisthenes, put to death by Alexander in 327, whose history went up to the death of Darius, Alexander's general Ptolemy, afterwards king in Egypt, Nearchus who commanded the fleet that sailed from the Indus to the Persian Gulf, Onesicritus who served as pilot in the same fleet, Aristobulus who was with Alexander in India, Clitarchus, a contemporary, if not an eye-witness, important from the fact that his highly coloured version of the life of Alexander became the popular authority for the succeeding centuries. Besides the historical narrative, there were works mainly geographical or topographical left by persons like Baeton and Diognetus, whom Alexander had employed (as *βηματισταί*) to survey the roads over which he passed. All such original sources have now perished. The fragments are collected in the Didot edition of Arrian by Karl Müller. Not reckoning scattered notices, we depend principally upon five later compositions, Diodorus, book xvii. (*c.* 20 B.C.), the work of Quintus Curtius (*c.* A.D. 42), Plutarch's (*c.* 45–125 A.D.) *Life of Alexander*, Arrian's *Anabasis* and *Indica* (*c.* A.D. 150), and the relevant books of Justin's abridgment (2nd cent. A.D.) of the history of Trogus (*c.* 10 B.C.?). To these we may add the Latin *Itinerarium Alexandri*, a skeleton outline of Alexander's campaigns dedicated to the emperor Constantius (A.D. 324–361), printed at the end of the Didot edition of Arrian, and the *Epitome Rerum Gestarum Alexandri magni*, an abridgment made in the 4th or 5th century of a lost Latin work of uncertain date, combining history with elements taken from the *Romance* (edited by O. Wagner, Leipzig, 1900). The relation of these works to the various original sources constitutes the critical problem before the modern historian in reference to the history of Alexander. See Droysen vol. i. appendix i.; A. Schoene, *De rerum Alexandri Magni scriptorum imprimis Arriani & Plutarchi fontibus* (1870); Fraenkel, *Die Geschichtschreiber Alex. d. Grossen* (1883); O. Maas, *Kleitarch und Diodor* (Petersburg, 1894); Kaerst, *Forschungen zur Gesch. Alex. d. Grossen* (1887), and *Gesch. d. hellenist. Zeitalters* (vol.i., 1901), pp. 421 f.; F. L. Schoenle, *Diodorstudien* (1891); E. Schwartz, articles "Aristobulos (14)," "Arrianus," "Quintus Curtius," "Diodorus" in Pauly-Wissowa's *Realencyclopädie*.

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[1] For the Indian campaigns of Alexander see especially McCrindle, *Invasion of India by Alexander the Great* (1896); Vincent A. Smith, *Early History of India* (1904), and the references there given to the researches of Sir T. H. Holdich, Raverty and Foucher; A. Anspach, *De Alex. Magni exped. ind.* (1903).

[2] Tomaschek, "Topographische Erläuterung der Kustenfahrt Nearchs" in the *Sitzungsberichte der kaiserl. Akad. d. Wissensch.* of Vienna (*Philosoph.-histor. Klasse*, vol. cxxi.); Major P. M. Sykes, *Ten Thousand Miles in Persia* (1902), pp. 166 f.

[3] For Alexander's funeral, see F. Jacoby in *Rhein. Mus.* (1903), pp. 461 f.

For modern views of Alexander see Thirlwall, *History of Greece*; Niebuhr, *Lectures on Ancient History* (Eng. trans. rev. by author, 1852); Grote, *History of Greece*; Droysen, *Histoire de l'Hellénisme* (translation by Bouché-Leclerq); Ad. Holm, *History of Greece* (Eng. trans., 1898); B. Niese, *Gesch. der griech. u. maked. Staaten* (vol. i.); Kaerst, *Gesch. des hellenist. Zeitalters* (1901); J. Beloch, *Griechische Gesch.* (vol. iii., 1904); J. B. Bury, *History of Greece* (1902); A. von Gutschmid, *Geschichte Irans* (1888). Among the mass of monographs and special articles, reference may be made to Freeman, *Historical Essays*, 2nd series, pp. 182 f.; Dodge, *Alexander* (in a series called *Great Captains*) 1890; Mahaffy, *Problems in Greek History* (1892), ch. viii.; D. G. Hogarth, *Philip and Alexander of Macedon* (1897), a striking effort of historical imagination to reconstruct Alexander as a man of the real world; Benjamin I. Wheeler, *Alexander the Great* (1900) in the "Heroes of the Nations Series." The purely military aspect of Alexander's campaigns is treated in general histories of warfare (Rustow-Kochly, Bauer, Delbrück, Verdy du Vernois), and in special monographs by Hogarth, *Journ. of Philol.* vol. xvii., 1888, pp. 1 foll.; H. Droysen, *Untersuchungen über A. des Gr. Heerwesen* (1885), and Graf Yorck von Wartenburg, *Kurze Übersicht der Feldzüge A. de Gr.* (1897). For further references to the literature on Alexander, see Kaerst's article in Pauly-Wissowa's *Realencyclopädie* (1894). (E. R. B.)

The Romance of Alexander.

The figure of Alexander naturally impressed itself upon the imagination of the world which his career had shaken. Even in India we are told that he was held in honour by the native kings who took his farthest provinces in possession. But Eastern tradition, so tenacious of the old myths of primitive man, has a short memory for actual history, and five centuries later Alexander was only remembered in Irān as the accursed destroyer of the sacred books, whose wisdom he had at the same time pilfered by causing translations to be made into "Roman." That the East to-day has so much to tell about Alexander is only due to the fact that old mythical stories of gods or heroes who go travelling through lands of monsters and darkness, of magical fountains and unearthly oceans, became attached to his name in the popular literature of the Roman empire, and this mythical Alexander was reintroduced in the 7th century A.D. into the farther East, where the historical Alexander was almost forgotten. The romance of Alexander is found written in the languages of nearly all peoples from the Indian Ocean to the Atlantic, but all these versions are derived, mediately or immediately, from the Greek original which circulated under the false name of Callisthenes. The Greek pseudo-Callisthenes (otherwise Aisopos we possess in three recensions, based all upon a book produced in Egypt in the 2nd century A.D. But this book itself was a farrago of heterogeneous elements—pieces of genuine history, ancient stories once told in Babylon of Gilgamesh or Etanna, literary forgeries of the days soon after Alexander, like the oldest part of the "Testament of Alexander," variations due to Egyptian patriotic sentiment, like that which made Alexander the son of the last Pharaoh, Nectanebus. As the story was reproduced, variations were freely introduced according to the bent of different times and peoples; in the Persian version Alexander (Iskander) became a son of Darius; among the Mahommedans he turned into a prophet, hot against idols; the pen of Christian monks made him an ascetic saint.

The Alexander romance found its way into Europe through the medium of Latin, but originated mainly from the versions of the pseudo-Callisthenes, not from the more sober narrative of Quintus Curtius. The pseudo-Callisthenes, in a recension which has not been preserved, was translated into Latin by Julius Valerius about the end of the 3rd century, and an epitome of this translation, also in Latin, was made some time before the 9th century, and is introduced by Vincent de Beauvais into his *Speculum historiale*. Much of the legend is a running travesty of the true history of the conqueror. The first book deals with his birth and early exploits. The trace of Alexandrian influence is to be found in the pretence that his actual father was Nectanebus, a fugitive king of Egypt. The latter was a great magician, able, by operating upon waxen figures of the armies and ships of his enemies, to obtain complete power over their real actions. Obliged, however, to flee to Pella in Macedonia, he established himself as an astrologer, and as such was consulted by the childless Olympias. Having promised that Zeus Ammon would visit her in the form of a dragon, he himself assumed the disguise. In due course Alexander was born, and Philip's suspicions were overcome by a second appearance of the dragon, which was held to prove the divine fatherhood. The child was small and somewhat deformed, but of great courage and intelligence. When he was twelve years old he was instructed in starcraft by Nectanebus, who was killed by a fall into a pit, into which he had been playfully pushed by Alexander. The first book also relates his conquests in Italy, Africa, Syria and Asia Minor; his return to Macedonia and the submission of Greece. The second book continues the history of his conquests, and the third contains the victory over Porus, the relations with the Brahmins, the letter to Aristotle on the wonders of India, the histories of Candace and the Amazons, the letter to Olympias on the marvels of Farther Asia, and lastly the account of Alexander's death in Babylon.

The most wide-spread Latin version of the story, however, was the *Historia de proeliis*,[1] printed at Strassburg in 1486, which began to supersede the *Epitome* of Julius Valerius in general favour about the end of the 13th century. It is said to have been written by the Neapolitan arch-presbyter Leo, who was sent by Johannes and Marinus, dukes of Campania (941–965) to Constantinople, where he found his Greek original. Auxiliary sources for the medieval romance-writers were:—the opuscule (4th century) known as *Alexandri magni iter ad Paradisum*, a fable of Eastern origin directed against ambition; the *Itinerarium Alexandri* (340), based partly on Julius Valerius and dedicated to Constans, son of the emperor Constantine; the letter of Alexander to Aristotle (*Epist. de situ et mirabilibus Indiae*), and the correspondence between Alexander and the king of the Brahmins, Dindimus, both of which are often contained in MSS. of the *Epitome*; and the treatise (based on a lost history of Alexander by Onesicritus), *De gentibus Indiae et Bragmanibus*, ascribed without certainty to Palladius (d. *c.* 430), successively bishop of Helenopolis and Aspona.

The Ethiopic versions are of great interest as a striking example of literary "accommodation." Not only is the whole atmosphere Christian in colouring, but we actually find the Greek gods in the guise of Enoch, Elijah, &c., while Philip is a Christian martyr, and Alexander himself a great apostle, even a saint; quotations from the Bible are frequent. Syriac and Armenian versions were made in the 5th century. Persians and Arabs told the deeds of Iskander; and Firdousi made use of the story in the *Shāhnāma*. Another early Persian poet, Nizami, made the story specially his own. The crusaders brought back fresh developments; Gog and Magog (partly Arab and partly Greek) and some Jewish stories were then added. In the 11th century Simeon Seth, *protovestiarius* at the Byzantine court, translated the fabulous history from the Persian back into Greek.

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[1] *Nativitas et victoriae Alexandri magni regis* was the original title.

The Alexander legend was the theme of poetry in all European languages; six or seven German poets dealt with the subject, and it may be read in French, English, Spanish, Danish, Swedish, Icelandic, Flemish and Bohemian.

French.—The earliest known French romance of Alexander, by Alberic of Besançon (or more properly Briançon), was, until the discovery of a fragment of 100 lines at Florence in 1852, known only through the German adaptation by Lamprecht the preacher, who wrote towards the end of the 12th century, and by the version made by a Poitevin poet named Simon in decasyllabic lines. Alberic followed the epitome of Julius Valerius. He had some knowledge of authentic history, and rejected the more marvellous elements of the story. The French feudal romance, *Li Romans d'Alexandre*, was written in the 12th century by Lambert li Tors of Chateâudun, Alexandre de Bernai, surnamed de Paris, and others. It contained 20,000 lines, and was written in twelve-syllabled lines, whence the term "alexandrine" verse. The authors endowed Alexander with the fashionable virtues of the chivalric hero, making him especially the type of lavish generosity. They used as their sources Valerius, the letter to Aristotle and the *Iter ad Paradisum*, adding much of their own. Pierre de Saint Cloud, the writer of the fourth section of the romance, was evidently acquainted with the *Historia de proeliis*. The incident of the *Fuerre de Gadres* (Foray of Gaza), interpolated in the second section, is assigned to a certain Eustache. The redaction of the whole work is due to Alexandre de Bernai, who replaced the original assonance by rhyme. According to all the traditions of romance it was necessary to avenge the death of Alexander. At the end of the 12th century Gui de Cambrai and Jean le Nevelon (or Nevelaux or Venelais), each wrote a *Vengeance d'Alexandre*. Jean le Nevelon relates how Alior, the son of Alexander and Candace, avenged his father's death on Antipater and others. Between 1310 and 1315 Jacques de Longuyon (or Langhion) introduced into the account of the Indian war *Les Vœux du paon*, a romanesque and fantastic episode very loosely connected with Alexander. It is interesting for its connexion with the 15th-century romance of *Perceforest*, since in it Alexander visits Britain, where he bestows Scotland on Gadifer and England on Betis (otherwise Perceforest). *Les Vœux du paon* enjoyed great popularity, and had two sequels, *Le Restor du paon*, written before 1338 by Jean Brisebarre de Douai, and *Le Parfait du paon*, written in 1340 by Jean de la Mote. *Florimont*, a 12th-century poem by Aimon de Varenne, relates to a fictitious personage said to have been the grandfather of Alexander. This poem gave rise to two prose romances—*La Conqueste de Grece faicte par Philippe de Madien*, by Perrinet du Pin, first printed in 1527, and *Histoire du roi Florimond* (1528). Quintus Curtius was largely used for the *Alexandreis* (*c.* 1180) of Gaultier de Lille or de Châtillon (Galtherus ab Insulis or de Castellione). It is a Latin poem in ten books of hexameters, and contains a curious admixture of Biblical history. It was translated at the end of the next century into Flemish by J. van Maerlant and into German by Ulrich von Eschenbach.

Of the French prose versions of the *Historia de proeliis* may be noticed the late romance, *L'Histoire du noble et vaillant roy Alixandre le Grant* (1506). After an account of the ancient history of Macedonia and of the intrigue of Nectanebus we are told how Philip dies, and how Alexander subdues Rome and receives tribute from all European nations. He then makes his Persian expedition; the Indian campaign gives occasion for descriptions of all kinds of wonders. The conqueror visits a cannibal kingdom and finds many marvels in the palace of Porus, among them a vine with golden branches, emerald leaves and fruit of other precious stones. In one country he meets with women who, after the burial in the winter, become alive again in the spring full of youth and beauty. Having reached the ends of the earth and conquered all nations, he aspires to the dominion of the air. He obtains a magic glass cage, yoked with eight griffins, flies through the clouds, and, thanks to enchanters who know the language of birds, gets information as to their manners and customs, and ultimately receives their submission. The excessive heat of the upper regions compels him to descend, and he next visits the bottom of the sea in a kind of diving-bell. The fish crowd round him and pay homage. Alexander returns to Babylon, is crowned with much pomp and mass is celebrated. He dies by poison soon afterwards.

English Versions.—The Alexander cycle was no less popular in Great Britain. The letter from Alexander to Aristotle and his correspondence with Dindimus are found in Early English versions dating from the 11th century. These are printed by O. Cockayne in his *Narratiunculae Anglice conscriptae* (1861). The Monk (*De Cas. ill. vir.*) in Chaucer's *Canterbury Tales* prefaces his account of Alexander with the statement that his story is so common

> That every wight that hath discrecioun
> Hath herd somewhat or al of his fortune.

There are two considerable fragments of an English alliterative romance on the subject written in the west midland dialect, and dating from the second half of the 14th century. The first, *The Gestes of the Worthy King and Emperor Alisaunder of Macedoine* (ed. W. W. Skeat, E.E.T.S., 1877, with *William of Palerme*) contains an account of the wars of Philip, of Nectanebus and of the education of Alexander. A second fragment (ed. Skeat, E.E.T.S., 1878) contains Alexander's visit to the Gymnosophists and his correspondence with Dindimus. Another alliterative poem in the northern dialect, of 15th-century origin, is based on the *Historia de proeliis*, and was edited by Skeat for the E.E.T.S. (1886) as *The Wars of Alexander*. Earlier than any of these is the rhyming *Lyfe of Alisaunder* (*c.* 1330) which is printed in H. Weber's *Metrical Romances* (vol. i., 1810). It is written in unusually picturesque and vigorous language, and is based on the *Roman de toute chevalerie*, a French compilation made about 1250 by a certain Eustace or Thomas of Kent. Fragments of another rhyming poem (pr. *c.* 1550) are preserved in the British Museum. *The Scots Buik of the most noble and vailyzeand Conqueror Alexander the Great*, printed by Alexander Arbuthnot (d. 1585) about 1580, reprinted in 1831 for the Bannatyne Club, is not really a life. It contains three episodes of the cycle, the "Forray of Gadderis" (not taken from the *Fuerre de Gadres* but from the *Assaut de Tyr* in the *Romans d'Alixandre*), "The Avowes of Alexander," and "The Great Battel of Effesoun," taken from the *Vœux du paon*. Many passages in John Barbour's *Bruce* are almost identical with this book, and it is suggested by G. Neilson (*John Barbour, Poet and Translator*, London, 1900) that Barbour was the author, although the colophon states that it was written in 1438. Bruce at Bannockburn makes the same oration as Alexander at "Effesoun." *A Buke of the Conqueror Alexander the Great* by Sir Gilbert Hay (fl. 1456) is in MS. at Taymouth Castle.

Bibliography.—The best sketch of the Alexander romance literature is by Paul Meyer, *Alexandre le grand dans la littérature française au moyen âge* (2 vols., Paris, 1886). The first volume contains some French texts, and the second a detailed discussion of the various versions from the pseudo-Callisthenes downwards. See also J. Zacher, *Pseudo-Callisthenes, Forschungen zur . . . . Alexandersage* (Halle, 1867), and for Oriental versions, T. Nöldeke, "Beiträge zur Geschichte des Alexanderromans" (*Denkschriften der ksl. Akad. d. Wissenschaften, Phil.-hist. Klasse*, vol. 38: Vienna, 1890). For early printed versions see Brunet, *Manuel du libraire*, s.v. "*Alexandre.*"

The text of the pseudo-Callisthenes was edited by C. W. Muller from three MSS. in the Bibl. Nat. and printed in the Arrian of the Coll. Didot (Paris, 1846), and by H. Meusel (Leipzig, 1871) from a Leiden MS. A. Mai edited Julius Valerius (Milan, 1817) and the *Itinerarium Alexandri* (Class. Auct. vol. vii.; Milan, 1835); J. Zacher, the *Epitome* (Halle, 1867) and *Alex. iter ad Paradisum* (Regensburg, 1859); the Oxford MS. of the *Epitome* was edited by G. Cilli (Strassburg, 1905); G. Landgraf, *Die "Vita Alexandri" . . . des Archpresbyter Leo* (*Historia de proeliis*), (Erlangen,

1885); Alexander's letter to Aristotle and his correspondence with Dindimus are included in the Teubner edition of Julius Valerius (ed. B. Kübler, Leipzig, 1888). A newly discovered anonymous *Epitome* was edited by O. Wagner (Leipzig, 1900).

The fragment by Alberic was edited by P. Heyse (Berlin, 1856); Lamprecht's German text by H. Weismann (Frankfort, 1850) and by C. Kinzel (Halle, 1884); the *Alexandreis* of Gaultier de Lille, by F. A. W. Müldener (Leipzig, 1863); an Icelandic prose version (*c.* 1250) of the same, *Alexanders Saga*, by C. R. Unger (Christiania, 1848); *Li Romans d'Alixandre*, by H. Michelant (Stuttgart, 1846); the Ethiopic version by E. A. T. Wallis Budge (1896, 2 vols., with English translation); the Syriac text of pseudo-Callisthenes by Budge (Cambridge, 1889); cp. K. F. Weymann, *Die äthiopische und arabische Übersetzungen des Pseudo-Kallisthenes* (Kirchhain, 1901).

Besides the English editions quoted in the text, the alliterative English poems were partially edited by J. Stevenson for the Roxburghe Club (1849). There is a great deal of information on the various texts in H. L. Wood's *Catalogue of Romances in the British Museum* (1883, vol. i. pp. 94 et seq.). See also A. Hermann, *Untersuchungen über das Scottische Alexanderbuch* (1893); and *Unters. über das med. Gedicht, The Wars of Alexander* (Berlin, 1889). Among other works see E. Rohde, *Der griechische Roman* (2nd ed. Leipzig, 1900); B. Meissner, *Alexander u. Gilgamos* (Leipzig, 1894); F. Kampers, "Alex. d. Grosse und die Idee des Weltimperiums in Prophetie und Sage" (in H. Granert's *Studien*, &c., Freiburg, 1901); Adolf Ausfeld, *Der griechische Alexanderroman* (Leipzig, 1907), edited after the author's death by W. Kroll; Wilhelm Hertz, "Aristoteles in den Alex. Dichtungen d. Mittelalters" (*Kgl. Acad. d. Wissenschaften*, Munich, 1891); H. Becker, *Die Brahmanen in d. Alex. Sage* (Königsberg, 1889). (M. Br.)

ALEXANDER, tagus or despot of Pherae in Thessaly, ruled from 369 to 358 B.C. His tyranny caused the Aleuadae of Larissa to invoke the aid of Alexander II. of Macedon, whose intervention was successful, but after his withdrawal Alexander treated his subjects as cruelly as before. The Thessalians now applied to Thebes; Pelopidas, who was sent to their assistance, was treacherously seized and thrown into prison (368), and it was necessary to send Epaminondas with a large army to secure his release. Alexander's conduct caused renewed intervention; in 364 he was defeated at Cynoscephalae by the Thebans, although the victory was dearly bought by the loss of Pelopidas, who fell in the battle. Alexander was at last crushed by the Thebans, compelled to acknowledge the freedom of the Thessalian cities and to limit his rule to Pherae, and forced to join the Boeotian league. He was murdered by his wife's brother at her instigation. Ancient accounts agree in describing Alexander as a typically cruel and suspicious tyrant.

ALEXANDER (1461–1506), king of Poland and grand-duke of Lithuania, fourth son of Casimir IV., king of Poland, was elected grand-duke of Lithuania on the death of his father in 1492, and king of Poland on the death of his brother John Albert in 1501. His extreme impecuniosity made him from the first subservient to the Polish senate and nobles (*szlachta*), who deprived him of the control of the mint—then one of the most lucrative sources of revenue of the Polish kings—curtailed his prerogative, and generally endeavoured to reduce him to a subordinate position. This ill-timed parsimony reacted injuriously upon Polish politics. Thus, for want of funds, Alexander was unable to assist the Grand Master of the Order of the Sword against Muscovite aggression, or prevent Tsar Ivan III. from ravaging Lithuania with the Tatars. The utmost the king could do was to garrison Smolensk and other fortresses and employ his wife Helena, the tsar's daughter, to mediate a truce between his father-in-law and himself. During his reign Poland suffered much humiliation from the attempts of her subject principalities, Prussia and Moldavia, to throw off her yoke. Only the death of Stephen, the great hospodar of Moldavia, enabled Poland still to hold her own on the Danube; while the liberality of Pope Julius II., who issued no fewer than 29 bulls in favour of Poland and granted Alexander Peter's Pence and other financial help, enabled the Polish king to restrain somewhat the arrogance of the Teutonic Order. In Alexander the characteristic virtues of the Jagiellos, patience and generosity, degenerated into slothfulness and extravagance. Frequently he was too poor to pay the expenses of his own table. But he never felt at home in Poland, and bestowed his favour principally upon his fellow-countrymen, the most notable of whom was the wealthy Lithuanian magnate Michael Glinsky, who justified his master's confidence by his great victory over the Tatars at Kleck (August 5, 1506), the news of which was brought to Alexander on his deathbed.

See V. Czerny, *The Reigns of John Albert and Alexander Jagiello* (Pol.) (Cracow, 1882).

ALEXANDER, the name of eight popes:—

ALEXANDER I. was bishop of Rome from about 106 to 115. He has been identified, without any foundation, with Alexander, a martyr of the Via Nomentana, whose day is the 3rd of May.

ALEXANDER II. (Anselmo Baggio), pope from 1061 to 1073, was a native of Milan. As bishop of Lucca he had been an energetic coadjutor with Hildebrand in endeavouring to suppress simony, and to enforce the celibacy of the clergy. His election, which Hildebrand had arranged in conformity with the decree of 1059 (see NICHOLAS II.), was not sanctioned by the imperial court of Germany. This court, faithful to the practice observed by it in the preceding elections, nominated another candidate, Cadalus, bishop of Parma, who was proclaimed at the council of Basel under the name of Honorius II., marched to Rome, and for a long time jeopardized his rival's position. At length, however, he was abandoned by the Germanic court and deposed by a council held at Mantua; and Alexander's position remained unchallenged. Alexander was succeeded by his associate Hildebrand, who took the title of Gregory VII. (L. D.*)

ALEXANDER III. (Orlando Bandinelli), pope from 1159 to 1181, was a Siennese, and as a teacher of canon law in Bologna composed the *Stroma* or the *Summa Magistri Rolandi*, one of the earliest commentaries on the Decretum Gratiani. In October 1150 Eugenius III. created him cardinal deacon SS. Cosmae and Damiani; later he became cardinal priest of St Mark's. Probably about this time he composed his *Sentences*, based on the *Introductio ad theologiam* of Abelard. In 1153 he became papal chancellor, and was the leader of the cardinals opposed to Frederick Barbarossa. On the 7th of September 1159 he was chosen the successor of Adrian IV., a minority of the cardinals, however, electing the cardinal priest Octavian, who assumed the name of Victor IV. This antipope, and his successors Paschal III. (1164–1168) and Calixtus III. (1168–1178), had the imperial support; but after the defeat of Legnano, Barbarossa finally (in the peace of Venice, 1177) recognized Alexander as pope. On the 12th of March 1178 Alexander returned to Rome, which he had been compelled to leave twice, namely, from 1162 until the 23rd of November 1165, and again in 1167. The first period he spent in France, the latter chiefly in Gaeta, Benevento, Anagni and Venice. In March 1179 Alexander held the third Lateran synod, a brilliant assemblage, reckoned by the Roman church as the eleventh oecumenical council; its acts embody several of the pope's proposals for the betterment of the condition of the church, among them the present law requiring that no one may be elected pope without the votes of two-thirds of the cardinals. This synod marks the summit of Alexander's power. Besides checkmating Barbarossa, he had humbled Henry II. of England in the affair of Thomas Becket, he had confirmed the right of Alphonso I. of Portugal to the crown, and even as a fugitive had enjoyed the favour and protection of Louis VII. of France. Nevertheless, soon after the close of the synod the Roman republic forced Alexander to leave the city, which he never re-entered; and on the 29th of September 1179 some nobles set up the antipope Innocent III. By the judicious use of money, however, Alexander got him into his power, so that he was deposed in January 1180. In 1181 Alexander excommunicated William the Lion of Scotland and put the kingdom under the interdict. The great pope died at Civita Castellana on the 30th of August 1181.

See Herzog-Hauck, *Realencyklopädie*, 3rd ed., i. 340-344; Wetzer and Welte, *Kirchenlexikon*, 2nd ed., 1481. The most elaborate biography is H. Reuter, *Geschichte Alexanders III. und der Kirche seiner Zeit* (3 vols., 2nd ed., Leipzig, 1860). (W. W. R.*)

ALEXANDER IV. (Rinaldo), pope from 1254 to 1261, was, like Innocent III. and Gregory IX., a member of the family of the counts of Segni. His uncle Gregory IX. made him cardinal deacon in 1227 and cardinal bishop of Ostia in 1231. On the death of Innocent IV. he was elected pope at Naples on the 12th of December 1254. He is described as a stout man, kindly, cheerful, but of no great brilliancy. He succeeded Innocent IV. as guardian of Conradin, the last of the Hohenstaufen, promising him his benevolent protection; but in less than a fortnight he conspired against him and bitterly opposed Conradin's uncle Manfred. Alexander fulminated with excommunication and interdict against the party of Manfred, but in vain; nor could he enlist the kings of England and Norway in a crusade against the Hohenstaufen. Rome itself became too Ghibelline for the pope, who withdrew to Viterbo, where he died on the 25th of May 1261. His pontificate was signalized by efforts to unite the Greek and Latin churches, by the establishment of the Inquisition in France, by favours shown to the mendicant orders, and by an attempt to organize a crusade against the Tatars.

The registers of Alexander IV. are published by Bourel de la Roncière and others in the *Bibliothèque des Écoles françaises d'Athènes et de Rome*, Paris, 1895 ff. (W. W. R.*)

ALEXANDER V. (Peter Philargès), pope 1409–1410, was born in Crete of unknown parents and entered the order of St Francis, for which, as for the other mendicant orders, he later manifested his affection in a striking manner. He was a member in turn of the universities of Oxford and Paris, and finally settled in Lombardy, where, thanks to the favour of Gian Galeazzo Visconti, he became bishop, first of Piacenza, then of Vincenza, then of Novara, and afterwards archbishop of Milan. On being created cardinal by Innocent VII. he devoted all his energies from 1408 onwards to the realization of the union of the church, in spite of the two rival popes. He was one of the promoters of the council of Pisa, and after that assembly had declared Gregory XII. and Benedict XIII. deposed, the cardinals assembled in conclave thought they could not do better than crown with the tiara this cosmopolitan prelate, who had an equal mastery of the Latin and Greek languages, and was renowned not only for his learning in theology but for his affability (June 26, 1409). As a matter of fact, the only effect of this election was to aggravate the schism by adding a third to the number of rival pontiffs. During his short reign of ten months Alexander V.'s aim was to extend his obedience with the assistance of France, and, notably, of the duke Louis II. of Anjou, upon whom he conferred the investiture of the kingdom of Sicily, together with the title of gonfalonier of the church. He proclaimed and promised rather than effected a certain number of reforms: the abandonment of the rights of "spoils" and "procurations," the re-establishment of the system of canonical election in the cathedral churches and principal monasteries, &c. But death came upon him almost without warning at Bologna, in the night of the 3rd-4th May 1410. A rumour went about that he had been poisoned by the cardinal Baldassare Cossa, impatient to be his successor, who succeeded him in fact under the name of John XXIII. The crime has, however, never been proved, though a Milanese physician, who performed the task of dissecting the corpse of Peter Philargès, seems to have thought that he found traces of poison. (N. V.)

ALEXANDER VI. (Rodrigo Borgia) (1431–1503), pope from 1492 to his death, is the most memorable of the corrupt and secular popes of the Renaissance. He was born (January 1, 1431) at Xativa, near Valencia in Spain, and his father's surname was Lanzol or Llançol; that of his mother's family, Borgia or Borja, was assumed by him on the elevation of his maternal uncle to the papacy as Calixtus III. (April 8, 1455). He studied law at Bologna, and after his uncle's election he was created successively bishop, cardinal and vice-chancellor of the church, an act of nepotism characteristic of the age. He served in the Curia under five popes and acquired much administrative experience, influence and wealth, although no great power; he was economical in his habits; on occasion he displayed great splendour and lived in a fine palace. His manners were agreeable and his appearance fascinating, but, like many other prelates of the day, his morals were far from blameless, his two dominant passions being greed of gold and love of women, and he was devotedly fond of the children whom his mistresses bore him. Although ecclesiastical corruption was then at its height, his riotous mode of life called down upon him a very severe reprimand from Pope Pius II., who succeeded Calixtus III. in 1458. Of his many mistresses the one for whom his passion lasted longest was a certain Vannozza (Giovanna) dei Cattani, born in 1442, and wife of three successive husbands. The connexion began in 1470, and she bore him many children whom he openly acknowledged as his own: Giovanni, afterwards duke of Gandia (born 1474), Cesare (born 1476), Lucrezia (born 1480), and Goffredo or Giuffre (born 1481 or 1482). His other children—Girolamo, Isabella and Pier Luigi—were of uncertain parentage. Before his elevation to the papacy Cardinal Borgia's passion for Vannozza somewhat diminished, and she subsequently led a very retired life. Her place in his affections was filled by the beautiful Giulia Farnese (Giulia Bella), wife of an Orsini, but his love for his children by Vannozza remained as strong as ever and proved, indeed, the determining factor of his whole career. He lavished vast sums on them and loaded them with every honour. A characteristic instance of the corruption of the papal court is the fact that Borgia's daughter Lucrezia (see BORGIA, LUCREZIA) lived with his mistress Giulia, who bore him a daughter Laura in 1492.

On the death of Pope Innocent VIII. the three likely candidates for the Holy See were Cardinals Borgia, Ascanio Sforza and Giuliano della Rovere; at no previous or subsequent election were such immense sums of money spent on bribery, and Borgia by his great wealth succeeded in buying the largest number of votes, including that of Sforza, and to his intense joy he was elected on the 10th of August 1492, assuming the name of Alexander VI. Borgia's elevation did not at the time excite much alarm, except in some of the cardinals who knew him, and at first his reign was marked by a strict administration of justice and an orderly method of government in satisfactory contrast with the anarchy of the previous pontificate, as well as by great outward splendour. But it was not long before his unbridled passion for endowing his relatives at the expense of the church and of his neighbours became manifest. For this object he was ready to commit any crime and to plunge all Italy into war. Cesare, then a youth of sixteen and a student at Pisa, was made archbishop of Valencia, his nephew Giovanni received a cardinal's hat, and for the duke of Gandia and Giuffre the pope proposed to carve fiefs out of the papal states and the kingdom of Naples. Among the fiefs destined for the duke of Gandia were Cervetri and Anguillara, lately acquired by Virginio Orsini, head of that powerful and turbulent house, with the pecuniary help of Ferdinand of Aragon, king of Naples (Don Ferrante). This brought the latter into conflict with Alexander, who determined to revenge himself by making an alliance with the king's enemies, especially the Sforza family, lords of Milan. In this he was opposed by Cardinal della Rovere, whose candidature for the papacy had been backed by Ferdinand. Della Rovere, feeling that Rome was a dangerous place for him, fortified himself in his bishopric of Ostia at the Tiber's mouth, while Ferdinand allied himself with Florence, Milan, Venice, and the pope formed a league against Naples (April 25, 1493) and prepared for war. Ferdinand appealed to Spain for help; but Spain was anxious to be on good terms with the pope to obtain a title over the newly discovered continent of America and could not afford to quarrel with him.

Alexander meditated great marriages for his children. Lucrezia had been married to the Spaniard Don Gasparo de Procida, but on her father's elevation to the papacy the union was annulled, and in 1493 she was married to Giovanni Sforza, lord of Pesaro, the ceremony being celebrated at the Vatican with unparalleled magnificence. But in spite of the splendours of the court, the condition of Rome became every day more deplorable. The city swarmed with Spanish adventurers, assassins, prostitutes and informers; murder and robbery were committed with impunity, heretics and Jews were admitted to the city on payment of bribes, and the pope himself shamelessly cast aside all show of decorum, living a purely secular and immoral life, and indulging in the chase, dancing, stage plays and indecent orgies. One of his boon companions was Jem, the brother of the sultan Bayezid, detained as a hostage.

The general political outlook in Italy was of the gloomiest, and the country was on the eve of the catastrophe of foreign invasion. At Milan Lodovico Sforza (il Moro) ruled, nominally as regent for the youthful duke Gian Galeazzo, but really with a view to making himself master of the state. He made many alliances to secure his position, but fearing himself isolated he sought help from Charles VIII. of France, and as the king of Naples threatened to come to the aid of Gian Galeazzo, who had married his grand-daughter, he encouraged the French king in his schemes for the conquest of Naples. Alexander carried on a double policy, always ready to seize opportunities to aggrandize his family. But through the intervention of the Spanish ambassador he made peace with Naples in July 1493 and also with the Orsini; the peace was cemented by a marriage between the pope's son Giuffre and Doña Sancha, Ferdinand's grand-daughter. In order to dominate the Sacred College more completely he created twelve new cardinals, among them his own son Cesare, then only eighteen years old, and Alessandro Farnese, the brother of Giulia Bella, one of the pope's mistresses, creations which caused much scandal. On the 25th of January 1494 Ferdinand died and was succeeded by his son Alphonso II. Charles of France now advanced formal claims on the kingdom, and Alexander drew him to his side and authorized him to pass through Rome ostensibly on a crusade against the Turks, without mentioning Naples. But when the French invasion became a reality he was alarmed, recognized Alphonso as king, and concluded an alliance with him in exchange for various fiefs to his sons (July 1494). Preparations for defence were made; a Neapolitan army was to advance through the Romagna and attack Milan, while the fleet was to seize Genoa; but both expeditions were badly conducted and failed, and on the 8th of September Charles crossed the Alps and joined Lodovico il Moro at Milan. The papal states were in a turmoil, and the powerful Colonna faction seized Ostia in the name of France. Charles rapidly advanced southward, and after a short stay in Florence set out for Rome (November 1494). Alexander appealed to Ascanio Sforza for help, and even to the sultan. He tried to collect troops and put Rome in a state of defence, but his position was most insecure, and the Orsini offered to admit the French to their castles. This defection decided the pope to come to terms, and on the 31st of December Charles entered Rome with his troops and the cardinals of the French faction. Alexander now feared that the king might depose him for simony and summon a council, but he won over the bishop of St Malo, who had much influence over the king, with a cardinal's hat, and agreed to send Cesare, as legate, to Naples with the French army, to deliver Jem to Charles and to give him Civitavecchia (January 16, 1495). On the 28th Charles departed for Naples with Jem and Cesare, but the latter escaped to Spoleto. Neapolitan resistance collapsed; Alphonso fled and abdicated in favour of his son Ferdinand II., who also had to fly abandoned by all, and the kingdom was conquered with surprising ease. But a reaction against Charles soon set in, for all the powers were alarmed at his success, and on the 31st of March a league between the pope, the emperor, Venice, Lodovico il Moro and Ferdinand of Spain was formed, ostensibly against the Turks, but in reality to expel the French from Italy. Charles had himself crowned king of Naples on the 12th of May, but a few days later began his retreat northward. He encountered the allies at Fornovo, and after a drawn battle cut his way through them and was back in France by November; Ferdinand II. with Spanish help was reinstated at Naples soon afterwards. The expedition, if it produced no material results, laid bare the weakness of the Italian political system and the country's incapacity for resistance.

Alexander availed himself of the defeat of the French to break the power of the Orsini, following the general tendency of all the princes of the day to crush the great feudatories and establish a centralized despotism. Virginio Orsini, who had been captured by the Spaniards, died a prisoner at Naples, and the pope confiscated his property. But the rest of the clan still held out, and the papal troops sent against them under Guidobaldo duke of Urbino and the duke of Gandia were defeated at Soriano (January 1497). Peace was made through Venetian mediation, the Orsini paying 50,000 ducats in exchange for their confiscated lands; the duke of Urbino, whom they had captured, was left by the pope to pay his own ransom. The Orsini still remained very powerful, and Alexander could count on none but his 3000 Spaniards. His only success had been the capture of Ostia and the submission of the Francophile cardinals Colonna and Savelli.

Now occurred the first of those ugly domestic tragedies for which the house of Borgia remained famous. On the 14th of June the duke of Gandia, lately created duke of Benevento, disappeared; the next day his corpse was found in the Tiber. Alexander, overwhelmed with grief, shut himself up in Castle St Angelo, and then declared that the reform of the church would be the sole object of his life henceforth—a resolution which he did not keep. Every effort was made to discover the assassin, and suspicion fell on various highly placed personages. Suddenly the rumour spread about that Cesare, the pope's second son, was the author of the deed, and although the inquiries then ceased and no conclusive evidence has yet come to light, there is every probability that the charge was well founded. No doubt Cesare, who contemplated quitting the church, was inspired by jealousy of Gandia's influence with the pope. Violent and revengeful, he now became the most powerful man in Rome, and even his father quailed before him. As he needed funds to carry out his various schemes, the pope began a series of confiscations, of which one of the victims was his own secretary, in order to enrich him. The process was a simple one: any cardinal, nobleman or official who was known to be rich would be accused of some offence; imprisonment and perhaps murder followed at once, and then the confiscation of his property. The disorganization of the Curia was appalling, the sale of offices became a veritable scandal, the least opposition to the Borgia was punished with death, and even in that corrupt age the state of things shocked public opinion. The story of Alexander's relations with Savonarola is narrated under the latter heading; it is sufficient to say here that the pope's hostility was due to the friar's outspoken invectives against papal corruption and to his appeals for a General Council. Alexander, although he could not get Savonarola into his own hands, browbeat the Florentine government into condemning the reformer to death (May 23, 1498). The pope was unable to maintain order in his own dominions; the houses of Colonna and Orsini were at open war with each other, but after much fighting they made peace on a basis of alliance against the pope. Thus further weakened, he felt more than ever that he had only his own kin to rely upon, and his thoughts were ever turned on family aggrandizement. He had annulled Lucrezia's marriage with Sforza in 1497, and, unable to arrange a union between Cesare and the daughter of Frederick, king of Naples (who had succeeded Ferdinand II. the previous year), he induced the latter by threats to agree to a marriage between the duke of Bisceglie, a natural son of Alphonso II., and Lucrezia. Cesare, who renounced his cardinalate, was sent on a mission to France at the end of the year, bearing a bull of divorce for the new king Louis XII., in exchange for which he obtained the duchy of Valentinois (hence his title of Duca Valentino) and a promise of material assistance in his schemes to subjugate the feudal princelings of Romagna; he married a princess of Navarre. Alexander hoped that Louis's help would be more profitable to his house than that of Charles had been and, in spite of the remonstrances of Spain and of the Sforza, he allied himself with France in January 1499 and was joined by Venice. By the autumn Louis was in Italy and expelled Lodovico Sforza from the Milanese. In order to consolidate his possessions still further, now that French success seemed assured, the pope determined to deal drastically with Romagna, which although nominally under papal rule was divided up into a number of practically independent lordships on which Venice, Milan and Florance cast hungry eyes. Cesare, nominated *gonfaloniere* of the Church, and strong in French favour, proceeded to attack the turbulent cities one by one (for detail see BORGIA, CESARE). But the expulsion of the French from Milan and the return of Lodovico Sforza interrupted his conquests, and he returned to Rome early in 1500. This year was a jubilee year, and crowds of pilgrims flocked to the city from all parts of the world bringing money for the purchase of indulgences, so that Alexander was able to furnish Cesare with funds for his enterprise. In the north the pendulum swung back once more and the French reoccupied Milan in April, causing the downfall of the Sforzas, much to Alexander's gratification. But there was no end to the Vatican tragedies, and in July the duke of Bisceglie, whose existence was no longer advantageous, was murdered by Cesare's orders; this left Lucrezia free to contract another marriage. The pope, ever in need of money, now created twelve new cardinals, from whom he received 120,000 ducats, and fresh conquests for Cesare were considered. But while a crusade was talked of, the real object was central Italy, and in the autumn Cesare, favoured by France and Venice, set forth with 10,000 men to complete his interrupted enterprise. The local despots of Romagna were dispossessed and an administration was set up, which, if tyrannical and cruel, was at least orderly and strong, and aroused the admiration of Machiavelli (*q.v.*). On his return to Rome (June 1501) he was created duke of Romagna. Louis XII., having succeeded in the north, determined to conquer southern Italy as well, and concluded a treaty with Spain for the division of the Neapolitan kingdom, which was ratified by the pope on the 25th of June, Frederick being formally deposed. The French army proceeded to invade Naples, and Alexander took the opportunity, with the help of the Orsini, to reduce the Colonna to obedience. In his absence he left Lucrezia as regent, offering the astounding spectacle of a pope's natural daughter in charge of the Holy See. Shortly afterwards he induced Alphonso d'Este, son of the duke of Ferrara, to marry her, thus establishing her as heiress to one of the most important principalities in Italy (January 1502). About this time a Borgia of doubtful parentage was born, Giovanni, described in some papal documents as Alexander's son and in others as Cesare's.

As France and Spain were quarrelling over the division of Naples and the Campagna barons were quiet, Cesare set out once more in search of conquests. In June he seized Camerino and Urbino, the news of which capture filled the pope with childish joy. But his military force was uncertain, for the *condottieri* were not to be trusted. His attempt to draw Florence into an alliance failed, but in July Louis of France again invaded Italy and was at once bombarded with complaints from the Borgia's enemies. Alexander's diplomacy, however, turned the tide, and Cesare, in exchange for promising to assist the French in the south, was given a free hand in central Italy. A new danger now arose in the shape of a conspiracy against him on the part of the deposed despots, the Orsini and some of his own *condottieri*. At first the papal troops were defeated and things looked black for the house of Borgia. But a promise of French help at once forced the confederates to come to terms, and Cesare by an act of treachery seized the ringleaders at Senigallia, and put Oliverotto da Fermo and Vitellozzo Vitelli to death (Dec. 31, 1502). As soon as Alexander heard the news he decoyed Cardinal Orsini to the Vatican and cast him into a dungeon, where he died. His goods were confiscated, his aged mother turned into the street and numbers of other members of the clan in Rome were arrested, while Giuffre Borgia led an expedition into the Campagna and seized their castles. Thus the two great houses of Orsini and Colonna, who had long fought for predominance in Rome and often flouted the pope's authority, were subjugated, and a great step achieved towards consolidating the Borgia's power. Cesare then returned to Rome, where his father wished him to assist Giuffre in reducing the last Orsini strongholds; this for some reason he was unwilling to do, much to Alexander's annoyance, but he eventually marched out, captured Ceri and made peace with Giulio Orsini, who surrendered Bracciano. Three more high personages fell victims to the Borgia's greed this year, viz. Cardinal Michiel, who was poisoned in April, J. da Santa Croce, who had helped to seize Cardinal Orsini, and Troches or Troccio, one of the family's most faithful assassins; all these murders brought immense sums to the pope. About Cardinal Ferrari's death there is more doubt; he probably died of fever, but the pope immediately confiscated his goods.

The war between France and Spain for the possession of Naples dragged on, and Alexander was ever intriguing, ready to ally himself with whichever power promised at the moment most advantageous terms. He offered to help Louis on condition that Sicily be given to Cesare, and then offered to help Spain in exchange for Siena, Pisa and Bologna. Cesare was preparing for another expedition into central Italy in July 1503, when, in the midst of all these projects and negotiations, both he and his father were taken ill with fever. The occurrence was of course attributed to poison, although quite without foundation, being merely due to malaria, at that time very prevalent in Rome. On the 18th of August Alexander died at the age of 72. His death was followed by scenes of wild disorder, and Cesare, being himself ill, could not attend to business, but sent Don Michelotto, his chief bravo, to seize the pope's treasures before the demise was publicly announced. When the body was exhibited to the people the next day it was in a shocking state of decomposition, which of course strengthened the suspicion of poison. At the funeral a brawl occurred between the soldiers and the priests, and the coffin having been made too short the body without the mitre was driven into it by main force and covered with an oil-cloth. Alexander's successor on the chair of St Peter was Francesco Todeschini-Piccolomini, who assumed the name of Pius III.

Alexander VI. has become almost a mythical character, and countless legends and traditions are attached to his name. As a matter of fact he cannot be regarded in any sense as a great man. His career shows no great political ideas, and none of his actions indicate genius. His one thought was family aggrandizement, and while it is unlikely that he meditated making the papacy hereditary in the house of Borgia, he certainly gave away its temporal estates to his children as though they belonged to him. The secularization of the church was carried to a pitch never before dreamed of, and it was clear to all Italy that he regarded the papacy as an instrument of worldly schemes with no thought of its religious aspect. During his pontificate the church was brought to its lowest level of degradation. The condition of his subjects was deplorable, and if Cesare's rule in Romagna was an improvement on that of the local tyrants, the people of Rome have seldom been more oppressed than under the Borgia. Alexander was not the only person responsible for the general unrest in Italy and the foreign invasions, but he was ever ready to profit by them. Even if we do not accept all the stories of his murders and poisonings and immoralities as true, there is no doubt that his greed for money and his essentially vicious nature led him to commit a great number of crimes. For many of his misdeeds his terrible son Cesare was responsible, but of others the pope cannot be acquitted. The one pleasing aspect of his life is his patronage of the arts, and in his days a new architectural era was initiated in Rome with the coming of Bramante. Raphael, Michelangelo and Pinturicchio all worked for him, and a curious contrast, characteristic of the age, is afforded by the fact that a family so steeped in vice and crime could take pleasure in the most exquisite works of art.

Bibliography.—The chief contemporary authorities for this reign are: the diary of Alexander's master of ceremonies, Johannes Burchardus, edited by L. Thuasne (Paris, 1883–1884), which is characterized by accuracy and extraordinary candour often amounting to gross indecency; the despatches of Giustiniani, the Venetian ambassador, edited by P. Villari (Florence, 1876), which show great insight and are based on the most accurate information; and Paolo Cappelli's "Diarii" in E. Alberi's *Relazioni*, series ii., iii. Among modern works the most important are: F. Gregorovius's *Geschichte der Stadt Rom* (3rd ed., Stuttgart, 1881), a work of immense research and admirable synthesis, giving a very unfavourable view of the Borgia; A. von Reumont's *Geschichte der Stadt Rom* (Berlin, 1867–1870), also a valuable book; M. Creighton's *History of the Papacy* (London, 1897) is very learned and accurate, but the author is more lenient towards Alexander; F. Gregorovius's *Lucrezia Borgia* (Stuttgart, 1874) contains a great deal of information on the Borgia family; P. Villari's *Machiavelli* (English translation, new ed., 1892) deals with the subject at some length. Of the Catholic writers

L. Pastor, *Geschichte der Päpste* (Freiburg i. B, 1886) should be consulted, for although the author tries to extenuate the pope to some extent, on the whole he is fair. (L. V.*)

ALEXANDER VII. (Fabio Chigi), pope from 1655 to 1667, was born at Siena on the 13th of February 1599. He was successively inquisitor at Malta, vice-legate at Ferrara and nuncio in Cologne (1639–1651). Though expected to take part in the negotiations which led in 1648 to the peace of Westphalia, he refused to deliberate with heretics, and protested against the treaties when completed. Innocent X. subsequently made him cardinal secretary of state. When Innocent died, Chigi, the candidate favoured by Spain, was elected pope on the 7th of April 1655. The conclave believed he was strongly opposed to the nepotism then prevalent. In the first year of his reign Alexander VII. forbade his relations even to visit Rome; but in 1656 he gave them the best-paid civil and ecclesiastical offices, also palaces and princely estates. Alexander disliked business of state, preferring literature and philosophy; a collection of his Latin poems appeared at Paris in 1656 under the title *Philomathi Labores Juveniles*. He also encouraged architecture, and in particular constructed the beautiful colonnade in the piazza of St Peter's. He favoured the Jesuits, especially in their conflict with the Jansenists, forbade in 1661 the translation of the Roman Missal into French, and in 1665 canonized Francis of Sales. His pontificate was marked by protracted controversies with France and Portugal. He died on the 22nd of May 1667. (W. W. R.*)

ALEXANDER VIII. (Pietro Ottoboni), pope from 1689 to 1691, was born in 1610 of a noble Venetian family, was created cardinal, and then successively bishop of Brescia and datary. The ambassador of Louis XIV. succeeded in procuring his election on the 6th of October 1689 as successor to Innocent XI.; nevertheless, after months of negotiation Alexander finally condemned the declaration made in 1682 by the French clergy concerning the liberties of the Gallican church. Charities on a large scale and unbounded nepotism exhausted the papal treasury. He bought the books and manuscripts of Queen Christina of Sweden for the Vatican library. Alexander condemned in 1690 the doctrines of so-called philosophic sin, taught in the Jesuit schools. He died on the 1st of February 1691. (W. W. R.*)

ALEXANDER I. (ALEKSANDER PAVLOVICH) (1777–1825), emperor of Russia, son of the grand-duke Paul Petrovich, afterwards Paul I., and Maria Fedorovna, daughter of Frederick Eugene of Württemberg, was born on the 28th of December 1777. The strange contradictions of his character make Alexander one of the most interesting as he is one of the most important figures in the history of the 19th century. Autocrat and "Jacobin," man of the world and mystic, he was to his contemporaries a riddle which each read according to his own temperament. Napoleon thought him a "shifty Byzantine," and called him the Talma of the North, as ready to play any conspicuous part. To Metternich he was a madman to be humoured. Castlereagh, writing of him to Lord Liverpool, gives him credit for "grand qualities," but adds that he is "suspicious and undecided." His complex nature was, in truth, the outcome of the complex character of his early environment and education. Reared in the free-thinking atmosphere of the court of Catherine II. he had imbibed from his Swiss tutor, Frédéric César de Laharpe, the principles of Rousseau's gospel of humanity; from his military governor, General Soltikov, the traditions of Russian autocracy; while his father had inspired him with his own passion of military parade, and taught him to combine a theoretical love of mankind with a practical contempt for men. These contradictory tendencies remained with him through life, revealed in the fluctuations of his policy and influencing through him the fate of the world. Another element in his character discovered itself when in 1801 he mounted the throne over the body of his murdered father: a mystic melancholy liable at any moment to issue in extravagant action. At first, indeed, this exercised but little influence on the emperor's life. Young, emotional, impressionable, well-meaning and egotistic, Alexander displayed from the first an intention of playing a great part on the world's stage, and plunged with all the ardour of youth into the task of realizing his political ideals. While retaining for a time the old ministers who had served and overthrown the emperor Paul, one of the first acts of his reign was to appoint a secret committee, called ironically the "Comité du salut public," consisting of young and enthusiastic friends of his own—Victor Gavovich Kochubey, Nikolai Nikolaevich Novosiltsov, Paul Alexandrovich Strogonov and Adam Czartoryski—to draw up a scheme of internal reform. Their aims, inspired by their admiration for English institutions, were far in advance of the possibilities of the time, and even after they had been raised to regular ministerial positions but little of their programme could be realized. For Russia was not ripe for liberty; and Alexander, the disciple of the revolutionist Laharpe, was—as he himself said—but "a happy accident" on the throne of the tsars. He spoke, indeed, bitterly of "the state of barbarism in which the country had been left by the traffic in men." "Under Paul," he said, "three thousand peasants had been given away like a bag of diamonds. If civilization were more advanced, I would abolish this slavery, if it cost me my head."[1] But the universal corruption, he complained, had left him no men; and the filling up of the government offices with Germans and other foreigners merely accentuated the sullen resistance of the "old Russians" to his reforms. That Alexander's reign, which began with so large a promise of amelioration, ended by riveting still tighter the chains of the Russian people was, however, due less to the corruption and backwardness of Russian life than to the defects of the tsar himself. His love of liberty, though sincere, was in fact unreal. It flattered his vanity to pose before the world as the dispenser of benefits; but his theoretical liberalism was mated with an autocratic will which brooked no contradiction. "You always want to instruct me!" he exlaimed to Derzhavin, the minister of justice, "but I am the autocratic emperor, and I will this, and nothing else!" "He would gladly have agreed," wrote Adam Czartoryski, "that every one should be free, if every one had freely done only what he wished." Moreover, with this masterful temper was joined an infirmity of purpose which ever let "I dare not wait upon I would," and which seized upon any excuse for postponing measures the principles of which he had publicly approved. The codification of the laws initiated in 1801 was never carried out during his reign; nothing was done to improve the intolerable status of the Russian peasantry; the constitution drawn up by Speranski, and passed by the emperor, remained unsigned. Alexander, in fact, who, without being consciously tyrannical, possessed in full measure the tyrant's characteristic distrust of men of ability and independent judgment, lacked also the first requisite for a reforming sovereign: confidence in his people; and it was this want that vitiated such reforms as were actually realized. He experimented in the outlying provinces of his empire; and the Russians noted with open murmurs that, not content with governing through foreign instruments, he was conferring on Poland, Finland and the Baltic provinces benefits denied to themselves. In Russia, too, certain reforms were carried out; but they could not survive the suspicious interference of the autocrat and his officials. The newly created council of ministers, and the senate, endowed for the first time with certain theoretical powers, became in the end but the slavish instruments of the tsar and his favourites of the moment. The elaborate system of education, culminating in the reconstituted, or new-founded, universities of Dorpat, Vilna, Kazan and Kharkov, was strangled in the supposed interests of "order" and of orthodox piety; while the military colonies which Alexander proclaimed as a blessing to both soldiers and state were forced on the unwilling peasantry and army with pitiless cruelty. Even the Bible Society, through which the emperor in his later mood of evangelical zeal proposed to bless his people, was conducted on the same ruthless lines. The Roman archbishop and the Orthodox metropolitans were forced to serve on its committee side by side with Protestant pastors; and village popes, trained to regard any tampering with the letter of the traditional documents of the church as mortal sin, became the unwilling instruments for the propagation of what they regarded as works of the devil.

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[1] Savary to Napoleon, Nov. 4, 1807. Tatischeff, p. 226.

Alexander's grandiose imagination was, however, more strongly attracted by the great questions of European politics than by attempts at domestic reform which, on the whole, wounded his pride by proving to him the narrow limits of absolute power. On the morrow of his accession he had reversed the policy of Paul, denounced the League of Neutrals, and made peace with England (April 1801), at the same time opening negotiations with Austria. Soon afterwards at Memel he entered into a close alliance with Prussia, not as he boasted from motives of policy, but in the spirit of true chivalry, out of friendship for the young king Frederick William and his beautiful wife. The development of this alliance was interrupted by the short-lived peace of October 1801; and for a while it seemed as though France and Russia might come to an understanding. Carried away by the enthusiasm of Laharpe, who had returned to Russia from Paris, Alexander began openly to proclaim his admiration for French institutions and for the person of Bonaparte. Soon, however, came a change. Laharpe, after a new visit to Paris, presented to the tsar his *Reflexions on the True Nature of the Consulship for Life*, which, as Alexander said, tore the veil from his eyes, and revealed Bonaparte "as not a true patriot," but only as "the most famous tyrant the world has produced." His disillusionment was completed by the murder of the duc d'Enghien. The Russian court went into mourning for the last of the Condés, and diplomatic relations with Paris were broken off.

The events of the war that followed belong to the general history of Europe; but the tsar's attitude throughout is personal to himself, though pregnant with issues momentous for the world. In opposing Napoleon, "the oppressor of Europe and the disturber of the world's peace," Alexander in fact already believed himself to be fulfilling a divine mission. In his instructions to Novosiltsov, his special envoy in London, the tsar elaborated the motives of his policy in language which appealed as little to the common sense of Pitt as did later the treaty of the Holy Alliance to that of Castlereagh. Yet the document is of great interest, as in it we find formulated for the first time in an official despatch those exalted ideals of international policy which were to play so conspicuous a part in the affairs of the world at the close of the revolutionary epoch, and issued at the end of the 19th century in the Rescript of Nicholas II.[1] and the conference of the Hague. The outcome of the war, Alexander argued, was not to be only the liberation of France, but the universal triumph of "the sacred rights of humanity." To attain this it would be necessary "after having attached the nations to their government by making these incapable of acting save in the greatest interests of their subjects, to fix the relations of the states amongst each other on more precise rules, and such as it is to their interest to respect." A general treaty was to become the basis of the relations of the states forming "the European Confederation"; and this, though "it was no question of realizing the dream of universal peace, would attain some of its results if, at the conclusion of the general war, it were possible to establish on clear principles the prescriptions of the rights of nations." "Why could not one submit to it," the tsar continued, "the positive rights of nations, assure the privilege of neutrality, insert the obligation of never beginning war until all the resources which the mediation of a third party could offer have been exhausted, having by this means brought to light the respective grievances, and tried to remove them? It is on such principles as these that one could proceed to a general pacification, and give birth to a league of which the stipulations would form, so to speak, a new code of the law of nations, which, sanctioned by the greater part of the nations of Europe, would without difficulty become the immutable rule of the cabinets, while those who should try to infringe it would risk bringing upon themselves the forces of the new union."[2]

Meanwhile Napoleon, little deterred by the Russian autocrat's youthful idealogy, never gave up hope of detaching him from the coalition. He had no sooner entered Vienna in triumph than he opened negotiations with him; he resumed them after Austerlitz. Russia and France, he urged, were "geographical allies"; there was, and could be, between them no true conflict of interests; together they might rule the world. But Alexander was still determined "to persist in the system of disinterestedness in respect of all the states of Europe which he had thus far followed," and he again allied himself with Prussia. The campaign of Jena and the battle of Eylau followed; and Napoleon, though still intent on the Russian alliance, stirred up Poles, Turks and Persians to break the obstinacy of the tsar. A party too in Russia itself, headed by the tsar's brother the grand-duke Constantine, was clamorous for peace; but Alexander, after a vain attempt to form a new coalition, summoned the Russian nation to a holy war against Napoleon as the enemy of the orthodox faith. The outcome was the rout of Friedland (June 13 and 14, 1807). Napoleon saw his chance and seized it. Instead of making heavy terms, he offered to the chastened autocrat his alliance, and a partnership in his glory.

The two emperors met at Tilsit on the 25th of June. Alexander, dazzled by Napoleon's genius and overwhelmed by his apparent generosity, was completely won. Napoleon knew well how to appeal to the exuberant imagination of his new-found friend. He would divide with Alexander the empire of the world; as a first step he would leave him in possession of the Danubian principalities and give him a free hand to deal with Finland; and, afterwards, the emperors of the East and West, when the time should be ripe, would drive the Turks from Europe and march across Asia to the conquest of India. A programme so stupendous awoke in Alexander's impressionable mind an ambition to which he had hitherto been a stranger. The interests of Europe were forgotten. "What is Europe?" he exclaimed to the French ambassador. "Where is it, if it is not you and we?"[3]

The brilliance of these new visions did not, however, blind Alexander to the obligations of friendship; and he refused to retain the Danubian principalities as the price for suffering a further dismemberment of Prussia. "We have made loyal war," he said, "we must make a loyal peace." It was not long before the first enthusiasm of Tilsit began to wane. Napoleon was prodigal of promises, but niggard of their fulfilment. The French remained in Prussia, the Russians on the Danube; and each accused the other of breach of faith. Meanwhile, however, the personal relations of Alexander and Napoleon were of the most cordial character; and it was hoped that a fresh meeting might adjust all differences between them. The meeting took place at Erfurt in October 1808, and resulted in a treaty which defined the common policy of the two emperors. But Alexander's relations with Napoleon none the less suffered a change. He realized that in Napoleon sentiment never got the better of reason, that as a matter of fact he had never intended his proposed "grand enterprise" seriously, and had only used it to preoccupy the mind of the tsar while he consolidated his own power in central Europe. From this moment the French alliance was for Alexander also not a fraternal agreement to rule the world, but an affair of pure policy. He used it, in the first instance, to remove "the geographical enemy" from the gates of St Petersburg by wresting Finland from the Swedes (1809); and he hoped by means of it to make the Danube the southern frontier of Russia. Events were in fact rapidly tending to the rupture of the Franco-Russian alliance. Alexander, indeed, assisted Napoleon in the war of 1809, but he declared plainly that he would not allow Austria to be crushed out of existence; and Napoleon complained bitterly of the inactivity of the Russian troops during the campaign. The tsar in his turn protested against Napoleon's encouragement of the Poles. In the matter of the French alliance he knew himself to be practically isolated in Russia, and he declared that he could not sacrifice the interest of his people and empire to his affection for Napoleon. "I don't want anything for myself," he said to the French ambassador, "therefore the world is *not* large enough to come to an understanding on the affairs of Poland, if it is a question of its restoration."[1] The treaty of Vienna, which added largely to the grand-duchy of Warsaw, he complained had "ill requited him for his loyalty," and he was only mollified for the time by Napoleon's public declaration that he had no intention of restoring Poland, and by a convention, signed on the 4th of January 1810 but not ratified, abolishing the Polish name and orders of chivalry.

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[1] Circular of Count Muraviev, Aug. 24, 1898.

[2] Instructions to M. Novosiltsov, Sept. 11, 1804. Tatischeff, p. 82.

[3] Savary to Napoleon, Nov. 18, 1807. Tatischeff, p. 232.

But if Alexander suspected Napoleon, Napoleon was no less suspicious of Alexander; and, partly to test his sincerity, he sent an almost peremptory request for the hand of the grand-duchess Anne, the tsar's youngest sister. After some little delay Alexander returned a polite refusal, on the plea of the princess's tender age and the objection of the dowager empress to the marriage. Napoleon's answer was to refuse to ratify the convention of the 4th of January, and to announce his engagement to the archduchess Marie Louise in such a way as to lead Alexander to suppose that the two marriage treaties had been negotiated simultaneously. From this time the relation between the two emperors gradually became more and more strained. The annexation of Oldenburg, of which the duke was the tsar's uncle, to France in December 1810, added another to the personal grievances of Alexander against Napoleon; while the ruinous reaction of "the continental system" on Russian trade made it impossible for the tsar to maintain a policy which was Napoleon's chief motive for the alliance. An acid correspondence followed, and ill-concealed armaments, which culminated in the summer of 1812 in Napoleon's invasion of Russia. Yet, even after the French had passed the frontier, Alexander still protested that his personal sentiments towards the emperor were unaltered; "but," he added, "God Himself cannot undo the past." It was the occupation of Moscow and the desecration of the Kremlin, the sacred centre of Holy Russia, that changed his sentiment for Napoleon into passionate hatred. In vain the French emperor, within eight days of his entry into Moscow, wrote to the tsar a letter, which was one long cry of distress, revealing the desperate straits of the Grand Army, and appealed to "any remnant of his former sentiments." Alexander returned no answer to these "fanfaronnades." "No more peace with Napoleon!" he cried, "He or I, I or He: we cannot longer reign together!"[2]

The campaign of 1812 was the turning-point of Alexander's life; and its horrors, for which his sensitive nature felt much of the responsibility, overset still more a mind never too well balanced. At the burning of Moscow, he declared afterwards, his own soul had found illumination, and he had realized once for all the divine revelation to him of his mission as the peacemaker of Europe. He tried to calm the unrest of his conscience by correspondence with the leaders of the evangelical revival on the continent, and sought for omens and supernatural guidance in texts and passages of scripture. It was not, however, according to his own account, till he met the Baroness de Krüdener—a religious adventuress who made the conversion of princes her special mission—at Basel, in the autumn of 1813, that his soul found peace. From this time a mystic pietism became the avowed force of his political, as of his private actions. Madame de Krüdener, and her colleague, the evangelist Empaytaz, became the confidants of the emperor's most secret thoughts; and during the campaign that ended in the occupation of Paris the imperial prayer-meetings were the oracle on whose revelations hung the fate of the world.

Such was Alexander's mood when the downfall of Napoleon left him the most powerful sovereign in Europe. With the memory of Tilsit still fresh in men's minds, it was not unnatural that to cynical men of the world like Metternich he merely seemed to be disguising "under the language of evangelical abnegation" vast and perilous schemes of ambition. The puzzled powers were, in fact, the more inclined to be suspicious in view of other, and seemingly inconsistent, tendencies of the emperor, which yet seemed all to point to a like disquieting conclusion. For Madame de Krüdener was not the only influence behind the throne; and, though Alexander had declared war against the Revolution, Laharpe was once more at his elbow, and the catchwords of the gospel of humanity were still on his lips. The very proclamations which denounced Napoleon as "the genius of evil," denounced him in the name of "liberty," and of "enlightenment." A monstrous intrigue was suspected for the alliance of the eastern autocrat with the Jacobinism of all Europe, which would have issued in the substitution of an all-powerful Russia for an all-powerful France. At the congress of Vienna Alexander's attitude accentuated this distrust. Castlereagh, whose single-minded aim was the restoration of "a just equilibrium" in Europe, reproached the tsar to his face for a "conscience" which suffered him to imperil the concert of the powers by keeping his hold on Poland in violation of his treaty obligation.[3]

Yet Alexander was sincere. Even the Holy Alliance, the pet offspring of his pietism, does not deserve the sinister reputation it has since obtained. To the other powers it seemed, at best "verbiage" and "exalted nonsense," at worst an effort of the tsar to establish the hegemony of Russia on the goodwill of the smaller signatory powers. To the Liberals, then and afterwards, it was clearly a hypocritical conspiracy against freedom. Yet to Alexander himself it seemed the only means of placing the "confederation of Europe" on a firm basis of principle[4] and, so far from its being directed against liberty he declared roundly to all the signatory powers that "free constitutions were the logical outcome of its doctrines." Europe, in fact, owed much at this time to Alexander's exalted temper. During the period when his influence was supreme, the fateful years, that is, between the Moscow campaign and the close of the congress of Aix-la-Chapelle, it had been used largely in the interests of moderation and liberty. To him mainly it was due that France was saved from dismemberment, and received a constitution which, to use his own words, "united crown and representatives of the people in a sense of common interests."[5] By his wise intervention Switzerland was saved from violent reaction, and suffered to preserve the essential gains of the Revolution. To his protection it was due that the weak beginnings of constitutional freedom in Germany were able for a while to defy the hatred of Austria. Lastly, whatever its ultimate outcome, the constitution of Poland was, in its inception, a genuine effort to respond to the appeal of the Poles for a national existence.

From the end of the year 1818 Alexander's views began to change. A revolutionary conspiracy among the officers of the guard, and a foolish plot to kidnap him on his way to the congress of Aix-la-Chapelle (*q.v.*), are said to have shaken the foundations of his Liberalism. At Aix he came for the first time into intimate contact with Metternich, and the astute Austrian was swift to take advantage of the psychological moment. From this time dates the ascendancy of Metternich over the mind of the Russian emperor and in the councils of Europe. It was, however, no case of sudden conversion. Though alarmed by the revolutionary agitation in Germany, which culminated in the murder of his agent, the dramatist Kotzebue (*q.v.*), Alexander approved of Castlereagh's protest against Metternich's policy of "the governments contracting an alliance against the peoples," as formulated in the Carlsbad decrees, 1819, and deprecated any intervention of Europe to support "a league of which the sole object is the absurd pretensions of absolute power."[6] He still declared his belief in "free institutions, though not in such as are forced from feebleness, nor contracts ordered by popular leaders from their sovereigns, nor constitutions granted in difficult circumstances to tide over a crisis. "Liberty," he maintained, "should be confined within just limits. And the limits of liberty are the principles of order."[1]

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[1] Coulaincourt to Napoleon, 4th report, Aug. 3, 1809. Tatischeff, p. 496.

[2] Alexander speaking to Colonel Michaud. Tatischeff, p. 612.

[3] Castlereagh to Liverpool, Oct. 2, 1814. F.O. Papers. Vienna VII.

[4] Martens IV. part i. p. 49.

[5] *État des négociations actuelles*, &c., mem. prepared by order of the Tsar, July 16, 1815, enclosed in Castlereagh to Liverpool, F.O. Cont. papers. Congress Paris, Castlereagh, 22.

[6] Despatch of Lieven, Nov. 30 (Dec. 12), 1819, and Russ. Circular of Jan. 27, 1820. Martens IV. part i. p. 270.

It was the apparent triumph of the principles of disorder in the revolutions of Naples and Piedmont, combined with increasingly disquieting symptoms of discontent in France, Germany and among his own people, that completed Alexander's conversion. In the seclusion of the little town of Troppau, where in October of 1820 the powers met in conference, Metternich found an opportunity for cementing his influence over Alexander which had been wanting amid the turmoil and feminine intrigues of Vienna and Aix. Here, in confidence begotten of friendly chats over afternoon tea, the disillusioned autocrat confessed his mistake. "You have nothing to regret," he said sadly to the exultant chancellor, "but I have!"[2] The issue was momentous. In January Alexander had still upheld the ideal of a free confederation of the European states, symbolized by the Holy Alliance, against the policy of a dictatorship of the great powers, symbolized by the Quadruple Treaty; he had still protested against the claims of collective Europe to interfere in the internal concerns of the sovereign states. On the 19th of November he signed the Troppau Protocol, which consecrated the principle of intervention and wrecked the harmony of the concert. (See TROPPAU, CONGRESS OF.)

At Laibach, whither in the spring of 1821 the congress had been adjourned, Alexander first heard of the revolt of the Greeks. From this time until his death his mind was torn between his anxiety to realize his dream of a confederation of Europe and his traditional mission as leader of the Orthodox crusade against the Turks. At first, under the careful nursing of Metternich, the former motive prevailed. He struck the name of Alexander Ypsilanti from the Russian army list, and directed his foreign minister, Count Capo d'Istria, himself a Greek, to disavow all sympathy of Russia with his enterprise; and, next year, a deputation of the Greeks of the Morea on its way to the congress of Verona was turned back by his orders on the road. He made, indeed, some effort to reconcile the principles at conflict in his mind. He offered to surrender the claim, successfully asserted when the sultan had been excluded from the Holy Alliance and the affairs of the Ottoman empire from the deliberations of Vienna, that the affairs of the East were the "domestic concerns of Russia," and to march into Turkey, as Austria had marched into Naples, "as the mandatory of Europe."[3] Metternich's opposition to this, illogical, but natural from the Austrian point of view, first opened his eyes to the true character of Austria's attitude towards his ideals. Once more in Russia, far from the fascination of Metternich's personality, the immemorial spirit of his people drew him back into itself; and when, in the autumn of 1825, he took his dying empress for change of air to the south of Russia, in order—as all Europe supposed—to place himself at the head of the great army concentrated near the Ottoman frontiers, his language was no longer that of "the peace-maker of Europe," but of the Orthodox tsar determined to take the interests of his people and of his religion "into his own hands." Before the momentous issue could be decided, however, Alexander died at Taganrog on the 1st of December (November 18, O.S.) 1825, "crushed," to use his own words, "beneath the terrible burden of a crown" which he had more than once declared his intention of resigning. A report, current at the time and often revived, affirmed that he did not in fact die. By some it is supposed that a mysterious hermit named Fomich, who lived at Tomsk until 1870 and was treated with peculiar deference by successive tsars, was none other than Alexander.[4]

Modern history knows no more tragic figure than that of Alexander. The brilliant promise of his early years; the haunting memory of the crime by which he had obtained the power to realize his ideals; and, in the end, the terrible legacy he left to Russia: a principle of government which, under lofty pretensions, veiled a tyranny supported by spies and secret police; an uncertain succession; an army permeated by organized disaffection; an armed Poland, whose hunger for liberty the tsar had whetted but not satisfied; the quarrel with Turkey, with its alternative of war or humiliation for Russia; an educational system rotten with official hypocrisy; a Church in which conduct counted for nothing, orthodoxy and ceremonial observance for everything; economical and financial conditions scarce recovering from the verge of ruin; and lastly, that curse of Russia,—serfdom.

In private life Alexander displayed many lovable qualities. All authorities combine in praising his handsome presence and the affability and charm of his address, together with a certain simplicity of personal tastes, which led him in his intercourse with his friends or with the representatives of friendly powers to dispense with ceremonial and etiquette. His personal friendship, too, once bestowed, was never lightly withdrawn. By nature he was sociable and pleasure-loving, he proved himself a notable patron of the arts and he took a conspicuous part in all the gaieties of the congress of Vienna. In his later years, however, he fell into a mood of settled melancholy; and, though still accessible to all who chose to approach him with complaints or petitions, he withdrew from all but the most essential social functions, and lived a life of strenuous work and of Spartan simplicity. His gloom had been increased by domestic misfortune. He had been married, in 1793, without his wishes being consulted, to the beautiful and amiable Princess Maria Louisa of Baden (Elizabeth Feodorovna), a political match which, as he regretfully confessed to his friend Frederick William of Prussia, had proved the misfortune of both; and he consoled himself in the traditional manner. The only child of the marriage, a little grand-duchess, died on the 12th of May 1808; and their common sorrow drew husband and wife closer together. Towards the close of his life their reconciliation was completed by the wise charity of the empress in sympathizing deeply with him over the death of his beloved daughter by Madame Narishkine.

See also EUROPE; RUSSIA; FRANCE; TURKEY; VIENNA, CONGRESS OF; NAPOLEON; METTERNICH; CAPO D'ISTRIA.

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ALEXANDER II. (1818–1881), emperor of Russia, eldest son of Nicholas I., was born on the 29th of April 1818. His early life gave little indication of his subsequent activity, and up to the moment of his accession in 1855 no one ever imagined that he would be known to posterity as a great reformer. In so far as he had any decided political convictions, he seemed to be animated with that reactionary spirit which was predominant in Europe at the time of his birth, and continued in Russia to the end of his father's reign. In the period of thirty years during which he was heir-apparent, the moral atmosphere of St Petersburg was very unfavourable to the development of any originality of thought or character. It was a time of government on martinet principles, under which all freedom of thought and all private initiative were as far as possible suppressed vigorously by the administration. Political topics were studiously avoided in general conversation, and books or newspapers in which the most keen-scented press-censor could detect the least odour of political or religious free-thinking were strictly prohibited. Criticism of existing authorities was regarded as a serious offence. The common policeman, the insignificant scribe in a public office, and even the actors in the "imperial" theatres, were protected against public censure as effectually as the government itself; for the whole administration was considered as one and indivisible, and an attack on the humblest representative of the imperial authority was looked on as an indirect attack on the fountain from which that authority flowed. Such was the moral atmosphere in which young Alexander Nicolaevich grew up to manhood. He received the education commonly given to young Russians of good family at that time—a smattering of a great many subjects, and a good practical acquaintance with the chief modern European languages. Like so many of his countryman he displayed great linguistic ability, and his quick ear caught up even peculiarities of dialect. His ordinary life was that of an officer of the Guards, modified by the ceremonial duties incumbent on him as heir to the throne. Nominally he held the post of director of the military schools, but he took little personal interest in military affairs. To the disappointment of his father, in whom the military instinct was ever predominant, he showed no love of soldiering, and gave evidence of a kindliness of disposition and a tender-heartedness which were considered out of place in one destined to become a military autocrat. These tendencies had been fostered by his tutor Zhukovsky, the amiable humanitarian poet, who had made the Russian public acquainted with the literature of the German romantic school, and they remained with him all through life, though they did not prevent him from being severe in his official position when he believed severity to be necessary. In 1841 he married the daughter of the grand-duke Louis II. of Hesse, Maximilienne Wilhelmine Marie, thenceforward known as Maria Alexandrovna, who bore him six sons and two daughters. He did not travel much abroad, for his father, in his desire to exclude from Holy Russia the subversive ideas current in Western Europe, disapproved foreign tours, and could not consistently encourage in his own family what he tried to prevent among the rest of his subjects. He visited England, however, in 1839, and in the years immediately preceding his accession he was entrusted with several missions to the courts of Berlin and Vienna. On the 2nd of March 1855, during the Crimean War, he succeeded to the throne on the death of his father.

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[1] *Aperçu des idées de l'Empereur*, Martens IV. part i. p. 269.

[2] Metternich *Mem.*

[3] Martens IV. part i. pp. 307, &c.

[4] See W. Gasiorowski, *Tragic Russia*, translated by Viscount de Busancy (London, 1908).

Emancipation of the serfs.

The first year of the new reign was devoted to the prosecution of the war, and after the fall of Sevastopol, to negotiations for peace. Then began a period of radical reforms, recommended by public opinion and carried out by the autocratic power. The rule of Nicholas, which had sacrificed all other interests to that of making Russia an irresistibly strong military power, had been tried by the Crimean War and found wanting. A new system must, therefore, be adopted. All who had any pretensions to enlightenment declared loudly that the country had been exhausted and humiliated by the war, and that the only way of restoring it to its proper position in Europe was to develop its natural resources and to reform thoroughly all branches of the administration. The government found, therefore, in the educated classes a new-born public spirit, anxious to assist it in any work of reform that it might think fit to undertake. Fortunately for Russia the autocratic power was now in the hands of a man who was impressionable enough to be deeply influenced by the spirit of the time, and who had sufficient prudence and practical common-sense to prevent his being carried away by the prevailing excitement into the dangerous region of Utopian dreaming. Unlike some of his predecessors, he had no grand, original schemes of his own to impose by force on unwilling subjects, and no pet crotchets to lead his judgment astray; and he instinctively looked with a suspicious, critical eye on the panaceas which more imaginative and less cautious people recommended. These traits of character, together with the peculiar circumstances in which he was placed, determined the part which he was to play. He moderated, guided and in great measure realized the reform aspirations of the educated classes. Though he carefully guarded his autocratic rights and privileges, and obstinately resisted all efforts to push him farther than he felt inclined to go he acted for several years somewhat like a constitutional sovereign of the continental type. At first he moved so slowly that many of the impatient, would-be reformers began to murmur at the unnecessary delay. In reality not much time was lost. Soon after the conclusion of peace important changes were made in the legislation concerning industry and commerce, and the new freedom thus accorded produced a large number of limited liability companies. At the same time plans were formed for constructing a great network of railways, partly for the purpose of developing the natural resources of the country, and partly for the purpose of increasing its powers of defence and attack. Then it was found that further progress was blocked by a great obstacle, the existence of serfage; and Alexander II. showed that, unlike his father, he meant to grapple boldly with the difficult and dangerous problem. Taking advantage of a petition presented by the Polish landed proprietors of the Lithuanian provinces, praying that their relations with the serfs might be regulated in a more satisfactory way—meaning in a way more satisfactory for the proprietors—he authorized the formation of committees "for ameliorating the condition of the peasants," and laid down the principles on which the amelioration was to be effected. This was a decided step and it was followed by one still more significant. Without consulting his ordinary advisers, his majesty ordered the minister of the interior to send a circular to the provincial governors of European Russia, containing a copy of the instructions forwarded to the governor-general of Lithuania, praising the supposed generous, patriotic intentions of the Lithuanian landed proprietors, and suggesting that perhaps the landed proprietors of other provinces might express a similar desire. The hint was taken, of course, and in all provinces where serfage existed emancipation committees were formed. The deliberations at once raised a host of important, thorny questions. The emancipation was not merely a humanitarian question capable of being solved instantaneously by imperial ukaz. It contained very complicated problems affecting deeply the economic, social and political future of the nation. Alexander II. had little of the special knowledge required for dealing successfully with such problems, and he had to restrict himself to choosing between the different measures recommended to him. The main point at issue was whether the serfs should become agricultural labourers dependent economically and administratively on the landlords, or should be transformed into a class of independent communal proprietors. The emperor gave his support to the latter project, and the Russian peasantry accordingly acquired rights and privileges such as are enjoyed by no other peasantry in Europe. In the numerous other questions submitted to him be began by consulting carefully the conflicting authorities, and while leaning as a rule rather to the side of those who were known as "Liberals," he never went so far as they desired, and always sought some middle course by which conflicting interests might be reconciled. On the 3rd of March 1861, the sixth anniversary of his accession, the emancipation law was signed and published. Other reforms followed in quick succession during the next five or six years: army and navy organization, a new judicial administration on the French model, a new penal code and a greatly simplified system of civil and criminal procedure, an elaborate scheme of local self-government for the rural districts and the large towns, with elective assemblies possessing a restricted right of taxation, and a new rural and municipal police under the direction of the minister of the interior. These new institutions were incomparably better than the old ones which they replaced, but they did not work such miracles as inexperienced enthusiasts expected. Comparisons were made, not with the past, but with an ideal state of things which never existed in Russia or elsewhere. Hence arose a general feeling of disappointment, which acted on different natures in different ways. Some of the enthusiasts sank into a sceptical, reactionary frame of mind; while others, with deeper convictions or capable of more lasting excitement, attributed the failure to the fact that only half-measures and compromises had been adopted by the government. Thus appeared in the educated classes two extreme groups: on the one hand, the discontented Conservatives, who recommended a return to a more severe disciplinarian *régime*; and on the other, the discontented Radicals, who would have been satisfied with nothing less than the adoption of a throughgoing socialistic programme. Between the two extremes stood the discontented Moderates, who indulged freely in grumbling without knowing how the unsatisfactory state of things was to be remedied. For some years the emperor, with his sound common-sense and dislike of exaggeration, held the balance fairly between the two extremes; but long years of uninterrupted labour, anxiety and disappointment weakened his zeal for reform, and when radicalism assumed more and more the form of secret societies and revolutionary agitation, he felt constrained to adopt severe repressive measures.

Nihilism.

The revolutionary agitation was of a very peculiar kind. It was confined to a section of the educated classes, and emanated from the universities and higher technical schools. At the beginning of the reform period there had been much enthusiasm for scientific as opposed to classical education. Russia required, it was said, not classical scholars, but practical, scientific men, capable of developing her natural resources. The government, in accordance with this view, had encouraged scientific studies until it discovered to its astonishment that there was some mysterious connexion between natural science and revolutionary tendencies. Many of the young men and women, who were supposed to be qualifying as specialists in the various spheres of industrial and commercial enterprise, were in reality devoting their time to considering how human society in general, and Russian society in particular, could be reconstructed in accordance with the latest physiological, biological and sociological principles. Some of these young people wished to put their crude notions immediately into practice, and as their desire to make gigantic socialist experiments naturally alarmed the government, their activity was opposed by the police. Many of them were arrested and imprisoned or exiled to distant provinces, but the revolutionary work was continued with unabated zeal. Thus arose a struggle between the youthful, hot-headed partisans of revolutionary physical science and the zealous official guardians of political order—a struggle which has made the strange term Nihilism (*q.v.*) a familiar word not only in Russia but also in western Europe. The movement gradually assumed the form of terrorism, and aimed at the assassination of prominent officials, and even of the emperor himself, and the natural result was that the reactionary tendencies of the government were strengthened.

Foreign policy.

In foreign policy Alexander II. showed the same qualities of character as in internal affairs, ever trying prudently to steer a middle course. When he came to the throne a peace policy was imposed on him by circumstances. The Crimean War was still going on, but as there was no doubt as to the final issue, and the country was showing symptoms of exhaustion, he concluded peace with the allies as soon as he thought the national honour had been satisfied. Prince Gorchakov could then declare to Europe, "*La Russie ne boude pas; elle se recueille*"; and for fifteen years he avoided foreign complications, so that the internal strength of the country might be developed, while the national pride and ambition received a certain satisfaction by the expansion of Russian influence and domination in Asia. Twice, indeed, during that period the chancellor ran the risk of provoking war. The first occasion was in 1863, when the Western powers seemed inclined to interfere in the Polish question, and the Russian chancery declared categorically that no interference would be tolerated. The second occasion was during the Franco-German War of 1870–71, when the cabinet of St Petersburg boldly declared that it considered itself no longer bound by the Black Sea clause of the treaty of Paris. On both these occasions hostilities were averted. Not so on the next occasion, when Russia abandoned her attitude of *recueillement*. When the Eastern question was raised in 1875 by the insurrection of Herzegovina, Alexander II. had no intention or wish to provoke a great European war. No doubt he was waiting for an opportunity of recovering the portion of Bessarabia which had been ceded by the treaty of Paris, and he perceived in the disturbed state of Eastern Europe a possibility of obtaining the desired rectification of frontier, but he hoped to effect his purpose by diplomatic means in conjunction with Austria. At the same time he was anxious to obtain for the Christians of Turkey some amelioration of their condition, and to give thereby some satisfaction to his own subjects. As autocratic ruler of the nation which had long considered itself the defender of the Eastern Orthodox faith and the protector of the Slav nationalities, he could not remain inactive at such a crisis, and he gradually allowed himself to drift into a position from which he could not retreat without obtaining some tangible result. Supposing that the Porte would yield to diplomatic pressure and menace so far as to make some reasonable concessions, he delivered his famous Moscow speech, in which he declared that if Europe would not secure a better position for the oppressed Slavs he would act alone. The diplomatic pressure failed and war became inevitable. During the campaign he displayed the same perseverance and the same moderation that he had shown in the emancipation of the serfs. To those who began to despair of success, and advised him to conclude peace on almost any terms so as to avoid greater disasters, he turned a deaf ear, and brought the campaign to a successful conclusion; but when his more headstrong advisers urged him to insist on terms which would probably have produced a conflict with Great Britain and Austria, he resolved, after some hesitation, to make the requisite concessions. In this resolution he was influenced by the discovery that he could not rely on the expected support of Germany, and the discovery made him waver in his devotion to the German alliance, which had been the main pivot of his foreign policy; but his personal attachment to the emperor William prevented him from adopting a hostile attitude towards the empire he had helped to create.

The patriotic excitement produced by the war did not weaken the revolutionary agitation. The struggle between the Terrorists and the police authorities became more and more intense, and attempts at assassination became more and more frequent. Alexander II. succumbed by degrees to the mental depression produced originally by the disappointments which he experienced in his home and foreign policy; and in 1880, when he had reigned twenty-five years, he entrusted to Count Loris-Melikov a large share of the executive power. In that year the empress died, and a few weeks afterwards he married secretly a Princess Dolgoruki, with whom he had already entertained intimate relations for some years. Early in 1881, on the advice of Count Loris-Melikov, he determined to try the effect of some moderate liberal reforms on the revolutionary agitation, and for this purpose he caused a ukaz to be prepared creating special commissions, composed of high officials and private personages who should prepare reforms in various branches of the administration. On the very day on which this ukaz was signed—13th of March 1881—he fell a victim to a Nihilist plot. When driving in one of the central streets of St Petersburg, near the Winter Palace, he was mortally wounded by the explosion of some small bombs and died a few hours afterwards. (D. M. W.)

ALEXANDER III. (1845–1894), emperor of Russia, second son of Alexander II., was born on the 10th of March 1845. In natural disposition he bore little resemblance to his soft-hearted, liberal-minded father, and still less to his refined, philosophic, sentimental, chivalrous, yet cunning grand-uncle Alexander I., who coveted the title of "the first gentleman of Europe." With high culture, exquisite refinement and studied elegance he had no sympathy and never affected to have any. Indeed, he rather gloried in the idea of being of the same rough texture as the great majority of his subjects. His straightforward, abrupt manner savoured sometimes of gruffness, while his direct, unadorned method of expressing himself harmonized well with his rough-hewn, immobile features and somewhat sluggish movements. His education was not fitted to soften these peculiarities. During the first twenty years of his life he had no prospect of succeeding to the throne, because he had an elder brother, Nicholas, who seemed of a fairly robust constitution. Even when this elder brother showed symptoms of delicate health it was believed that his life might be indefinitely prolonged by proper care and attention, and precautions had been taken for the succession by his betrothal with Princess Dagmar of Denmark. Under these circumstances the greatest solicitude was devoted to the education of Nicholas as cesarevich, whereas Alexander received only the perfunctory and inadequate training of an ordinary grand-duke of that period, which did not go much beyond primary and secondary instruction, practical acquaintance with French, English and German, and a certain amount of drill. When he became heir-apparent by the death of his elder brother in 1865, he began to study the principles of law and administration under Professor Pobêdonostsef, who did not succeed in awakening in his pupil a love of abstract studies or prolonged intellectual exertion, but who influenced the character of his reign by instilling into his mind the belief that zeal for Eastern Orthodoxy ought, as an essential factor of Russian patriotism, to be specially cultivated by every right-minded tsar. His elder brother when on his deathbed had expressed a wish that his affianced bride, Princess Dagmar of Denmark, should marry his successor, and this wish was realized on the 9th of November 1866. The union proved a most happy one and remained unclouded to the end. During those years when he was heir-apparent—1865 to 1881—he did not play a prominent part in public affairs, but he allowed it to become known that he had certain ideas of his own which did not coincide with the principles of the existing government. He deprecated what he considered undue foreign influence in general, and German influence in particular, and he longed to see the adoption of genuine national principles in all spheres of official activity, with a view to realizing his ideal of a homogeneous Russia—homogeneous in language, administration and religion. With such ideas and aspirations he could hardly remain permanently in cordial agreement with his father, who, though a good patriot according to his lights, had strong German sympathies, often used the German language in his private relations, occasionally ridiculed the exaggerations and eccentricities of the Slavophils and based his foreign policy on the Prussian alliance. The antagonism first appeared publicly during the Franco-German War, when the tsar supported the cabinet of Berlin and the cesarevich did not conceal his sympathies with the French. It reappeared in an intermittent fashion during the years 1875–1879, when the Eastern question produced so much excitement in all ranks of Russian society. At first the cesarevich was more Slavophil than the government, but his phlegmatic nature preserved him from many of the exaggerations indulged in by others, and any of the prevalent popular illusions he may have imbibed were soon dispelled by personal observation in Bulgaria, where he commanded the left wing of the invading army. The Bulgarians had been represented in St Petersburg and Moscow not only as martyrs but also as saints, and a very little personal experience sufficed to correct the error. Like most of his brother officers he could not feel any very great affection for the "little brothers," as the Bulgarians were then commonly called, and he was constrained to admit that the Turks were by no means so black as they had been painted. He did not, however, scandalize the believers by any public expression of his opinions, and did not indeed make himself conspicuous in any way during the campaign. Never consulted on political questions, he confined himself to his military duties and fulfilled them in a conscientious and unobtrusive manner. After many mistakes and disappointments, the army reached Constantinople and the treaty of San Stefano was signed, but much that had been obtained by that important document had to be sacrificed at the congress of Berlin. Prince Bismarck failed to do what was confidently expected of him. In return for the Russian support, which had enabled him to create the German empire, it was thought that he would help Russia to solve the Eastern question in accordance with her own interests, but to the surprise and indignation of the cabinet of St Petersburg he confined himself to acting the part of "honest broker" at the congress, and shortly afterwards he ostentatiously contracted an alliance with Austria for the express purpose of counteracting Russian designs in Eastern Europe. The cesarevich could point to these results as confirming the views he had expressed during the Franco-German War, and he drew from them the practical conclusion that for Russia the best thing to do was to recover as quickly as possible from her temporary exhaustion and to prepare for future contingencies by a radical scheme of military and naval reorganization. In accordance with this conviction, he suggested that certain reforms should be introduced. During the campaign in Bulgaria he had found by painful experience that grave disorders and gross corruption existed in the military administration, and after his return to St Petersburg he had discovered that similar abuses existed in the naval department. For these abuses, several high-placed personages—among others two of the grand-dukes—were believed to be responsible, and he called his father's attention to the subject. His representations were not favourably received. Alexander II. had lost much of the reforming zeal which distinguished the first decade of his reign, and had no longer the energy required to undertake the task suggested to him. The consequence was that the relations between father and son became more strained. The latter must have felt that there would be no important reforms until he himself succeeded to the direction of affairs. That change was much nearer at hand than was commonly supposed. On the 13th of March 1881 Alexander II. was assassinated by a band of Nihilists, and the autocratic power passed to the hands of his son.

In the last years of his reign, Alexander II. had been much exercised by the spread of Nihilist doctrines and the increasing number of anarchist conspiracies, and for some time he had hesitated between strengthening the hands of the executive and making concessions to the widespread political aspirations of the educated classes. Finally he decided in favour of the latter course, and on the very day of his death he signed a ukaz, creating a number of consultative commissions which might have been easily transformed into an assembly of notables. Alexander III. determined to adopt the opposite policy. He at once cancelled the ukaz before it was published, and in the manifesto announcing his accession to the throne he let it be very clearly understood that he had no intention of limiting or weakening the autocratic power which he had inherited from his ancestors. Nor did he afterwards show any inclination to change his mind. All the internal reforms which he initiated were intended to correct what he considered as the too liberal tendencies of the previous reign, so that he left behind him the reputation of a sovereign of the retrograde type. In his opinion Russia was to be saved from anarchical disorders and revolutionary agitation, not by the parliamentary institutions and so-called liberalism of western Europe, but by the three principles which the elder generation of the Slavophils systematically recommended—nationality, Eastern Orthodoxy and autocracy. His political ideal was a nation containing only one nationality, one language, one religion and one form of administration; and he did his utmost to prepare for the realization of this ideal by imposing the Russian language and Russian schools on his German, Polish and Finnish subjects, by fostering Eastern Orthodoxy at the expense of other confessions, by persecuting the Jews and by destroying the remnants of German, Polish and Swedish institutions in the outlying provinces. In the other provinces he sought to counteract what he considered the excessive liberalism of his father's reign. For this purpose he clipped the feeble wings of the zemstvo, an elective local administration resembling the county and parish councils in England, and placed the autonomous administration of the peasant communes under the supervision of landed proprietors appointed by the government. At the same time he sought to strengthen and centralize the imperial administration, and to bring it more under his personal control. In foreign affairs he was emphatically a man of peace, but not at all a partisan of the doctrine of peace at any price, and he followed the principle that the best means of averting war is to be well prepared for it. Though indignant at the conduct of Prince Bismarck towards Russia, he avoided an open rupture with Germany, and even revived for a time the Three Emperors' Alliance. It was only in the last years of his reign, when M. Katkov had acquired a certain influence over him, that he adopted towards the cabinet of Berlin a more hostile attitude, and even then he confined himself to keeping a large quantity of troops near the German frontier, and establishing cordial relations with France. With regard to Bulgaria he exercised similar self-control. The efforts of Prince Alexander and afterwards of Stamboloff to destroy Russian influence in the principality excited his indignation, but he persistently vetoed all proposals to intervene by force of arms. In Central Asian affairs he followed the traditional policy of gradually extending Russian domination without provoking a conflict with Great Britain, and he never allowed the bellicose partisans of a forward policy to get out of hand. As a whole his reign cannot be regarded as one of the eventful periods of Russian history; but it must be admitted that under his hard unsympathetic rule the country made considerable progress. He died at Livadia on the 1st of November 1894, and was succeeded by his eldest son, Nicholas II. D. M. W.

ALEXANDER I. (*c.* 1078–1124), king of Scotland, was the fourth son of Malcolm Canmore by his wife (St) Margaret, grand-niece of Edward the Confessor. On the death of his brother Edgar in 1107 he succeeded to the Scottish crown; but, in accordance with Edgar's instructions, he inherited only a part of its possessions. By a partition, the motive of which is not quite certain, the districts south of the Forth and Clyde were erected into an earldom for Alexander's younger brother, David. Alexander, dissatisfied, sought to obtain the whole, but without success. A curious combination of the fierce warrior and the pious churchman, he manifested the one aspect of his character in his ruthless suppression of an insurrection in his northern dominion (thus gaining for himself the title of "the Fierce"), the other in his munificent foundation of bishoprics and abbeys. Among the latter were those of Scone and Inchcolm. His strong championship of the independence of the Scottish church involved him in struggles with both the English metropolitan sees. He died on the 27th of April 1124, and was succeeded by his brother, David I.

ALEXANDER II. (1198–1249), king of Scotland, son of William the Lion and Ermengarde of Beaumont, was born at Haddington in 1198, and succeeded to the kingdom on the death of his father in 1214. The year after his accession the clans MacWilliam and MacHeth, inveterate enemies of the Scottish crown, broke into revolt; but the insurrection was speedily quelled. In the same year Alexander joined the English barons in their struggle against John, and led an army into England in support of their cause; but on the conclusion of peace after John's death between his youthful son Henry III. and the French prince Louis, the Scottish king was included in the pacification. The reconciliation thus effected was further strengthened by the marriage of Alexander to Henry's sister Joanna in 1221. The next year was marked by the subjection of the hitherto semi-independent district of Argyll. A revolt in Galloway in 1235 was crushed without difficulty; nor did an invasion attempted soon afterwards by its exiled leaders meet with any better fortune. Soon afterwards a claim for homage from Henry of England drew forth from Alexander a counter-claim to the northern English counties. The dispute, however, was settled by a compromise in 1237. A threat of invasion by Henry in 1243 for a time interrupted the friendly relations between the two countries; but the prompt action of Alexander in anticipating his attack, and the disinclination of the English barons for war, compelled him to make peace next year at Newcastle. Alexander now turned his attention to securing the Western Isles, which still owned a nominal dependence on Norway. Negotiations and purchase were successively tried but without success. Alexander next attempted to seduce Ewen, the son of Duncan, lord of Argyll, from his allegiance to the Norwegian king. Ewen refused his overtures, and Alexander sailed forth to compel him. But on the way he was seized with fever at Kerrera, and died there on the 8th of July 1249.

ALEXANDER III. (1241–1285), king of Scotland, son of Alexander II. by his second wife Mary de Coucy, was born in 1241. At the age of eight years the death of his father called him to the throne. The years of his minority were marked by an embittered struggle for the control of affairs between two rival parties, the one led by Walter Comyn, earl of Menteith, the other by Alan Durward, the justiciar. The former was in the ascendant during the early years of the reign. At the marriage of Alexander to Margaret of England in 1251, Henry III. seized the opportunity to demand from his son-in-law homage for the Scottish kingdom, but the claim was refused. In 1255 an interview between the English and Scottish kings at Kelso resulted in the deposition of Menteith and his party in favour of their opponents. But though disgraced, they still retained great influence; and two years later, seizing the person of the king, they compelled their rivals to consent to the erection of a regency representative of both parties. On attaining his majority in 1262, Alexander declared his intention of resuming the projects on the Western Isles which had been cut short by the death of his father thirteen years before. A formal claim was laid before the Norwegian king Haakon. Not only was this unsuccessful, but next year Haakon replied by a formidable invasion. Sailing round the west coast of Scotland he halted off Arran, where negotiations were opened. These were artfully prolonged by Alexander until the autumn storms should begin. At length Haakon, weary of delay, attacked, only to encounter a terrific storm which greatly damaged his ships. The battle of Largs, fought next day, was indecisive. But even so Haakon's position was hopeless. Baffled he turned homewards, but died on the way. The Isles now lay at Alexander's feet, and in 1266 Haakon's successor concluded a treaty by which the Isle of Man and the Western Isles were ceded to Scotland in return for a money payment, Orkney and Shetland alone being retained. Towards the end of Alexander's reign, the death of all his three children within a few years made the question of the succession one of pressing importance. In 1284 he induced the Estates to recognize as his heir-presumptive his grand-daughter Margaret, the "Maid of Norway"; and next year the desire for a male heir led him to contract a second marriage. But all such hopes were defeated by the sudden death of the king, who was killed by a fall from his horse in the dark while riding to visit the queen at Kinghorn on the 16th of March 1285.

ALEXANDER (Alexander Obrenovich) (1876–1903), king of Servia, was born on the 14th of August 1876. On the 6th of March 1889 his father, King Milan, abdicated and proclaimed him king of Servia under a regency until he should attain his majority at eighteen years of age. King Alexander, on the 13th of April 1893, being then in his seventeenth year, made his notable first *coup d'état*, proclaimed himself of full age, dismissed the regents and their government, and took the royal authority into his own hands. His action was popular, and was rendered still more so by his appointment of a radical ministry. In May 1894 King Alexander, by another *coup d'état*, abolished the liberal constitution of 1889 and restored the conservative one of 1869. His attitude during the Turco-Greek war of 1897 was one of strict neutrality. In 1898 he appointed his father commander-in-chief of the Servian army, and from that time, or rather from his return to Servia in 1894 until 1900, ex-king Milan was regarded as the *de facto* ruler of the country. But while, during the summer of 1900, Milan was away from Servia taking waters in Carlsbad, and making arrangements to secure the hand of a German princess for his son, and while the premier, Dr Vladan Dyorevich, was visiting the Paris Universal Exhibition, King Alexander suddenly announced to the people of Servia his engagement to Mme Draga Mashin, a widow, formerly a lady-in-waiting to Queen Natalie. The projected union aroused great opposition at first. Ex-King Milan resigned his post; so did the government; and King Alexander had great difficulty in forming a new cabinet. But the opposition subsided somewhat on the publication of Tsar Nicholas's congratulations to the king on his engagement and of his acceptance to act as the principal witness at the wedding. The marriage was then duly celebrated on the 5th of August 1900. Still this union was unpopular and weakened the position of King Alexander in the army and the country. He tried to reconcile political parties by granting from his own initiative a liberal constitution (April 6, 1901), introducing for the first time in the constitutional history of Servia the system of two chambers (skupshtina and senate). This did in a certain measure reconcile the political parties, but did not reconcile the army, which, already dissatisfied with the king's marriage, became still more so at the rumours that one of the two unpopular brothers of Queen Draga, Lieutenant Nicodiye, was to be proclaimed heir-apparent to the throne. Meanwhile the independence of the senate and of the council of state caused growing irritation to King Alexander, which led him to another *coup d'état*. He suspended (March 1903) the constitution for half an hour, time enough to publish the decrees by which the old senators and councillors of state were dismissed and replaced by new ones. This arbitrary act naturally increased the dissatisfaction in the country. The general impression was that inasmuch as the senate was packed with men devoted to the royal couple, and inasmuch as the government obtained a large majority at the general elections, King Alexander would not hesitate any longer to proclaim Queen Draga's brother as the heir to the throne. Apparently to prevent this, but in reality to replace Alexander Obrenovich by Peter Karageorgevich, a military conspiracy was organized. The conspirators penetrated into the palace and savagely murdered King Alexander and Queen Draga in the early morning of the 11th of June 1903. (C. Mi.)

ALEXANDER, son of Numenius, Greek rhetorician, flourished in the first half of the second century A.D. In addition to general treatises on rhetoric, he wrote a special work Περὶ *τῶν τῆς διανοίας καὶ τῆς λέξεως σχημάτων*, of which only an abridgment is extant; later epitomes were made in Latin by Aquila Romanus and Julius Rufinianus under the title *De Figuris Sententiarum et Elocutionis*. Another epitome was made in the fourth century by a Christian for use in Christian schools, containing additional examples from Gregory of Nazianzus.

Text in Spengel, *Rhetores Graeci* (1856).

ALEXANDER, ARCHIBALD (1772–1851), American Presbyterian divine, was born, of Scottish-Irish descent, in that part of Augusta county which is now Rockbridge county, Virginia, on the 17th of April 1772. After completing his preliminary education in the little school at Lexington, Virginia, which later developed into Washington and Lee University, he came under the influence of the religious movement known as the "great revival" (1789–1790) and devoted himself to the study of theology. Licensed to preach in 1791, he was engaged for several years as an itinerant Presbyterian preacher in his native state, and acquired during this period the facility in extemporaneous speaking for which he was remarkable. He was president of Hampden-Sidney College from 1796 to 1807, with a short intermission (in 1801–1802), and in 1807 became pastor of Pine Street Church, Philadelphia. In 1812 he became first professor in the newly established Presbyterian Theological Seminary at Princeton, New Jersey, where he remained until his death at Princeton on the 22nd of October 1851, filling successively the chairs of didactic and polemic theology (1812–1840), and pastoral and polemic theology (1840–1851). He married, in 1802, Janetta Waddel, the daughter of the celebrated blind preacher, James Waddel (1739–1805), whose eloquence was described in William Wirt's *Letters of a British Spy* (1803). Dr Alexander wrote a considerable number of theological works, which had a large circulation. Among these may be mentioned his *Brief Outline of the Evidences of the Christian Religion* (1825), which passed through several editions, and was translated into various languages; *The Canon of the Old and New Testament Ascertained; or the Bible Complete without the Apocrypha and Unwritten Traditions* (1826); *A History of the Israelitish Nation* (1852), and *Outlines of Moral Science* (1852), the last two being published posthumously.

See the biography (New York, 1854) by his son James W. Alexander.

ALEXANDER, FRANCIS (1800–1881), American portrait-painter, was born in Windham county, Connecticut, in February 1800. Brought up on a farm, he taught himself the use of colours, and in 1820 went to New York City and studied painting with Alexander Robertson. He spent the winters of 1831 and 1832 in Rome, and then for nearly a decade he lived in Boston, Massachusetts, where he had considerable vogue, and where in 1842 he painted a portrait of Charles Dickens. One of his best portraits is that of Mrs Fletcher Webster in the Boston Museum of Fine Arts. He died in 1881 in Florence.

ALEXANDER, GEORGE (1858–), English actor, whose family name was Samson, was born in Reading on the 19th of June 1858, the son of a Scottish manufacturer. He went into business in London after leaving school, but having acted as an amateur he determined to make the stage his profession. His first appearance was at Nottingham in 1879, and after some seasons of provincial experience he made his first London appearance as Caleb Deecie in *Two Roses* in 1881 with Irving at the Lyceum. He was selected by W. S. Gilbert to support Mary Anderson in *Comedy and Tragedy*, returned for a time to the Lyceum, where he was Irving's principal associate, especially as Faust (1886) and Macduff (1888); and, after starting successfully under his own management at the Avenue Theatre in 1890 with *Dr Bill*, in 1891 became manager of the St James's Theatre. There he produced a number of successful plays, notably Oscar Wilde's *Lady Windermere's Fan* and *The Importance of being Earnest*, Pinero's *Second Mrs Tanqueray*, *The Princess and the Butterfly*, *His House in Order* and *The Thunderbolt*; C. Haddon Chambers's *The Idler*; H. A. Jones's *Masqueraders*; Alfred Sutro's *John Glayde's Honour* and *The Builder of Bridges*; Carton's *Liberty Hall* and *The Tree of Knowledge*; Anthony Hope's *Prisoner of Zenda* and *Rupert of Hentzau*; and Stephen Phillips's *Paolo and Francesca*, himself playing the leading parts with great distinction. In 1907 he was elected a member of the London County Council as a municipal reformer, but continued to act regularly at the St James's.

ALEXANDER, SIR JAMES EDWARD (1803–1885), British soldier and traveller, was born on the 16th of October 1803. He joined the East India Company's army in 1820, transferring into the British army in 1825. As aide-de-camp to the British envoy to Persia, he was an eye-witness of the fighting in the war between Persia and Russia (1826), and in 1829 was present in the Balkans during the Russo-Turkish war. In 1832–1834 he was in Portugal during the Miguelete war, and in 1835 served in the Kaffir war in South Africa as aide-de-camp to Sir Benjamin D'Urban. Subsequently he conducted an exploring expedition into Namaqualand and Damaraland, and was knighted for his services (1838). From 1841 to 1855 he served in Canada, proceeding thence to the Crimea, and in 1862 held an important command in New Zealand during the Maori war. He retired from the service in 1877, and in 1881 was given the honorary rank of general. He was largely responsible for the preservation and transfer to England of Cleopatra's Needle in 1877. His varied experiences provided material for a large number of books, among which were *Travels from India to England* (1827); *Transatlantic Sketches* (1833); *An Expedition of Discovery into the Interior of Africa* (1838); *Passages in the Life of a Soldier* (1857); *Incidents of the Maori War* (1863). He was also the author of a *Life of Field-Marshal the Duke of Wellington* (1840). He died on the 2nd of April 1885.

ALEXANDER, JOHN WHITE (1856–), American painter, was born in Allegheny, Pennsylvania, on the 7th of October

1856. He was left an orphan when very young, became an illustrator for *Harper's Magazine*, studied in Europe, became a pupil of the Royal Academy at Munich, and also worked in Venice, in Holland and in Paris, where he attracted much attention by his exhibition at the Salon of two female portraits entitled “ Gris ” and “ Noir.” He became a member of the Société Nationale des Beaux Arts (Paris), of the National Academy of Design (New York), of the International Society (London), and of the Vienna and Munich Societies of Painters. In 1901 he was made a Chevalier of the Legion of Honour. He executed decorative panels for the Congressional Library, Washington, D.C., and a large decoration for the Carnegie Institute, Pittsburg, Pennsylvania; and his works include numerous portraits and subject pictures.

ALEXANDER, JOSEPH ADDISON (1809–1860), American biblical scholar, the third son of Archibald Alexander, was born in Philadelphia, Pennsylvania, on the 24th of April 1809. He graduated at the College of New Jersey (now Princeton University) in 1826, having devoted himself especially to the study of Hebrew and other oriental languages, and from 1830 to 1833 was adjunct professor of ancient languages and literature there. In 1834 he became an assistant to Dr Charles Hodge, professor of oriental and biblical literature in the Princeton Theological Seminary, and in 1838 became associate professor of oriental and biblical literature there, succeeding Dr Hodge in that chair in 1840 and being transferred in 1851 to the chair of biblical and ecclesiastical history, and in 1859 to that of Hellenistic and New Testament literature, which he occupied until his death at Princeton on the 28th of January 1860. Alexander was a remarkable linquist and exegete. He had been ordained as a Presbyterian minister in 1839, and was well known for his pulpit eloquence. He was the author of *The Earlier Prophecies of Isaiah* (1846), *The Later Prophecies of Isaiah* (1847), and an abbreviation of these two volumes, *Isaiah Illustrated and Explained* (2 vols., 1851), *The Psalms Translated and Explained* (3 vols., 1850), commentaries on *Acts* (2 vols., 1857), *Mark* (1858) and *Matthew* (1860), and two volumes of *Sermons* (1860).

See *The Life of Joseph A. Alexander* (2 vols., 2nd ed., New York, 1875) by his nephew, Henry C. Alexander.

His brother, James Waddel Alexander (1804–1859), born in Louisa county, Virginia, on the 13th of March 1804, was a famous Presbyterian preacher. He graduated at the College of New Jersey in 1820, studied theology in the Princeton Seminary, and was pastor of a Presbyterian church in Charlotte county, Virginia, from 1826 to 1828, and of the First Presbyterian church in Trenton, New Jersey, in 1829–1832. From 1833 to 1844 he was professor of belles-lettres and Latin language and literature in the College of New Jersey, from 1844 to 1849 was pastor of the Duane Street Presbyterian church in New York City, from 1849 to 1851 was professor of ecclesiastical history, church government and sacred rhetoric in the Princeton Theological Seminary, and from 1851 until his death, at Red Sweet Springs, Virginia, on the 31st of July 1859, was pastor of the Fifth Avenue Presbyterian church in New York City. He wrote numerous magazine articles and published a number of books, including *The American Mechanic and Workingman* (2 vols., 1847, a collection of papers to mechanics first printed under the pseudonym of “ Charles Quill ”), *Thoughts on Family Worship* (1847), *Sacramental Addresses* (1854), *The Revival and its Lessons* (1859), *Thoughts on Preaching* (1861), *Faith* (1862), and many juvenile books for Sunday-school libraries.

See *Forty Years' Familiar Letters of James W. Alexander* (2 vols., New York, 1860), edited by Dr John Hall (1806–1894) of Trenton, N. J.

ALEXANDER, WILLIAM (1824–   ), Protestant archbishop of Armagh and primate of all Ireland, was born at Londonderry on the 13th of April 1824 and educated at Tonbridge Grammar School and Brasenose College, Oxford. After holding several livings in the north of Ireland he was made bishop of Derry and Raphoe in 1867, and was elevated to the primacy in 1896. He was Bampton lecturer in 1876. An eloquent preacher and the author of numerous theological works, he is best known to literature as a master of dignified and animated verse. His poems were collected in 1887 under the title of *St Augustine's Holiday, and other Poems*. His wife, Cecil Francis Humphreys (1818–1895), wrote some tracts in connexion with the Oxford movement, but is famous as the author of “ Jesus calls us o'er the tumult,” “ There is a green hill far away ” and other well-known hymns (nearly four hundred in all). A collection of her verse was published in 1896.

ALEXANDER, WILLIAM LINDSAY (1808–1884), Scottish divine, was born at Leith on the 24th of August 1808. He was educated at the universities of St Andrews and Edinburgh, where he gained a lasting reputation for classical scholarship. He entered Glasgow Theological Academy under Ralph Wardlaw in September 1827, but in December of the same year he left to become classical tutor at the Blackburn Theological Academy (afterwards the Lancashire Independent College). At Blackburn he stayed till 1831, lecturing on biblical literature, metaphysics, Greek and Latin. After short visits to Germany and London he was invited in November 1834 to become minister of North College Street church (afterwards Argyle Square), Edinburgh, an independent church which had arisen out of the evangelical movement associated with the Haldanes. He deliberately put aside the ambition to become a pulpit orator in favour of the practice of biblical exposition, which he invested with a singular charm and impressiveness. In 1836 he became one of the editors of the *Congregational Magazine*, to which he contributed articles on biblical literature and theology and on the “ voluntary ” controversy. In 1840 he delivered the Congregational Lecture in London on the “ Connexion and Harmony of the Old and New Testaments.”

Alexander took an active part in the “ voluntary ” controversy which ended in the Disruption, but he also maintained broad and catholic views of the spiritual relations between different sections of the Christian church. In 1845 he visited Switzerland with the special object of inquiring into the religious life of the churches there. He published an account of his journey in a book, *Switzerland and the Swiss Churches*, which led to an interchange of correspondence between the Swiss and Scottish churches. In 1845 he received the degree of D.D. from the university of St Andrews. In 1861 he undertook the editorship of the third edition of Kitto's *Biblical Encyclopaedia* with the understanding that the whole work should be thoroughly revised and brought up to date. In January 1870 he became one of the committee of Old Testament revisers, and by his thorough biblical scholarship rendered exceptional service to the board; he enjoyed the work and devoted much time to it for the next fourteen years. In 1877 he became principal of the Edinburgh Theological Hall, a position which he held, in spite of many tempting offers of preferment elsewhere, until his death on the 20th of December 1884.

See his *Life and Work* by James Ross (1887). (D. Mn.)

ALEXANDER AETOLUS, of Pleuron in Aetolia, Greek poet and man of letters, the only representative of Aetolian poetry, flourished about 280 B.C. When living in Alexandria he was commissioned by Ptolemy Philadelphus to arrange the tragedies and satyric dramas in the library; some ten years later he took up his residence at the court of Antigonus Gonatas, king of Macedonia. His reputation as a tragic poet was so high that he was allotted a place in the Alexandrian tragic Pleiad; we only know the title of one play (*Astragalistae*). He also wrote short epics, epigrams and elegies, the considerable fragments of which show learning and eloquence.

Meineke, *Analecta Alexandrina* (1853); Bergk, *Poetae Lyrici Graeci*; Couat, *La Poésie alexandrine* (1882).

ALEXANDER BALAS (*i.e.* “ lord ”), ruler of the Greek kingdom of Syria 150–146 B.C., was a native of Smyrna of humble origin, but gave himself out to be the son of Antiochus IV. Epiphanes and heir to the Syrian throne. His claims were recognized by the Roman senate, Ptolemy Philometor of Egypt and others. At first unsuccessful, he finally defeated the reigning king Demetrius Soter in 150 B.C. Being now undisputed master of Syria, he abandoned himself to a life of debauchery. Demetrius Soter's son profited by the opportunity to regain the throne. Ptolemy Philometor, who was Alexander's father-in-law, went over to his side, and Alexander was defeated in a pitched battle near Antioch in Syria. He fled for refuge to a Nabataean prince, who murdered him and sent his head to Ptolemy, who had been mortally wounded in the engagement.

See 1 Maccab. 10 ff.; Justin xxxv. 1 and 2; Josephus, *Antiq.* xiii. 2; Appian, *Syr.* 67; Polybius xxxiii. 14.

ALEXANDER CORNELIUS, Greek grammarian, surnamed Polyhistor from his great learning, born at Miletus or Myndus in Caria, flourished about 70 B.C. He was taken prisoner in the Mithridatic war by Sulla, from whom (or from Cornelius Lentulus) he received his freedom and assumed the name Cornelius. He accompanied Crassus on his Parthian campaigns, and perished at the destruction by fire of his house at Laurentum. He is said to have written "books without number," chiefly on historical and geographical subjects. Of the extant fragments (Müller, *Fragmenta Historicorum Graecorum*, iii.) those relating to the Jews are important as containing quotations from lost Jewish authors.

ALEXANDER JANNAEUS, king of the Jews, succeeded his brother Aristobulus in 103 B.C. and died in 76 B.C. His first act was the murder of one of his brothers who claimed the throne, and his reign was disgraced by the cruelties that he perpetrated in order to retain his position. (See Jews and Pharisees.)

ALEXANDER NEVSKY, SAINT (1220–1263), grand-duke of Vladimir, was the second son of the grand-duke Yaroslav. His childhood and youth were spent at Great Novgorod, whither his father sent him to rule (1228) with some guardian boyars. In 1239 he married Alexandra, daughter of Prince Bryachislav of Polotsk. At an early age he distinguished himself in constant warfare with the Germans, Swedes and Lithuanians, who tried to wrest Novgorod and Pskov from Russia while she was still suffering from the effects of the terrible Tatar invasion. The most notable of these battles, whereby he won his honorific epithet of Nevsky (*i.e.* of the Neva), was fought on the banks of the Neva (July 15, 1240) against the famous Swedish statesman, Birger Jarl, whom he utterly defeated, besides wounding him with his lance. In the following year the Teutonic Order, in conjunction with the Order of the Sword, succeeded in capturing Pskov; but Alexander recovered it in 1242, advanced into Livonia, and on the 5th of April defeated the knights on the ice of Lake Peipus and compelled them in the ensuing peace to renounce all their conquests. He also prevented the Swedes (in 1256) from settling in South Finland. On the death of his father (1246) Alexander and his younger brother Andrew went on a two years' journey into Mongolia to obtain their *yarluiki*, or letters of investiture, from the Grand Khan, who then disposed of the fate of all the Russian princes. He returned (1250) as grand-duke of Kiev and Novgorod, while to Andrew was given the far more important grand-duchy of Vladimir. In 1252, however, the Tatars themselves expelled Andrew and placed Alexander on the throne of Vladimir. Alexander henceforth did his best for his country by humbling himself before the Tatars so as to give them no pretext for ravaging the land again. Most of his spare money he devoted to the ransoming of the numerous Russian captives detained at the Golden Horde. But the men of Novgorod, in their semi-independent republic, continued (1255–1257) to give the grand-duke trouble, their chief grievance being the imposition of a Tatar tribute, which they only submitted to in 1259 on the rumour of an impending Tatar invasion. In 1262 the Tatar tribute was felt so grievously all over Russia that preparations were made for a general insurrection, and Alexander, who knew that an abortive rebellion would make the yoke heavier, was obliged to go to the Horde in person to prevent the Tatars from again attacking Russia. He stayed at Sarai, their Volgan capital, all the winter, and not only succeeded in obtaining a mitigation of the tribute, but also the abolition of the military service previously rendered by the Russians to the Tatars. This was his last service to his country. He died on his way home from the Horde, and in the words of his contemporary, the metropolitan Cyril, "with him the sun of Russia set." The Orthodox Church has canonized the ruler who gave his whole life for Russia and the Orthodox faith. His relics, discovered in 1380, were in 1724 translated by Peter the Great from Vladimir to St Petersburg.

See Sergyei Mikhailovich Solovev, *History of Russia* (Rus., 2nd ed., St Petersburg, 1897, vol. 3). (R. N. B.)

ALEXANDER OF APHRODISIAS, pupil of Aristocles of Messene, the most celebrated of the Greek commentators on the writings of Aristotle, and styled, by way of pre-eminence, ὁ ἐξηγητής ("the expositor"), was a native of Aphrodisias in Caria. He came to Athens towards the end of the 2nd century A.D., became head of the Lyceum and lectured on peripatetic philosophy. The object of his work was to free the doctrine from the syncretism of Ammonius and to reproduce the pure doctrine of Aristotle. Commentaries by Alexander on the following works of Aristotle are still extant:—the *Analytica Priora*, i.; the *Topica*; the *Meteorologica*; the *De Sensu*; and the *Metaphysica*, i.-v., together with an abridgment of what he wrote on the remaining books of the *Metaphysica*. His commentaries were greatly esteemed among the Arabians, who translated many of them. There are also several original writings by Alexander still extant. The most important of these are a work *On Fate*, in which he argues against the Stoic doctrine of necessity; and one *On the Soul*, in which he contends that the undeveloped reason in man is material (νοῦς ὑλικός) and inseparable from the body. He argued strongly against the doctrine of immortality. He identified the active intellect (νοῦς ποιητικός), through whose agency the potential intellect in man becomes actual, with God. Several of Alexander's works were published in the Aldine edition of Aristotle, Venice, 1495–1498; his *De Fato* and *De Anima* were printed along with the works of Themistius at Venice (1534); the former work, which has been translated into Latin by Grotius and also by Schulthess, was edited by J. C. Orelli, Zürich, 1824; and his commentaries on the *Metaphysica* by H. Bonitz, Berlin, 1847. J. Nourisson has treated of his doctrine of fate (*De la liberté et du hazard*, Paris, 1870). In the early Renaissance his doctrine of the soul's mortality was adopted by P. Pomponazzi against the Thomists and the Averroists.

See Peripatetics (*ad fin.*); Alexandrists; Pomponazzi, Pietro; also A. Apelt, "Die Schrift d. Alex. v. Aphr.," *Philologus*, xlv., 1886; C. Ruelle, "Alex. d'Aphr. et le prétendu Alex. d'Alexandrie," *Rev. des études grecques*, v., 1892; E. Zeller's *Outlines of Gk. Phil.* (Eng. trans., ed. 1905, p. 296).

ALEXANDER OF HALES (Alexander Halensis), surnamed Doctor Irrefragabilis, Theologorum Monarcha and Fons Vitae, a celebrated English theologian of the 13th century, was born in Gloucestershire. Trained in the monastery of Hales he was early raised to an archdeaconry. He went, like most of the scholars of his day, to study at Paris, where he took the degree of doctor and became celebrated as a teacher. It is generally held that he taught Bonaventura, Duns Scotus and Thomas Aquinas, but a comparison of dates makes it clear that the two latter could not have been his pupils and that the statement about Bonaventura is open to doubt. In 1222 (or 1231, see Denifle, *Chartul. Univers. Paris*, Paris, 1889, i. 135) Alexander entered the order of Minorite Friars and thenceforward lived in strict seclusion. He refused, however, to renounce his degree of doctor, and was the first of his order who continued to bear that title after initiation. He died in 1245 and was buried in the convent of the Cordeliers at Paris. His most celebrated work was the *Summa Theologiae* (Nuremberg, 1452; Venice, 1576; Cologne, 1611), undertaken by the orders of Pope Innocent IV. and approved by Alexander IV., on the report of seventy learned theologians, as a system of instruction for all the schools in Christendom. The form is that of question and answer, and the method is rigidly scholastic. Of small intrinsic value, it is interesting partly as the first philosophical contribution of the Franciscans who were afterwards to take a prominent part in medieval thought (see Scholasticism), and partly as the first work based on a knowledge of the whole Aristotelian *corpus* and the Arabian commentators.

See Wadding, *Script. ord. minor.* (Rome, 1650); for his method

B. Hauréau, *Hist. de philos. scholast.* (Paris, 1880); F. Picavet, "Abélard et A. de H." in the *Bibliothèque de l'école des hautes-études* (2nd series, Paris, 1896, pp. 222-230); Schwane, *Dogmengesch.* (Freiburg, 1882); A. Harnack, *Dogmengesch.* (1890); J. Endres, "Des A. von H. Leben und psychol. Lehre" in *Philos. Jahrb.* (i. Fulda, 1888, pp. 24-55, 203-296); also Vacant's *Dict. de théologie catholique*, vol. i.

ALEXANDER OF TRALLES (Alexander Trallianus), Greek physician, born at Tralles in Lydia, lived probably about the middle of the 6th century and practised medicine with success at Rome. The Greek text of his Βιβλία *ἰατρικά* was printed at Paris in 1548 and his *De Lumbricis* at Venice in 1570.

See E. Milward, *Trallianus Reviviscens* (London, 1734).

ALEXANDER SEVERUS (Marcus Aurelius Severus Alexander) (208–235), Roman emperor from A.D. 222 to 235, was born at Arca Caesarea in Palestine on the 1st of October 208. His father, Gessius Marcianus, held office more than once as an imperial procurator; his mother, Julia Mamaea, was the daughter of Julia Maesa and the aunt of Heliogabalus. His original name was Bassianus, but he changed it in 221 when his grandmother, Maesa, persuaded the emperor Heliogabalus to adopt his cousin as successor and create him Caesar. In the next year, on the 11th of March, Heliogabalus was murdered, and Alexander was proclaimed emperor by the Praetorians and accepted by the senate. He was then a mere lad, amiable, well-meaning, but entirely under the dominion of his mother, a woman of many virtues, who surrounded him with wise counsellors, watched over the development of his character and improved the tone of the administration, but on the other hand was inordinately jealous, and alienated the army by extreme parsimony, while neither she nor her son had a strong enough hand to keep tight the reins of military discipline. Mutinies became frequent in all parts of the empire; to one of them the life of the jurist and praetorian praefect Ulpian was sacrificed; another compelled the retirement of Dio Cassius from his command. On the whole, however, the reign of Alexander was prosperous till he was summoned to the East to face the new power of the Sassanians (see Persia: *History*). Of the war that followed we have very various accounts; Mommsen leans to that which is least favourable to the Romans. According to Alexander's own despatch to the senate he gained great victories. At all events, though the Persians were checked for the time, the conduct of the Roman army showed an extraordinary lack of discipline. The emperor returned to Rome and celebrated a triumph (233), but next year he was called to face German invaders in Gaul, where he was slain (on the 18th or 19th of March 235), together with his mother, in a mutiny which was probably led by Maximinus, a Thracian legionary, and at any rate secured him the throne. Alexander was the last of the Syrian princes. During his reign, acting, as he did in most things, under the influence of his mother, he did much to improve the morals and condition of the people. His advisers were men like the famous jurist Ulpian, the historian Dio Cassius and a select board of sixteen senators; a municipal council of fourteen assisted the city praefect in administering the affairs of the fourteen districts of Rome. The luxury and extravagance that had formerly been so prevalent at the court were put down; the standard of the coinage was raised; taxes were lightened; literature, art and science were encouraged; the lot of the soldiers was improved; and, for the convenience of the people, loan offices were instituted for lending money at a moderate rate of interest. In religious matters Alexander preserved an open mind. In his private chapel he had busts of Orpheus, Abraham, Apollonius of Tyana and Jesus Christ. It is said that he was desirous of erecting a temple to the founder of Christianity, but was dissuaded by the pagan priests. There is no doubt that, had Alexander's many excellent qualities been supported by the energy and strength of will necessary for the government of a military empire, he would have been one of the greatest of the Roman emperors.

See Lampridius, *Alexander Severus*; Dio Cassius lxxviii. 30, lxxix. 17, lxxx. 1; Herodian vi. 1-18; Porrath, *Der Kaiser Alex. Sev.* (1876); Pauly-Wissowa, *Realencyclopädie*, ii. 2526 foll. (Groebe); monograph by R. V. Nind Hopkins, *Cambridge Historical Essays*, No. xiv. (1907).

ALEXANDER THE PAPHLAGONIAN, a celebrated impostor and worker of false oracles, was born at Abonouteichos (see Ineboli) in Paphlagonia in the early part of the 2nd century A.D. The vivid narrative of his career given by Lucian might be taken as fictitious but for the corroboration of certain coins of the emperors Lucius Verus and Marcus Aurelius (J. H. Eckhel, *Doctrina Nummorum veterum*, ii. pp. 383, 384) and of a statue of Alexander, said by Athenagoras (*Apology*, c. 26) to have stood in the forum of Parium. After a period of instruction in medicine by a doctor who also, according to Lucian, was an impostor, he succeeded in establishing an oracle of Aesculapius at his native town. Having circulated a prophecy that the son of Apollo was to be born again, he contrived that there should be found in the foundations of the temple to Aesculapius, then in course of construction at Abonouteichos, an egg in which a small live snake had been placed. In an age of superstition no people had so great a reputation for credulity as the Paphlagonians, and Alexander had little difficulty in convincing them of the second coming of the god under the name of Glycon. A large tame snake with a false human head, wound round Alexander's body as he sat in a shrine in the temple, gave "autophones" or oracles unasked, but the usual methods practised were those of the numerous oracle-mongers of the time, of which Lucian gives a detailed account, the opening of sealed inquiries by heated needles, a neat plan of forging broken seals, and the giving of vague or meaningless replies to difficult questions, coupled with a lucrative blackmailing of those whose inquiries were compromising. The reputation of the oracle, which was in origin medical, spread, and with it grew Alexander's skilled plans of organized deception. He set up an "intelligence bureau" in Rome, instituted mysteries like those of Eleusis, from which his particular enemies the Christians and Epicureans were alike excluded as "profane," and celebrated a mystic marriage between himself and the moon. During the plague of A.D. 166 a verse from the oracle was used as an amulet and was inscribed over the doors of houses as a protection, and an oracle was sent, at Marcus Aurelius' request, by Alexander to the Roman army on the Danube during the war with the Marcomanni, declaring that victory would follow on the throwing of two lions alive into the river. The result was a great disaster, and Alexander had recourse to the old quibble of the Delphic oracle to Croesus for an explanation. Lucian's own close investigations into Alexander's methods of fraud led to a serious attempt on his life. The whole account gives a graphic description of the inner working of one among the many new oracles that were springing up at this period. Alexander had remarkable beauty and the striking personality of the successful charlatan, and must have been a man of considerable intellectual abilities and power of organization. His income is said by Lucian to have reached an enormous figure. He died of gangrene of the leg in his seventieth year.

See Lucian, 'Αλέξανδρος ἢ ψευδόμαντις; Samuel Dill, *Roman Society from Nero to Marcus Aurelius* (1904); and F. Gregorovius, *The Emperor Hadrian*, trans. by M. E. Robinson (1898).

ALEXANDERS (botanical name, *Smyrnium Olusatrum*, natural order Umbelliferae), a stout herbaceous plant with a furrowed, much-branched stem 1-3 ft. high, and large compound leaves with broad sheathing stalks, and broad, cut or lobed segments. The small yellow flowers are borne in compound umbels. The plant is a native of the Mediterranean region, and was formerly cultivated as a pot-herb. It is now found apparently wild in Great Britain and Ireland, growing in waste places, especially near the sea and amongst ruins.

In England the plant is sometimes popularly termed "alisander"; in North America *Thaspium aureum* is sometimes called "alexanders." "Alexander's foot," botanical name *Anacyclus Pyrethrum*, is the pellitory of Spain.

ALEXANDERSBAD, a watering-place of Germany, in the kingdom of Bavaria, romantically situated in the Fichtelgebirge, near Wunsiedel, at a height of 1900 ft. above the sea. Pop. 1200. Its waters, which are ferruginous and largely charged with carbonic acid gas, are of use in nervous and rheumatic disorders. In the neighbourhood is the Luisenburg (or Luxburg), so called after a visit paid by Queen Louise of Prussia in 1805, a hill covered by majestic granite rocks, commanding a grand view of the whole range of the Fichtelgebirge.

ALEXANDRE, NOËL (Natalis Alexander) (1639–1724), French theologian and ecclesiastical historian, was born at Rouen on the 19th of January 1639. In his 15th year he joined the Dominicans, and shortly after his ordination was appointed professor of philosophy at the convent of Saint-Jacques in Paris. The success of his subsequent lectures at the Sorbonne led to his selection by Colbert as tutor to his son, Jacques Nicolas Colbert, afterwards archbishop of Rouen. Alexandre obtained the degree of doctor in divinity from the Sorbonne in 1675 and for twelve years taught philosophy, theology and ecclesiastical law to the members of the Saint-Jacques community. He played a prominent part in ecclesiastical affairs and preached several times before Louis XIV., who granted him an annual pension of 800 livres, and in the general assemblies of the French bishops. He became provincial of his order in 1706, but was banished to Châtelleraült in 1709 for having subscribed to the *Cas de conscience* (1703), and was deprived of his pension in 1713 on account of his opposition to the bull *Unigenitus*. He died in Paris on the 21st of August 1724, having lost his sight some time before owing to his strenuous literary activity. His numerous works are still much valued by ecclesiastical students.

His best-known work, the *Selecta historiae ecclesiasticae capita, et in loca ejusdem insignia dissertationes historicae, chronologicae, dogmaticae* (26 vols., Paris, 1676–1686), was placed on the Index by Innocent XI., on account of his bold defence of the Gallican claims. In 1689 he brought out at Paris his history of the Old Testament: *Selecta historiae Veteris Testamenti capita, &c., in* 6 vols. Of the numerous editions of Alexandre's ecclesiastical history the best is that of P. J. D. Mansi, which contains many valuable notes and additions (11 vols., Lucca, 1749) and has been frequently reprinted. Alexandre's principal contribution to theological literature is his *Theologia dogmatica et moralis secundum ordinem catechismi concilii Tridentini* (10 vols., Paris, 1694), in which he clearly shows himself a disciple of the Thomist school. His *Conformité des cérémonies chinoises avec l'idolâtrie grecque et romaine* and *Sept lettres sur les cérémonies de la Chine* (both published at Cologne in 1700) are interesting as they mark him out as a pioneer in the study of comparative religion.

See *Catalogue complet des œuvres du Père Alexandre* (Paris, 1716); Quétif-Echard, *Scriptores ordinis praedicatorum* (Paris, 1719–1721), t. ii. p. 810; and full bibliography in A. Vacant, *Dict. de théologie* (scholarly article by P. Mandounet, cols. 769-772).

ALEXANDRETTA, or Iskanderun (med. *Scanderoon*), a town of N. Syria, situated in the N.E. angle of the Levantine Mediterranean on the S.E. of the gulf to which it gives a title. Pop. about 10,000, two-thirds Moslem. Iskanderun preserves the name, but probably not the exact site, of *Alexandria ad Issum*, founded by Alexander in 333 B.C., about 23 m. S. of the scene of his victory, to supersede Myriandrus as key of the Syrian Gates (Beilan Pass). The importance of the place ever since has been derived from its relation to this pass, the easiest approach to the open ground of N. Syria of which Antioch and Aleppo have been the successive capitals; and this relation has prevailed over the extreme unhealthiness of the site, which lies on marshy deltaic ground, screened by the horseshoe of Elma Dagh from all purifying influences of N. and E. winds. As the main outlet for the overland trade from Bagdad and India, whose importance was great until the establishment of the Egyptian overland route, the place was a great resort, first of Genoese and Venetian merchants, then of those of West and North European nations. The British Levant (Turkey) Company maintained an agency and factory here for 200 years, till 1825, in spite of appalling mortality among its employés. Alexandretta is still the main port for the Aleppo district, to which a good *chaussée* leads over the Beilan Pass, and it has a considerable export trade in tobacco, silk, cereals, liquorice, textiles. The health of the place has improved with the draining of the marshes and the provision of a better supply of water, but still leaves much to be desired. The wealthier inhabitants have summer residences at Beilan near the summit of the pass, long a stronghold of freebooting Dere Beys and the scene of the victory won by Ibrahim Pasha in 1832, which opened Cilicia to his advance. There are resident consuls of all the principal powers, and the port is well served by coasting steamers under European and Ottoman flags. The distance by road to Aleppo has been shortened to about 70 m., and Antakia (Antioch) is about 45 m. distant by a branch of the same *chaussée*. (D. G. H.)

ALEXANDRIA (Arab. *Iskenderia*), a city and chief seaport of Egypt, and for over a thousand years from its foundation the capital of the country, situated on the Mediterranean in 31° 12′ N., 29° 15′ E., and 129 m. by rail N.W. of Cairo. The ancient Canopic mouth of the Nile (now dry) was 12 m. E.

I. *The Modern City.*—The city is built on the strip of land which separates the Mediterranean from Lake Mareotis (Mariut), and on a T-shaped peninsula which forms harbours east and west. The stem of the T was originally a mole leading to an island (Pharos) which formed the cross-piece. In the course of centuries this mole has been silted up and is now an isthmus half a mile wide. On it a part of the modern city is built. The cape at the western end of the peninsula is Ras et-Tin (Cape of Figs); the eastern cape is known as Pharos or Kait Bey. South of the town—between it and Lake Mareotis—runs the Mahmudiya canal, which enters the western harbour by a series of locks.

The customs house and chief warehouses are by the western harbour, but the principal buildings of the city are in the east and south-east quarters. From the landing-stage, by the customs house, roads lead to the Place Mehemet Ali, the centre of the life of the city and the starting-point of the electric tramways. The *place*, usually called the Grand Square, is an oblong open space, tree-lined, in the centre of which there is an equestrian statue of the prince after whom it is named. The square is faced with handsome buildings mainly in the Italian style. The most important are the law courts, exchange, Ottoman bank, English church and the Abbas Hilmi theatre. A number of short streets lead from the square to the eastern harbour. Here a sea wall, completed in 1905, provides a magnificent drive and promenade along the shore for a distance of about 3 m. In building this quay a considerable area of foreshore was reclaimed and an evil-smelling beach done away with. From the south end of the square the rue Sherif Pasha—in which are the principal shops—and the rue Tewfik Pasha lead to the boulevard, or rue, de Rosette, a long straight road with a general E. and W. direction. In it are the Zizinia theatre and the municipal palace (containing the public library); the museum lies up a short street to the N. Opened in 1895 this museum possesses an important collection of Egyptian, Greek and Roman antiquities, found not only in the city but in all Lower Egypt and the Fayum. The western end of the boulevard leads to the Place Ibrahim, often called Place Ste Cathérine, from the Roman Catholic church at its S.E. side. In a street running S. from the boulevard to the railway station is the mosque of Nebi Daniel, containing the tombs of Said Pasha and other members of the khedivial family. Immediately E. of the mosque is Kom ed-Dik, garrisoned by British troops, one of several forts built for the protection of the city. Except Kom ed-Dik the forts have not been repaired since the bombardment of 1882. Equally obsolete is the old line of fortifications which formerly marked the limits of the city south and east and has now been partly demolished. Throughout the central part of Alexandria the streets are paved with blocks of lava and lighted by electricity.

The north quarter is mainly occupied by natives and Levantines. The narrow winding streets and the Arab bazaars present an Oriental scene contrasting with the European aspect of the district already described. This Arab quarter is traversed by the rue Ras et-Tin, leading to the promontory of that name. Here, overlooking the harbour, is the khedivial yacht club (built 1903) and the palace, also called Ras et-Tin, built by Mehemet Ali, a large but not otherwise noteworthy building. In the district between the Grand Square and the western harbour, one of the poorest quarters of the city, is an open space with Fort Caffareli or Napoleon in the centre. This quarter has been pierced by several straight roads, one of which, crossing the Mahmudiya canal by the Pont Neuf, leads to Gabbari, the most westerly part of the city and an industrial and manufacturing region, possessing asphalt works and oil, rice and paper mills. On either side of the canal are the warehouses of wholesale dealers in cotton, wool, sugar, grain and other commodities. In the southern part of the city are the Arab cemetery, "Pompey's Pillar" and the catacombs. "Pompey's Pillar," which stands on the highest spot in Alexandria, is nearly 99 ft. high, including the pedestal. The shaft is of red granite and is beautifully polished. Nine feet in diameter at the base, it tapers to eight feet at the top. The catacombs, a short distance S.W. of the pillar, are hewn out of the rocky slope of a hill, and are an elaborate series of chambers adorned with pillars, statues, religious symbols and traces of painting (see below, *Ancient City*). Along the northern side of the Mahmudiya canal, which here passes a little S. of the catacombs, are many fine houses and gardens (Moharrem Bey quarter), stretching eastward for a considerable distance, favourite residences of wealthy citizens. A similar residential quarter has also grown up on the N.E., where the line of the old fortifications has become a boulevard. The district extending outside the E. fortifications, in the direction of Hadra, has been laid out with fine avenues, and contains numerous garden-cafés and pleasure resorts. Thence roads lead to the E. suburb known generally as Ramleh, which stretches along the coast, and is served by a local railway. It begins E. of the racecourse with Sidi Gabr, and does not end till the khedivial estates E. of San Stefano are reached, some 5 m. E. All this space is filled with villas, gardens and hotels, and is a favourite summer resort not only of Alexandrians but also of Cairenes.

The eastern bay is rocky, shallow and exposed, and is now used only by native craft. The harbour is on the W. of Pharos and partly formed by a breakwater (built 1871–1873 and prolonged 1906–1907), 2 m. long. The breakwater starts opposite the promontory of Ras et-Tin, on which is a lighthouse, 180 ft. above the sea, built by Mehemet Ali. Another breakwater starts from the Gabbari side, the opening between the two works being about half a mile. A number of scattered rocks lie across the entrance, but through them two fairways have been made, one 600 ft. wide and 35 ft. deep, the other 300 ft. wide and 30 ft. deep. The enclosed water is divided into an outer and inner harbour by a mole, 1000 yds. long, projecting N.W. from the southern shore. The inner harbour covers 464 acres. It is lined for 2½ m. by quays, affording accommodation for ships drawing up to 28 ft. The outer harbour (1400 acres water area) is furnished with a graving dock, completed in 1905, 520 ft. long, and with quays and jetties along the Gabbari foreshore. Their construction was begun in 1906.

Alexandria is linked by a network of railway and telegraph lines to the other towns of Egypt, and there is a trunk telephone line to Cairo. The city secured in 1906 a new and adequate water-supply, modern drainage works having been completed the previous year. Being the great *entrepôt* for the trade of Egypt, the city is the headquarters of the British chamber of commerce and of most of the merchants and companies engaged in the development of the Delta. About 90 % of the total exports and imports of the country pass through the port, though the completion, in 1904, of a broad-gauge railway connecting Cairo and Port Said deflected some of the cotton exports to the Suez Canal route. The staple export is raw cotton, the value of which is about 80 % of all the exports. The principal imports are manufactured cotton goods and other textiles, machinery, timber and coal. The value of the trade of the port increased from £30,000,000 in 1900 to £46,000,000 in 1906. In the same period the tonnage of the ships entering the harbour rose from 2,375,000 to 3,695,000. Of the total trade Great Britain supplies from 35 to 40 % of the imports and takes over 50 % of the exports. Among the exports sent to England are the great majority of the 80,000,000 eggs annually shipped (see also Egypt: *Commerce*).

The population of the city (1907) was 332,246 or including the suburbs, about 400,000. The foreigners numbered over 90,000. The majority of these were Greeks, Italians, Syrians, Armenians and other Levantines, though almost every European and Oriental nation is represented. The predominant languages spoken, besides the Arabic of the natives, are Greek, French, English and Italian. The labouring population is mainly Egyptian; the Greeks and Levantines are usually shopkeepers or petty traders. In its social life Alexandria is the most progressive and occidental of all the cities of North Africa, with the possible exception of Algiers. (F. R. C.)

II. *The Ancient City.*—The Greek Alexandria was divided into three regions: (1) the Jews' quarter, forming the north-east portion of the city; (2) Rhacotis, on the west, occupied chiefly by Egyptians; (3) Brucheum, the Royal or Greek quarter, forming the most magnificent portion of the city. In Roman times Brucheum was enlarged by the addition of an official quarter, making up the number of four *regiones* in all. The city was laid out as a gridiron of parallel streets, each of which had an attendant subterranean canal. Two main streets, lined with colonnades and said to have been each about 200 ft. wide, intersected in the centre of the city, close to the point where rose the *Sema* (or *Soma*) of Alexander (*i.e.* his Mausoleum). This point is very near the present mosque of Nebi Daniel; and the line of the great east-west "Canopic" street only slightly diverged from that of the modern Boulevard de Rosette. Traces of its pavement and canal have been found near the Rosetta Gate; but better remains still of streets and canals were exposed in 1899 by the German excavators outside the E. fortifications, which lie well within the area of the ancient city.

Alexandria consisted originally of little more than the island of Pharos, which was joined to the mainland by a mole nearly a mile long and called the *Heptastadium*. The end of this abutted on the land at the head of the present Grand Square, where rose the "Moon Gate." All that now lies between that point and the modern Ras et-Tin quarter is built on the silt which gradually widened and obliterated this mole. The Ras et-Tin quarter represents all that is left of the island of Pharos, the site of the actual lighthouse having been weathered away by the sea. On the east of the mole was the Great Harbour, now an open bay; on the west lay the port of *Eunostos*, with its inner basin *Kibotos*, now vastly enlarged to form the modern harbour.

In Strabo's time, (latter half of 1st century B.C.) the principal buildings were as follows, enumerated as they were to be seen from a ship entering the Great Harbour. (1) *The Royal Palaces*, filling the N.E. angle of the town and occupying the promontory of Lochias, which shut in the Great Harbour on the east. Lochias, the modern *Pharillon*, has almost entirely disappeared into the sea, together with the palaces, the "Private Port" and the island of Antirrhodus. There has been a land subsidence here, as throughout the N. Delta and indeed all the N.E. coast of Africa; and on calm days the foundations of buildings may be seen, running out far under sea, near the Pharillon. Search was made for relics of these palaces by German explorers in 1898–1899, but without much success. (2) The Great Theatre, on the modern Hospital Hill near the Ramleh station. This was used by Caesar as a fortress, where he stood a siege from the city mob after the battle of Pharsalus. (3) The *Poseideion* or Temple of the Sea God, close to the theatre and in front of it. (4) The *Timonium* built by Antony. (5, 6, 7) The *Emporium* (Exchange), *Apostases* (Magazines) and *Navalia* (Docks), lying west of (4), along the sea-front as far as the mole. Behind the Emporium rose (8) the Great *Caesareum*, by which stood the two great obelisks, later known as "Cleopatra's Needles," and now removed to New York and London. This temple became in time the Patriarchal Church, some remains of which have been discovered: but the actual Caesareum, so far as not eroded by the waves, lies under the houses lining the new sea-wall. (9) The *Gymnasium* and (10) the *Palaestra* are both inland, near the great Canopic street (Boulevard de Rosette) in the eastern half of the town, but on sites not determined. (11) The *Temple of Saturn*: site unknown. (12) The Mausolea of Alexander (*Soma*) and the Ptolemies in one ring-fence, near the point of intersection of the two main streets. (13) The *Museum* with its library and theatre in the same region; but on a site not identified. (14) The *Serapeum*, the most famous of all Alexandrian temples. Strabo tells us that this stood in the west of the city; and recent discoveries go far to place it near "Pompey's Pillar" (see above), which, however, was an independent monument erected to commemorate Diocletian's siege of the city. We know the names of a few other public buildings on the mainland, but nothing as to their position. On the eastern point of the Pharos island stood the Great Lighthouse, one of the "Seven Wonders," reputed to be 400 ft. high. The first Ptolemy began it, and the second completed it, at a total cost of 800 talents. It is the prototype of all lighthouses (*q.v.*) in the world. A temple of Hephaestus also stood on Pharos at the head of the mole. In the Augustan age the population of Alexandria was estimated at 300,000 free folk, in addition to an immense number of slaves.

Ancient and medieval period.

III. *History.*—Founded in 332 B.C. by Alexander the Great, Alexandria was intended to supersede Naucratis (*q.v.*) as a Greek centre in Egypt, and to be the link between Macedonia and the rich Nile Valley. If such a city was to be on the Egyptian coast, there was only one possible site, behind the screen of the Pharos island and removed from the silt thrown out by Nile mouths. An Egyptian townlet, Rhacotis, already stood on the shore and was a resort of fishermen and pirates. Behind it (according to the Alexandrian treatise, known as pseudo-Callisthenes) were five native villages scattered along the strip between Lake Mareotis and the sea. Alexander occupied Pharos, and had a walled city marked out by Deinocrates on the mainland to include Rhacotis. A few months later he left Egypt for the East and never returned to his city; but his corpse was ultimately entombed there. His viceroy, Cleomenes, continued the creation of Alexandria. The Heptastadium, however, and the mainland quarters seem to have been mainly Ptolemaic work. Inheriting the trade of ruined Tyre and becoming the centre of the new commerce between Europe and the Arabian and Indian East, the city grew in less than a century to be larger than Carthage; and for some centuries more it had to acknowledge no superior but Rome. It was a centre not only of Hellenism but of Semitism, and the greatest Jewish city in the world. There the Septuagint was produced. The early Ptolemies kept it in order and fostered the development of its museum into the leading Greek university; but they were careful to maintain the distinction of its population into three nations, "Macedonian" (*i.e.* Greek), Jew and Egyptian. From this division arose much of the later turbulence which began to manifest itself under Ptolemy Philopater. Nominally a free Greek city, Alexandria retained its senate to Roman times; and indeed the judicial functions of that body were restored by Septimius Severus, after temporary abolition by Augustus. The city passed formally under Roman jurisdiction in 80 B.C., according to the will of Ptolemy Alexander; but it had been under Roman influence for more than a hundred years previously. There Julius Caesar dallied with Cleopatra in 47 B.C. and was mobbed by the rabble; there his example was followed by Antony, for whose favour the city paid dear to Octavian, who placed over it a prefect from the imperial household. Alexandria seems from this time to have regained its old prosperity, commanding, as it did, an important granary of Rome. This latter fact, doubtless, was one of the chief reasons which induced Augustus to place it directly under the imperial power. In A.D. 215 the emperor Caracalla visited the city; and, in order to repay some insulting satires that the inhabitants had made upon him, he commanded his troops to put to death all youths capable of bearing arms. This brutal order seems to have been carried out even beyond the letter, for a general massacre was the result. Notwithstanding this terrible disaster, Alexandria soon recovered its former splendour, and for some time longer was esteemed the first city of the world after Rome. Even as its main historical importance had formerly sprung from pagan learning, so now it acquired fresh importance as a centre of Christian theology and church government. There Arianism was formulated and there Athanasius, the great opponent of both heresy and pagan reaction, worked and triumphed. As native influences, however, began to reassert themselves in the Nile valley, Alexandria gradually became an alien city, more and more detached from Egypt; and, losing much of its commerce as the peace of the empire broke up during the 3rd century A.D., it declined fast in population and splendour. The Brucheum and Jewish quarters were desolate in the 5th century, and the central monuments, the *Soma* and Museum, fallen to ruin. On the mainland life seems to have centred in the vicinity of the Serapeum and Caesareum, both become Christian churches: but the Pharos and Heptastadium quarters remained populous and intact. In 616 it was taken by Chosroes, king of Persia; and in 640 by the Arabians, under 'Amr, after a siege that lasted fourteen months, during which Heraclius, the emperor of Constantinople, did not send a single ship to its assistance. Notwithstanding the losses that the city had sustained, 'Amr was able to write to his master, the caliph Omar, that he had taken a city containing "4000 palaces, 4000 baths, 12,000 dealers in fresh oil, 12,000 gardeners, 40,000 Jews who pay tribute, 400 theatres or places of amusement."

The story of the destruction of the library by the Arabs is first told by Bar-hebraeus (Abulfaragius), a Christian writer who lived six centuries later; and it is of very doubtful authority. It is highly improbable that many of the 700,000 volumes collected by the Ptolemies remained at the time of the Arab conquest, when the various calamities of Alexandria from the time of Caesar to that of Diocletian are considered, together with the disgraceful pillage of the library in A.D. 389 under the rule of the Christian bishop, Theophilus, acting on Theodosius' decree concerning pagan monuments (see LIBRARIES: *Ancient History*). The story of Abulfaragius runs as follows:—

> John the Grammarian, a famous Peripatetic philosopher, being in Alexandria at the time of its capture, and in high favour with 'Amr, begged that he would give him the royal library. 'Amr told him that it was not in his power to grant such a request, but promised to write to the caliph for his consent. Omar, on hearing the request of his general, is said to have replied that if those books contained the same doctrine with the Koran, they could be of no use, since the Koran contained all necessary truths; but if they contained anything contrary to that book, they ought to be destroyed; and therefore, whatever their contents were, he ordered them to be burnt. Pursuant to this order, they were distributed among the public baths, of which there was a large number in the city, where, for six months, they served to supply the fires.

Shortly after its capture Alexandria again fell into the hands of the Greeks, who took advantage of 'Amr's absence with the greater portion of his army. On hearing what had happened, however, 'Amr returned, and quickly regained possession of the city. About the year 646 'Amr was deprived of his government by the caliph Othman. The Egyptians, by whom 'Amr was greatly beloved, were so much dissatisfied by this act, and even showed such a tendency to revolt, that the Greek emperor determined to make an effort to reduce Alexandria. The attempt proved perfectly successful. The caliph, perceiving his mistake, immediately restored 'Amr, who, on his arrival in Egypt, drove the Greeks within the walls of Alexandria, but was only able to capture the city after a most obstinate resistance by the defenders. This so exasperated him that he completely demolished its fortifications, although he seems to have spared the lives of the inhabitants as far as lay in his power. Alexandria now rapidly declined in importance. The building of Cairo in 969, and, above all, the discovery of the route to the East by the Cape of Good Hope in 1498, nearly ruined its commerce; the canal, which supplied it with Nile water, became blocked; and although it remained a principal Egyptian port, at which most European visitors in the Mameluke and Ottoman periods landed, we hear little of it until about the beginning of the 19th century.

[Alexandria figured prominently in the military operations of Napoleon's Egyptian expedition of 1798. The French troops stormed the city on the 2nd of July 1798, and it remained in their hands until the arrival of the British expedition of 1801. The battle of Alexandria, fought on the 21st of March of that

Battle of 1801.

year, between the French army under General Menou and the British expeditionary corps under Sir Ralph Abercromby, took place near the ruins of Nicopolis, on the narrow spit of land between the sea and Lake Aboukir, along which the British troops had advanced towards Alexandria after the actions of Aboukir on the 8th and Mandora on the 13th. The British position on the night of the 20th extended across the isthmus, the right resting upon the ruins of Nicopolis and the sea, the left on the lake of Aboukir and the Alexandria canal. The line faced generally south-west towards the city, the reserve division under Major-General (Sir) John Moore on the right, the Guards brigade in the centre, and three other brigades on the left. In second line were two brigades and the cavalry (dismounted). On the 21st the troops were under arms at 3 A.M., and at 3.30 the French attacked and drove in the outposts. The French army now moved forward with great rapidity in their usual formation of columns. The brunt of the attack fell upon the command of Moore, and in particular upon the 28th (Gloucestershire Regiment). The first shock was repulsed, but a French column penetrated in the dark between two regiments of the British and a confused fight ensued in the ruins, in which the 42nd (Black Watch) captured a colour. The front and rear ranks of the 28th were simultaneously engaged, and the conduct of the regiment won for it the distinction of wearing badges both at the front and at the back of their head-dress. Other regiments which assisted in the overthrow of the French column were the 23rd, 40th and 58th. In a second attack the enemy's cavalry inflicted severe losses on the 42nd. Sir Ralph Abercromby was here engaged in personal conflict with some French dragoons, and about this time received a mortal wound, though he remained on the field and in command to the end. The attack on the centre was repulsed by the cool and steady fire of the Guards, and the left wing maintained its position with ease, but the French cavalry for the second time came to close quarters with the reserve. About half-past eight the combat began to wane, and the last shots were fired at ten. The real attack had been pressed home on the British right, and the *History* of the Queen's Royal West Surrey Regiment gives no undue praise to the regiments of the reserve in saying that "the determined attack would have been successful against almost any other troops." Technically, the details of the action show that, while not markedly better in a *mêlée* than the war-seasoned French, the British infantry had in its volleys a power which no other troops then existing possessed, and it was these volleys that decided the day even more than the individual stubbornness of the men. The 42nd, twice charged by cavalry, had but thirteen men wounded by the sabre. Part of the French losses, which were disproportionately heavy, were caused by the gunboats which lay close inshore and cannonaded the left flank of the French columns, and by a heavy naval gun which was placed in battery near the position of the 28th. The forces engaged on this day were approximately 14,000 British to about 20,000 French, and the losses were:—British, 1468 killed, wounded and missing, including Abercromby (who died on the 28th), Moore and three other generals wounded; French, 1160 killed and (?) 3000 wounded. The British subsequently advanced upon Alexandria, which surrendered on the 31st of August. (C. F. A.).]

Modern city.

During the anarchy which accompanied Ottoman rule in Egypt from first to last, Alexandria sank to a small town of about 4000 inhabitants; and it owed its modern renascence solely to Mehemet Ali, who wanted a deep port and naval station for his viceregal domain. He restored its water communication with the Nile by making the Mahmudiya canal, finished in 1820; and he established at Ras et-Tin his favourite residence. The old Eunostus harbour became the port, and a flourishing city arose on the old Pharos island and the Heptastadium district, with outlying suburbs and villa residences along the coast eastwards and the Mareotic shore. Being the starting-point of the "overland route" to India, and the residence of the chief foreign consuls, it quickly acquired a European character and attracted not only Frank residents, but great numbers of Greeks, Jews and Syrians. There most of the negotiations between the powers and Mehemet Ali were conducted; thence started the Egyptian naval expeditions to Crete, the Morea and Syria; and thither sailed the betrayed Ottoman fleet in 1839. It was twice threatened by hostile fleets, the Greek in 1827 and the combined British, French and Russian squadrons in 1828. The latter withdrew on the viceroy's promise that Ibrahim should evacuate the Morea. The fortifications were strengthened in 1841, and remained in an antiquated condition until 1882, when they were renovated by Arabi Pasha. Alexandria was connected with Cairo by railway in 1856. Much favoured by the earlier viceroys of Mehemet Ali's house, and removed from the Mameluke troubles, Alexandria was the real capital of Egypt till Said Pasha died there in 1863 and Ismail came into power. Though this prince continued to develop the city, giving it a municipality in 1866[1] and new harbour works in 1871–1878, he developed Cairo still more; and the centre of gravity definitely shifted to the inland capital. Fate, however, again brought Alexandria to the front. After a mutiny of soldiers there in 1881, the town was greatly excited by the arrival of an Anglo-French fleet in May 1882, and on the 11th of June a terrible riot and massacre took place, resulting in the death of four hundred Europeans. Since satisfaction was not given for this and the forts were being strengthened at the instigation of Arabi Pasha, the war minister, the British admiral, Sir Beauchamp Seymour (afterwards Lord Alcester), sent an ultimatum on the 10th of July and opened fire on the forts the next day. They were demolished, but as no troops were landed immediately a fresh riot and massacre ensued. As Arabi did not submit, a British military expedition landed at Alexandria on the 10th of August, the sequel being the British occupation of the whole country, the history of which is set forth under EGYPT.

Bombardment of 1882.

Since the restoration of tranquillity and the establishment of sound political and economic conditions in the Nile valley, Alexandria has greatly expanded. As the British consular report for 1904 says, "Building . . . for residential and other purposes proceeds with almost feverish rapidity. The cost of living has doubled and the price of land has risen enormously." On the E. and S.E. a new town of handsome houses, gardens and boulevards has been called into existence, in the arrangement of which the controlling influence of the municipality is evident (see *Modern City* above).

IV. *Antiquities.*—Persistent efforts have been made to explore the antiquities of Alexandria. Encouragement and help have been given by the local Archaeological Society, and by many individuals, notably Greeks justly proud of a city which is one of the glories of their national story. The past and present directors of the museum have been enabled from time to time to carry out systematic excavations when opportunity offered; Mr D. G. Hogarth made tentative researches on behalf of the Egypt Exploration Fund and the Society for the Promotion of Hellenic Studies in 1895; and a German expedition worked for two years (1898–1899). But two difficulties face the would-be excavator in Alexandria. First, since the great and growing modern city stands right over the ancient one, it is almost impossible to find any considerable space in which to dig, except at enormous cost. Second, the general subsidence of the coast has sunk the lower-lying parts of the ancient town under water. Unfortunately the spaces still most open are the low grounds to N.E. and S.W., where it is practically impossible to get below the Roman strata.

The most important results were those achieved by Dr G. Botti, late director of the museum, in the neighbourhood of "Pompey's Pillar," where there is a good deal of open ground. Here substructures of a large building or group of buildings have been exposed, which are perhaps part of the Serapeum. Hard by immense catacombs and *columbaria* have been opened which may have been appendages of the temple. These contain one very remarkable vault with curious painted reliefs, now lighted by electricity and shown to visitors. The objects found in these researches are in the museum, the most notable being a great basalt bull, probably once an object of cult in the Serapeum. Other catacombs and tombs have been opened in Kom es-Shugafa Hadra (Roman) and Ras et-Tin (painted). The Germans found remains of a Ptolemaic colonnade and streets in the north-east of the city, but little else. Mr Hogarth explored part of an immense brick structure under the mound of Kom ed-Dik, which may have been part of the Paneum, the Mausolea or a Roman fortress. The making of the new foreshore led to the dredging up of remains of the Patriarchal Church; and the foundations of modern buildings are seldom laid without some objects of antiquity being discovered. The wealth underground is doubtless immense; but, despite all efforts, there is not much for antiquarians to see in Alexandria outside the museum and the neighbourhood of "Pompey's Pillar." The native tomb-robbers, well-sinkers, dredgers and the like, however, come upon valuable objects from time to time, which find their way into private collections.

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[1] This municipality was superseded by a new municipal body, with extensive powers, created in 1890.

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ALEXANDRIA, a city of Madison county, Indiana, U.S.A., about 46 m. N.E. of Indianapolis. Pop. (1890) 715; (1900) 7221 (1002 foreign-born); (1910) 5096. Alexandria is served by the Cleveland, Cincinnati, Chicago & St Louis, and the Lake Erie & Western railways, and by the Indiana Union Traction System (electric). In the city are a Carnegie library and Beulah Park (24 acres), the latter belonging to the Northern Indiana Holiness Association, which there holds summer camp-meetings. The city is in a rich farming country, which produces Indian corn, oats and wheat; and is in the Indiana natural gas region, to which fact it owes its rapid growth as a manufacturing centre. It is one of the principal seats of the glass industry in Indiana—plate glass, lamp chimneys, mirrors, &c., being manufactured here—and also has mineral wool factories and paper mills. The municipality owns and operates the water-works and the gas-lighting plant. Alexandria was founded in 1836 and was chartered as a city in 1893.

ALEXANDRIA, a city of Louisiana, U.S.A., capital of Rapides Parish, on the S. bank of the Red river in almost the exact geographical centre of the state. Pop. (1890) 2861; (1900) 5648 (3142 negroes); (1910) 11,213. The city is served by the Louisiana Railway & Navigation Company, the St Louis, Watkins & Gulf, the Texas & Pacific, the Louisiana & Arkansas, the Southern Pacific, the Chicago, Rock Island & Pacific, and the Missouri Pacific railways. The Red river is navigable to Alexandria during the entire year. Alexandria is on a level plain in the centre of the Louisiana long-leaf pine forests, in which pine is interspersed with various hardwoods. The forests stretch on all sides within a radius of 75 m. In the immediate vicinity of the city, on the Red river, cotton, sugar, alfalfa and garden vegetables are cultivated; south of the Red river is a peculiarly rich farming country watered by Bayou Rapides and Bayou Bœuf. Near the city is the Louisiana Asylum for the Insane. The principal industries are cotton-pressing and the manufacture of lumber and of cotton-seed products; sugar and molasses, artificial ice, mineral waters and brick are other manufactures. The city owns and operates the water-works and electric-lighting plant; the water-supply is derived from artesian wells. Alexandria was named in honour of Alexander Fulton, on whose grant from Spain the first settlement was made in 1785; it was first incorporated as a town in 1818 and received a city charter in 1882. In the spring of 1863 a Union fleet under Admiral David D. Porter, operating on the Red river, co-operated with land forces under General N. P. Banks in pushing the Confederates westward. Alexandria was occupied on the 7th of May 1863, but the troops were soon withdrawn for the Port Hudson attack. On the 19th of March 1864 it was again occupied by the Union forces, who made it the point of concentration for another land and naval expedition against E. Kirby Smith and Shreveport. After the check of this expedition and its abandonment, Alexandria was again vacated on the 12th-13th of May, when the city was almost entirely burned. The Union gunboats, which had passed up the river toward Shreveport at high water, were caught in its decline above the falls at Alexandria, but they were saved by a splendid piece of engineering (a dam at the falls), constructed by Lieutenant-Colonel Joseph Bailey (1827–1867), who for this service received the thanks of Congress and the brevet of brigadier-general of volunteers.

ALEXANDRIA, a town of Rumania, situated among the rich corn-lands of the Teleorman department, on the right bank of the river Vedea. Pop. (1900) 13,675. Its chief trade is in grain, despatched by rail to the Danubian port of Zimnicea, or by river to Giurgevo. Alexandria was named after its founder, Alexander John Cuza, prince of Rumania from 1859 to 1866.

ALEXANDRIA, a manufacturing town of Dumbartonshire, Scotland, situated on the right bank of the Leven about 3 m. north of Dumbarton, on the North British and Caledonian railways. It owes its origin almost entirely to the cotton printing and bleaching works of the vicinity, for which there is an abundant supply of excellent water, and contains one of the largest of the Turkey-red dyeing establishments in the Vale of Leven. The public buildings include a public hall, the mechanics' institute with library and lecture-hall, an institute for men, with library and recreation rooms, a similar institution for women, banks and other important commercial offices. Pop. (1891) 7796; (1901) 8007. Alexandria is connected with BONHILL, on the opposite bank of the river, by a bridge which replaced in 1898 one bought three years earlier by the county council from the Smollett family, who have been closely associated with the district since the time of Sir James Smollett, the novelist's grandfather. The industries of Bonhill centre in the calico printing, dyeing and bleaching which find their headquarters in the valley. Population (1891) 3843; (1901) 3333. JAMESTOWN, about 1 m. to the north-east of Alexandria, with a station on the Forth & Clyde railway from Balloch to Stirling (North British), contains some of the largest cotton-printing works in Scotland. Population (1891) 1668; (1901) 2080.

ALEXANDRIA, a city and a port of entry of Alexandria county, Virginia, U.S.A., on the W. bank of the Potomac river, 6 m. below Washington, D.C., with which it is connected by a ferry. Pop. (1890) 14,339; (1900) 14,528, of whom 4533 were negroes; (1910, census), 15,329. Alexandria is served by the Baltimore & Ohio, the Chesapeake & Ohio, the Southern and the Washington Southern railways; by the Washington, Alexandria & Mount Vernon electric railway; and by several lines of river and coasting steamboats. It is a quaint, old-fashioned city, with quiet, shady streets, and a number of buildings dating back to the 18th century; of these the most interesting is the old Christ Church in which George Washington and Robert E. Lee worshipped. The city has a public library. About 2½ m. W. of Alexandria is the Protestant Episcopal Theological Seminary in Virginia, opened here in 1823 and chartered in 1854; in 1906–1907 the Seminary had a faculty of 7 and 46 students. Alexandria is a distributing and jobbing centre for the north-east counties of Virginia. Among its manufactures are fertilizers, bottles, carbonated beverages, flour, beer, shoes, silk thread, aprons, brooms, leather, bricks, and tiling and structural iron. The total value of its factory product in 1905 was $2,186,658. The municipality owns and operates its gas-lighting plant. Alexandria, first known as Belhaven, was named in honour of John Alexander, who in the last quarter of the 17th century had bought the land on which the city now stands from Robert Howison; the first settlement here was made in 1695. Alexandria was laid out in 1749 and was incorporated in 1779. From 1790 until 1846 Alexandria county was a part of the District of Columbia; at present the city, although within the limits of Alexandria county, is not administratively a part of it. The city was re-chartered in 1852. For some time Alexandria seemed destined to become an important commercial centre, but the rise of Washington created a rival that soon outstripped it, and since the Civil War the city's growth has been comparatively slight. At Alexandria in 1755 General Edward Braddock organized his fatal expedition against Fort Duquesne, and here, in April of the same year, the governors of Virginia, Massachusetts, New York, Pennsylvania and Maryland met (in a house still standing) to determine upon concerted action against the French in America. In March 1785 commissioners from Virginia and Maryland met here to discuss the commercial relations of the two states, finishing their business at Mount Vernon on the 28th with an agreement for freedom of trade and freedom of navigation of the Potomac. The Maryland legislature in ratifying this agreement on the 22nd of November proposed a conference between representatives from all the states to consider the adoption of definite commercial regulations. This led to the calling of the Annapolis convention of 1786, which in turn led to the calling of the Federal convention of 1787. In 1814 Alexandria was threatened by a British fleet, but bought immunity from attack by paying about $100,000. At the opening of the Civil War the city was occupied by Federal troops, and great excitement throughout the North was caused by the killing (May 24, 1861) of Colonel E. E. Ellsworth (1837–1861) by Captain James W. Jackson, a hotel proprietor, from whose building Ellsworth had removed a Confederate flag. After the erection of the state of West Virginia (1863), and until the close of the war, Alexandria was the seat of what was known as the "Alexandria Government" (see Virginia).

ALEXANDRIAN SCHOOL. Under this title are generally included certain strongly marked tendencies in literature, science and art, which took their rise in the ancient Egyptian city of Alexandria. That city, founded by Alexander the Great about the time when Greece, in losing her national independence, lost also her intellectual supremacy, was in every way admirably adapted for becoming the new centre of the world's activity and thought. Its situation brought it into commercial relations with all the nations lying around the Mediterranean, and at the same time rendered it the one communicating link with the wealth and civilization of the East. The great natural advantages it thus enjoyed were artificially increased to an enormous extent by the care of the sovereigns of Egypt. Ptolemy Soter (reigned 323–285 B.C.), to whom, in the general distribution of Alexander's conquests, this kingdom had fallen, began to draw around him from various parts of Greece a circle of men eminent in literature and philosophy. To these he gave every facility for the prosecution of their learned researches. Under the inspiration of his friend Demetrius of Phalerum, the Athenian orator, statesman and philosopher, this Ptolemy laid the foundations of the great Alexandrian library and originated the keen search for all written works, which resulted in the formation of a collection such as the world has seldom seen. He also built, for the convenience of his men of letters, the Museum, in which, maintained by the royal bounty, they resided, studied and taught. This Museum, or academy of science, was in many respects not unlike a modern university. The work thus begun by Ptolemy Soter was carried on vigorously by his descendants, in particular by his two immediate successors, Ptolemy Philadelphus and Ptolemy Euergetes. Philadelphus (285–247), whose librarian was the celebrated Callimachus, bought up all Aristotle's collection of books, and also introduced a number of Jewish and Egyptian works. Among these appears to have been a portion of the Septuagint. Euergetes (247–222) largely increased the library by seizing on the original editions of the dramatists laid up in the Athenian archives, and by compelling all travellers who arrived in Alexandria to leave a copy of any work they possessed.

The intellectual movement so originated extended over a long period of years. If we date its rise from the 4th century B.C., at the time of the fall of Greece and the foundation of the Graeco-Macedonian empire, we must look for its final dissolution in the 7th century of the Christian era, at the time of the fall of Alexandria and the rise of the Mahommedan power. But this very long period falls into two divisions. The first, extending from about 306 to 30, includes the time from the foundation of the Ptolemaic dynasty to its final subjugation by the Romans; the second extends from 30 to A.D. 642, when Alexandria was destroyed by the Arabs. The characteristic features of these divisions are very clearly marked, and their difference affords an explanation of the variety and vagueness of meaning attaching to the term "Alexandrian School." In the first of the two periods the intellectual activity was of a purely literary and scientific nature. It was an attempt to continue and develop, under new conditions, the old Hellenic culture. This direction of effort was particularly noticeable under the early Ptolemies, Alexandria being then almost the only home in the world for pure literature. During the last century and a half before the Christian era, the school, as it might be called, began to break up and to lose its individuality. This was due partly to the state of government under some of the later Ptolemies, partly to the formation of new literary circles in Rhodes, Syria and elsewhere, whose supporters, though retaining the Alexandrian peculiarities, could scarcely be included in the Alexandrian school. The loss of active life, consequent on this gradual dissolution, was much increased when Alexandria fell under Roman sway. Then the influence of the school was extended over the whole known world, but men of letters began to concentrate at Rome rather than at Alexandria. In that city, however, there were new forces in operation which produced a second grand outburst of intellectual life. The new movement was not in the old direction—had, indeed, nothing in common with it. With its character largely determined by Jewish elements, and even more by contact with the dogmas of Christianity, this second Alexandrian school resulted in the speculative philosophy of the Neo-Platonists and the religious philosophy of the Gnostics and early church fathers.

There appear, therefore, to be at least two definite significations of the title Alexandrian School; or rather, there are two Alexandrian schools, distinct both chronologically and in substance. The one is the Alexandrian school of poetry and science, the other the Alexandrian school of philosophy. The term "school," however, has not the same meaning as when applied to the Academics or Peripatetics, the Stoics or Epicureans. These consisted of a company united by holding in common certain speculative principles, by having the same theory of things. There was nothing at all corresponding to this among the Alexandrians. In literature their activities were directed to the most diverse objects; they have only in common a certain spirit or form. There was among them no definite system of philosophy. Even in the later schools of philosophy proper there is found a community rather of tendency than of definite result or of fixed principles.

I. *Literature.*—The general character of the literature of the school appears as the necessary consequence of the state of affairs brought about by the fall of Greek nationality and independence. The great works of the Greek mind had formerly been the products of a fresh life of nature and perfect freedom of thought. All their hymns, epics and histories were bound up with their individuality as a free people. But the Macedonian conquest at Chaeroneia brought about a complete dissolution of this Greek life in all its relations, private and political. The full, genial spirit of Greek thought vanished when freedom, with which it was inseparably united, was lost. A substitute for this originality was found at Alexandria in learned research, extended and multifarious knowledge. Amply provided with means for acquiring information, and under the watchful care of a great monarch, the Alexandrians readily took this new direction in literature. With all the great objects removed which could excite a true spirit of poetry, they devoted themselves to minute researches in all sciences subordinate to literature proper. They studied criticism, grammar, prosody and metre, antiquities and mythology. The results of this study constantly appear in their productions. Their works are never national, never addressed to a people, but to a circle of learned men. Moreover, the very fact of being under the protection and, as it were, in the pay of an absolute monarch was damaging to the character of their literature. There was introduced into it a courtly element, clear traces of which, with all its accompaniments, are found in the extant works of the school. One other fact, not to be forgotten in forming a general estimate of the literary value of their productions, is, that the same writer was frequently or almost always distinguished in several special sciences. The most renowned poets were at the same time men of culture and science, critics, archaeologists, astronomers or physicians. To such writers the poetical form was merely a convenient vehicle for the exposition of science.

The forms of poetical composition chiefly cultivated by the Alexandrians were epic and lyric, or elegiac. Great epics are wanting; but in their place, as might almost have been expected, are found the historical and the didactic or expository epics. The subjects of the historical epics were generally some of the well-known myths, in the exposition of which the writer could exhibit the full extent of his learning and his perfect command of verse. These poems are in a sense valuable as repertoires of antiquities; but their style is on the whole bad, and infinite patience is required to clear up their numerous and obscure allusions. The best extant specimen is the *Argonautica* of Apollonius Rhodius; the most characteristic is the *Alexandra* or *Cassandra* of Lycophron, the obscurity of which is almost proverbial.

The subjects of didactic epics were very numerous; they seem to have depended on the special knowledge possessed by the writers, who used verse as a form for unfolding their information. Some, *e.g.* the lost poem of Callimachus, called Αἴτια, were on the origin of myths and religious observances; others were on special sciences. Thus we have two poems of Aratus, who, though not resident at Alexandria, was so thoroughly imbued with the Alexandrian spirit as to be with reason included in the school; the one is an essay on astronomy, the other an account of the signs of the weather. Nicander of Colophon has also left us two epics, one on remedies for poisons, the other on the bites of venomous beasts. Euphorion and Rhianus wrote mythological epics. The spirit of all their productions is the same, that of learned research. They are distinguished by artistic form, purity of expression and strict attention to the laws of metre and prosody, qualities which, however good in themselves, do not compensate for want of originality, freshness and power.

In their lyric and elegiac poetry there is much worthy of admiration. The specimens we possess are not devoid of talent or of a certain happy art of expression. Yet, for the most part, they either relate to objects thoroughly incapable of poetic treatment, where the writer's endeavour is rather to expound the matter fully than to render it poetically beautiful, or else expend themselves on short isolated subjects, generally myths, and are erotic in character. The earliest of the elegiac poets was Philetas, the sweet singer of Cos. But the most distinguished was Callimachus, undoubtedly the greatest of the Alexandrian poets. Of his numerous works there remain to us only a few hymns, epigrams and fragments of elegies.[1] Other lyric poets were Phanocles, Hermesianax, Alexander of Aetolia and Lycophron.

Some of the best productions of the school were their epigrams. Of these we have several specimens, and the art of composing them seems to have been assiduously cultivated, as might naturally be expected from the court life of the poets, and their constant endeavours after terseness and neatness of expression. Of kindred character were the parodies and satirical poems, of which the best examples were the *Silli* of Timon and the *Cinaedi* of Sotades.

Dramatic poetry appears to have flourished to some extent. There are still extant three or four varying lists of the seven great dramatists who composed the Pleiad of Alexandria. Their works, perhaps not unfortunately, have perished. A ruder kind of drama, the amoebaean verse, or bucolic mime, developed into the only pure stream of genial poetry found in the Alexandrian School, the *Idylls* of Theocritus. The name of these poems preserves their original idea; they were *pictures* of fresh country life.

The most interesting fact connected with this Alexandrian poetry is the powerful influence it exercised on Roman literature. That literature, especially in the Augustan age, is not to be thoroughly understood without due appreciation of the character of the Alexandrian school. The historians of this period were numerous and prolific. Many of them, *e.g.* Cleitarchus, devoted themselves to the life and achievements of Alexander the Great. The best-known names are those of Timaeus and Polybius.

Before the Alexandrians had begun to produce original works, their researches were directed towards the masterpieces of ancient Greek literature. If that literature was to be a power in the world, it must be handed down to posterity in a form capable of being understood. This was the task begun and carried out by the Alexandrian critics. These men did not merely collect works, but sought to arrange them, to subject the texts to criticism, and to explain any allusion or reference in them which at a later date might become obscure. The complete philological examination of any work consisted, according to them, of the following processes:—*διόρθωσις*, arrangement of the text; *ἀνάγνωσις*, settlement of accents; *τέχνη*, theory of forms, syntax; *ἐξήγησις*, explanation either of words or things; and finally, *κρίσις*, judgment on the author and his work, including all questions as to authenticity and integrity. To perform their task adequately required from the critics a wide circle of knowledge; and from this requirement sprang the sciences of grammar, prosody, lexicography, mythology and archaeology. The service rendered by these critics is invaluable. To them we owe not merely the possession of the greatest works of Greek intellect, but the possession of them in a readable state. The most celebrated critics were Zenodotus; Aristophanes of Byzantium, to whom we owe the theory of Greek accents; Crates of Mallus; and Aristarchus of Samothrace, confessedly the coryphaeus of criticism. Others were Lycophron, Callimachus, Eratosthenes and many of a later age, for the critical school long survived the literary. Dionysius Thrax, the author of the first scientific Greek grammar, may also be mentioned. These philological labours were of great indirect importance, for they led immediately to the study of the natural sciences, and in particular to a more accurate knowledge of geography and history. Considerable attention began to be paid to the ancient history of Greece, and to all the myths relating to the foundation of states and cities. A large collection of such curious information is contained in the *Bibliotheca* of Apollodorus, a pupil of Aristarchus who flourished in the 2nd century B.C. Eratosthenes was the first to write on mathematical and physical geography; he also first attempted to draw up a chronological table of the Egyptian kings and of the historical events of Greece. The sciences of mathematics, astronomy and medicine were also cultivated with assiduity and success at Alexandria, but they can scarcely be said to have their origin there, or in any strict sense to form a part of the peculiarly Alexandrian literature. The founder of the mathematical school was the celebrated Euclid (Eucleides); among its scholars were Archimedes; Apollonius of Perga, author of a treatise on *Conic Sections*; Eratosthenes, to whom we owe the first measurement of the earth; and Hipparchus, the founder of the epicyclical theory of the heavens, afterwards called the Ptolemaic system, from its most famous expositor, Claudius Ptolemaeus. Alexandria continued to be celebrated as a school of mathematics and science long after the Christian era. The science of medicine had distinguished representatives in Herophilus and Erasistratus, the two first great anatomists.

AUTHORITIES.—Müller and Donaldson, *History of the Literature of Ancient Greece*; W. Christ, *Geschichte der griechischen Litteratur*;

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[1] A considerable fragment of his epic *Hecalē* has been discovered in the Rainer papyrus.

Mahaffy, *Greek Life and Thought from the Age of Alexander to the Roman Empire*; Couat, *La Poésie alexandrine*; and especially Susemihl, *Geschichte der griechischen Litteratur in der Alexandrinerzeit*. Nicolai's *Griechische Literaturgeschichte*, though somewhat out of date, is useful for bibliography.

II. *Philosophy.*—Although it is not possible to divide literatures with absolute rigidity by centuries, and although the intellectual life of Alexandria, particularly as applied to science, long survived the Roman conquest, yet at that period the school, which for some time had been gradually breaking up, seems finally to have succumbed. The later productions in the field of pure literature bear the stamp of Rome rather than of Alexandria. But in that city for some time past there had been various forces secretly working, and these, coming in contact with great spiritual changes in the world around, produced a second outburst of intellectual activity, which is generally known as the Alexandrian school of philosophy. The doctrines of this school were a fusion of Eastern and Western thought, and combined in varying proportions the elements of Hellenistic and Jewish philosophy. Traces of this eclectic tendency are discoverable as far back as 280 B.C., but for practical purposes the dates of the school may be given as from about 30 B.C. to A.D. 529. The city of Alexandria had gradually become the neutral ground of Europe, Asia and Africa. Its population, then as at the present day, was a heterogeneous collection of all races. Alexander had planted a colony of Jews who had increased in number until at the beginning of the Christian era they occupied two-fifths of the city and held some of the highest offices. The contact of Jewish theology with Greek speculation became the great problem of thought. The Jewish ideas of divine authority and their transcendental theories of conduct were peculiarly attractive to the Greek thinkers who found no inspiration in the dry intellectualism into which they had fallen (see NEO-PYTHAGOREANISM). At the same time the Jews of the Dispersion had to some extent shaken off the exclusiveness of their old political relations and were prepared to compare and contrast their old territorial theology with cosmopolitan culture. Further, when the two sides came to consider the results of their intellectual inheritance they found that they had sufficient common ground for the initial compromise. Thus the Hellenistic doctrine of personal revelation could be combined with the Jewish tradition of a complete theology revealed to a special people. The result was the application of a purely philosophical system to the somewhat vague and unorganized corpus of Jewish theology. The matter was Jewish, the arrangement Greek. According to the relative predominance of these two elements arose Gnosticism, the Patristic theology, and the philosophical schools of Neo-Pythagoreanism, Neo-Platonism and eclectic Platonism.

The members of the school may be enumerated under three heads. (1) The beginnings of the eclectic spirit are, according to some authorities, discernible in the Septuagint (280 B.C.) (see Frankel, *Historisch-kritische Studien zur Septuaginta*, 1841), but the first concrete exemplification is found in Aristobulus (*c.* 160 B.C.). So far as the Jewish succession is concerned, the great name is that of Philo in the first century of our era. He took Greek metaphysical theories, and, by the allegorical method, interpreted them in accordance with the Jewish Revelation. He dealt with (*a*) human life as explained by the relative nature of Man and God, (*b*) the Divine nature and the existence of God, and, (*c*) the great *Logos* doctrine as the explanation of the relation between God and the material universe. From these three arguments he developed an elaborate theosophy which was a syncretism of oriental mysticism and pure Greek metaphysic, and may be regarded as representing the climax of Jewish philosophy. (2) The first purely philosophical phenomenon of the Alexandrian school was Neo-Pythagoreanism, the second and last Neo-Platonism. Leaving all detailed descriptions of these schools to special articles devoted to them, it is sufficient here to say that their doctrines were a synthesis of Platonism, Stoicism and the later Aristotelianism with a leaven of oriental mysticism which gradually became more and more important. The world to which they spoke had begun to demand a doctrine of salvation to satisfy the human soul. They endeavoured to deal with the problem of good and evil. They therefore devoted themselves to examining the nature of the soul, and taught that its freedom consists in communion with God, to be achieved by absorption in a sort of ecstatic trance. This doctrine reaches its height in Plotinus, after whom it degenerated into magic and theurgy in its unsuccessful combat with the victorious Christianity. Finally this pagan theosophy was driven from Alexandria back to Athens under Plutarch and Proclus, and occupied itself largely in purely historical work based mainly on the attempt to re-organize ancient philosophy in conformity with the system of Plotinus. This school ended under Damascius when Justinian closed the Athenian schools (A.D. 529). (3) The eddies of Neo-Platonism had a considerable effect on certain Christian thinkers about the beginning of the 3rd century. Among these the most important were Clement of Alexandria and Origen. Clement, as a scholar and a theologian, proposed to unite the mysticism of Neo-Platonism with the practical spirit of Christianity. He combined the principle of pure living with that of free thinking, and held that instruction must have regard to the mental capacity of the hearer. The compatibility of Christian and later Neo-Platonic ideas is evidenced by the writings of Synesius, bishop of Ptolemais, and though Neo-Platonism eventually succumbed to Christianity, it had the effect, through the writings of Clement and Origen, of modifying the tyrannical fanaticism and ultra-dogmatism of the early Christian writers.

AUTHORITIES.—Matter, *Histoire de l'école d'Alexandrie*, 2nd ed. (3 vols., 1840–1844); Simon, *Histoire de l'école d'Alexandrie* (2 vols., 1844–1845); Vacherot, *Histoire critique de l'école d'Alexandrie* (3 vols., 1846–1851); Kingsley, *Alexandria and her Schools* (1854); Gfrörer, *Philo und die Alexandrinische Theosophie* (1835); Dähne, *Geschicht. Darstellung der Jüdisch-Alexandrinischen Religionsphilosophie* (1834); *Histories of Philosophy* by Zeller, Ueberweg, Windelband, &c., and Bibliography of CHURCH HISTORY, &c.

ALEXANDRIA TROAS (mod. *Eski Stambul*), an ancient Greek city of the Troad, situated on the west coast at nearly its middle point, a little south of Tenedos. It was built by Antigonus, perhaps about 310 B.C., and was called by him Antigonia Troas. Early in the next century the name was changed by Lysimachus to Alexandria Troas, in honour of Alexander's memory. As the chief port of north-west Asia Minor, the place prospered greatly in Roman times, and the existing remains sufficiently attest its former importance. Thence St Paul sailed for Europe for the first time, and there occurred later the episode of the raising of Eutychus (Acts xx. 5-12). The site is now covered with valonia oaks, and has been much plundered, *e.g* by Mahommed IV., who took columns to adorn his new Valideh mosque in Stambul; but the circuit of the old walls can be traced, and in several places they are fairly well preserved. They had a circumference of about six English miles, and were fortified with towers at regular intervals. Remains of some ancient buildings, including a bath and gymnasium, can be traced within this area. Trajan built an aqueduct which can still be traced. The harbour had two large basins, now almost choked with sand. A Roman colony was sent to the place, as Strabo mentions, in the reign of Augustus. The abridged name "Troas" (Acts xvi. 8) was probably the current one in later Roman times. (D. G. H.)

ALEXANDRINE VERSE, a name given to the leading measure in French poetry. It is the heroic French verse, used in epic narrative, in tragedy and in the higher comedy. There is some doubt as to the origin of the name; but most probably it is derived from a collection of romances, collected in the 12th century, of which Alexander of Macedon was the hero, and in which he was represented, somewhat like the British Arthur, as the pride and crown of chivalry. Before the publication of this work most of the trouvère romances appeared in octosyllabic verse. There is also a theory that the form was invented by a poet named Alexander. The new work, which was henceforth to set the fashion to French literature, was written in lines of twelve syllables, but with a freedom of pause which was afterwards greatly curtailed. The new fashion, however, was not adopted all at once. The metre fell into disuse until the reign of Francis I., when it was revived by Jean Antoine de Baïf, one of the seven poets known as the Pleiades. Jodelle mingled episodical Alexandrines with the *vers communs* of his tragedies and so introduced them into drama. It was Ronsard, however, who made the verse popular, and gave it vogue in France. From his time it became the recognized vehicle for all great poetry, and the regulation of its pauses became more and more strict. The following is an example of the verse as used by Racine—

Où suis-je ? qu'ai-je fait ? || que dois-je faire encore ?
Quel transport me saisit ? || quel chagrin me dévore ?

Two inexorable laws came to be established with regard to the pauses. The first is, that each line should be divided into two equal parts, the sixth syllable always ending with a word. In the earlier use of this metre, on the contrary, it frequently happened that the sixth and seventh syllables belonged to the same word. The other is that, except under the most stringent conditions, there should be none of what the French critics call *enjambement*, that is, the overlapping of the sense from one line on to the next. Ronsard completely ignored this rule, which was after his time settled by the authority of Malherbe. The latest school of French prosody has given great attention to the breaking up of the Alexandrine, which no longer possesses the rigidity of authoritative form which it held until about 1880, but is often used with a licence no less than when Ronsard wrote.

Michael Drayton, who was twenty-two years of age when Ronsard died, seemed to think that the Alexandrine might be as pleasing to English as it was to French ears, and in this metre he wrote a long poem in twenty-four books called the *Polyolbion*. The metre, however, failed to catch the English ear. The principal English measure is a line of ten syllables, and the Alexandrine is used only occasionally to give it variety and weight. In ordinary English heroic verse it is but rarely introduced; but in the favourite narrative metre, known as the Spenserian, it comes in regularly as the concluding line of each stanza. In English usage, moreover, it is to be observed that there is no fixed rule as to the position of the pause, though it is true that most commonly the pause occurs at the end of the sixth syllable. Spenser is very free in shifting the pause about; and though the later poets who have used this stanza are not so free, yet, with the exception of Shenstone and of Byron, they do not scruple to obliterate all pause between the sixth and seventh syllables. Thus Thomson (*Castle of Indolence*, i. 42):—

And music lent new gladness to the morning air.

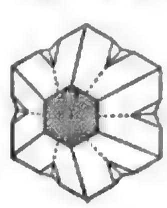
The danger in the use of the Alexandrine is that, in attempting to give dignity to his line, the poet may only produce heaviness, incurring the sneer of Pope—

A needless Alexandrine ends the song,
That, like a wounded snake, drags its slow length along.

The Alexandrine was the dominant metre in Dutch poetry from the 16th to the middle of the 19th century, and about the time of its introduction to Holland it was accepted in Germany by the school of Opitz. In the course of the 17th century, after being used without rhyme by Seckendorf and others, it formed a transitional station on the route to German blank verse, and has since then been rarely employed, except occasionally in rhymed comedy.

ALEXANDRISTS, the name given to those philosophers of the Renaissance, who, in the great controversy on the subject of personal immortality, adopted the explanation of the *De Anima* given by Alexander of Aphrodisias. According to the orthodox Thomism of the Roman Catholic Church, Aristotle rightly regarded reason as a faculty of the individual soul. Against this, the Averroists, led by Agostino Nifo (*q.v.*), introduced the modifying theory that universal reason in a sense individualizes itself in each soul and then absorbs the active reason into itself again. These two theories respectively evolved the doctrine of individual and universal immortality, or the absorption of the individual into the eternal One. The Alexandrists, led by Pietro Pomponazzi, boldly assailed these beliefs and denied that either was rightly attributed to Aristotle. They held that Aristotle considered the soul as a material and therefore a mortal entity which operates during life only under the authority of universal reason. Hence the Alexandrists denied the possibility of immortality in every shape or form. Since the soul is organically connected with the body, the dissolution of the latter involves the extinction of the former.

ALEXANDRITE, a variety of chrysoberyl (*q.v.*) discovered in the Urals in 1833, on the day set apart for celebrating the majority of the cesarevich, afterwards the tsar, Alexander II., in whose honour the stone was named by Nils Gustaf Nordenskiöld, of Helsingfors. It is remarkable for being strongly dichroic, generally appearing dark green by daylight and raspberry-red by candle-light, or by daylight transmitted through the stone. As red and green are the military colours of Russia, the mineral became highly popular as a gem-stone. The dark green crystals are usually cloudy and cracked, and grouped in triplets presenting a pseudo-hexagonal form. Alexandrite was found originally in the emerald-mine of Takovaya, east of Ekaterinburg in the Urals, and afterwards in the gold-bearing sands of the Sanarka in the southern Urals. Subsequently it was discovered in greater abundance in the gem-gravels of Ceylon. It has been found also in Tasmania. Some of the Ceylon alexandrite exhibits, when suitably cut, the Cat's-eye chatoyance, whence it has been called alexandrite cat's-eye. (F. W. R.*)



ALEXANDROPOL, or Alexandrapol (Turk. *Gumri*), a Russian town and fortified camp in Transcaucasia, government of Erivan, near the junction of the Arpa-chai with the Aras, 48 m. by rail E.N.E. of Kars. Altitude 5080 ft. It has a trade in silk. Here the Russians defeated the Turks in 1853. Pop. (1885) 22,670; (1897) 32,735.

ALEXANDROVSK. (1) A town of N. Russia, in the government of Archangel, on the harbour of Catherine (Ekaterininsk), on the Murman coast, 5 m. from the mouth of Kola Bay. It was opened in 1899 and is a naval station, being free from ice all the year round. It is also called Port Catherine. Pop. (1901) 300. (2) A town of S. Russia, 83 m. S. of Ekaterinoslav, on the railway to the Crimea, near the left bank of the Dnieper, below its rapids. Pop. (1897) 16,393. Opposite it is the island of Khortitsa, upon which was the *sich* (or *syech*) or camp of the Zaporozhian Cossacks. All its neighbourhood is strewn with *kurgans* (tumuli).

ALEXIS, Greek comic poet of the Middle Comedy, was born about 394 B.C. at Thurii and taken early to Athens, where he became a citizen. Plutarch says that he lived to the age of 106, and that he died on the stage while being crowned. According to Suidas, who calls him Menander's uncle, he wrote 245 comedies, of which some 130 titles are preserved. The fragments (about 1000 lines) attest the wit and refinement of the author (Koch, *Comicorum Atticorum Fragmenta*).

ALEXIS, WILLIBALD, the pseudonym of Georg Wilhelm Heinrich Häring (1798–1871), German historical novelist. He was born on the 29th of June 1798 at Breslau, where his father, who came of a French refugee family, named Hareng, held a high position in the war department. He attended the Werdersche Gymnasium in Berlin, and then, serving as a volunteer in the campaign of 1815, took part in the siege of the Ardenne fortresses. On his return he studied law at the universities of Berlin and Breslau and entered the legal profession, but he soon abandoned this career and devoted himself to literature. Settling in Berlin he edited, 1827–1835, the *Berliner Konversationsblatt*, in which for the first two years he was assisted by Friedrich Christoph Förster (1791–1868); and in 1828 was created a doctor of philosophy by the university of Halle. In 1852 he retired to Arnstadt in Thuringia, where after many years of broken health he died on the 16th of December 1871.

Häring made his name first known as a writer by an idyll in hexameters, *Die Treibjagd* (1820), and several short stories in which the influence of Tieck is observable; but his literary reputation was first established by the historical romance *Walladmor* (1823), which, published as being "freely translated from the English of Sir Walter Scott, with a preface by Willibald Alexis," so closely imitated the style of the famous Scotsman as really to deceive even Scott's admirers. The work became immediately popular and was translated into several languages, including English. It was followed by *Schloss Avalon* (1827), with regard to which the author adopted the same tactics and with equal success. These historical novels, however, were of considerable literary merit, and would doubtless have achieved popularity even without the borrowed plumage. Soon afterwards Häring published a number of successful short stories (*Gesammelte Novellen*, 4 vols., 1830–1831), some books of travel, and in the novels *Das Haus Dusterweg* (1835) and *Zwölf Nächte* (1838) showed for a while a leaning towards the "Young German" school. In *Cabanis* (1832), however, a story of the time of Frederick the Great, he entered the field of patriotic-historical romance, in which he so far excelled as to have earned the name of "der Märkische Walter Scott" (Walter Scott of the Mark). From 1840 onwards he published at short intervals a series of romances, each dealing with some epoch in the history of Brandenburg. Among them may be especially noted *Der Roland von Berlin* (1840), *Der falsche Woldemar* (1842), *Die Hosen des Herrn von Bredow* (1846–1848), *Ruhe ist die erste Bürgerpflicht* (1852), *Isegrimm* (1854) and *Dorothe* (1856). In all these the author shows himself as a keen observer of men and things; the characters, situations and natural surroundings are excellently delineated, and the patriotic feeling which pervades them is not overdone. Häring also made a name for himself in the field of criminology by commencing in 1842, in conjunction with the publicist, Julius Eduard Hitzig (1780–1849), the publication of *Der neue Pitaval* (continued by A. Vollert, 36 vols., Leipzig, 1842–1865; new edition, 24 vols., Leipzig, 1866–1891), a collection of criminal anecdotes culled from all nations and all times. This publication attained great popularity, and is to-day of psychological interest and value.

His *Gesammelte Werke* were published in 20 volumes (Berlin, 1874); the *Vaterländische Romane* separately in 8 volumes (Berlin, 1881, 1884), and, since the expiry of the copyright in 1901, in many cheap reprints. Cp. *W. Alexis' Erinnerungen*, edited by M. Ewert (1900), and essays by Julian Schmidt (*Neue Bilder aus dem geistigen Leben unsrer Zeit*, 1873), G. Freytag (*Werke*, vols. 16 and 23), A. Stern (*Zur Literatur der Gegenwart*, 1880) and T. Fontane (in *Bayreuther Blätter*, vi., 1883).

ALEXISBAD, a spa of Germany, in the duchy of Anhalt, lying under the Harz mountains, 1000 ft. above the sea, on the railway from Gernrode to Harzgerode. Pop. 1000. It is celebrated for its medicinal waters, of which the Alexisbrunnen, a ferruginous spring, is used for drinking, while the Selkebrunnen supplies the baths, which are of use in feminine disorders. The place was founded in 1810 by Duke Alexius of Anhalt-Bernburg.

ALEXIUS I. (1048–1118), emperor of the East, was the third son of John Comnenus, nephew of Isaac Comnenus, emperor 1057–1059. His father declined the throne on the abdication of Isaac, who was accordingly succeeded by four emperors of other families between that date and 1081. Under one of these emperors, Romanus Diogenes (1067–1071), he served with distinction against the Seljuk Turks. Under Michael Parapinaces (1071–1078) and Nicephorus Botaniates (1078–1081) he was also employed, along with his elder brother Isaac, against rebels in Asia Minor, Thrace and in Epirus (1071). The success of the Comneni roused the jealousy of Botaniates and his ministers, and the Comneni were almost compelled to take up arms in self-defence. Botaniates was forced to abdicate and retire to a monastery, and Isaac declined the crown in favour of his younger brother Alexius, who then became emperor in the 33rd year of his age. His long reign of nearly 37 years was full of difficulties (see ROMAN EMPIRE, LATER). At the very outset he had to meet the formidable attack of the Normans (Robert Guiscard and his son Bohemund), who took Dyrrhachium and Corfu, and laid siege to Larissa in Thessaly. The Norman danger ended for the time with Robert Guiscard's death (1085) and the conquests were recovered. He had next to repel the invasions of Patzinaks (Petchenegs) and Kumans in Thrace, with whom the Manichaean sects of the Paulicians and Bogomilians made common cause; and thirdly, he had to cope with the fast-growing power of the Turks in Asia Minor. Above all he had to meet the difficulties caused by the arrival of the warriors of the First Crusade, which had been in a great degree initiated owing to the representations of his own ambassadors, though the help which he wanted from the West was simply mercenary forces and not the immense hosts which arrived to his consternation and embarrassment. The first part, under Peter the Hermit, he got rid of by sending them on to Asia Minor, where they were massacred by the Turks (1096). The second and much more serious host of warriors, led by Godfrey of Bouillon, he conducted also into Asia, promising to supply them with provisions in return for an oath of homage, and by their victories recovered for the Empire a number of important cities and islands—Nicaea, Chios, Rhodes, Smyrna, Ephesus, Philadelphia, Sardis, and in fact most of Asia Minor (1097–1099). This is ascribed as a credit to his policy and diplomacy by his daughter, by the Latin historians of the crusade to his treachery and falseness, but during the last twenty years of his life he lost much of his popularity. They were marked by persecution of the followers of the Paulician and Bogomilian heresies (one of his last acts was to burn Basilius, a Bogomilian leader, with whom he had engaged in a theological controversy), by renewed struggles with the Turks (1110–1117), by anxieties as to the succession, which his wife Irene wished to alter in favour of her daughter Anne's husband, Nicephorus Bryennius for whose benefit the special title panhypersebastos (*i.e.* as it were *augustissimus si quis alius*) was created. This intrigue disturbed even his dying hours. He deserves the credit of having raised the Empire from a condition of anarchy and decay at a time when it was threatened on all sides by new dangers. No emperor devoted himself more laboriously or with a greater sense of duty to the task of ruling.

AUTHORITIES.—Zonaras xviii. 27-29; Anna Comnena's *Life*; see also Du Cange, *Familiae Byzantinae*; Friedrich Wilken, *Rerum ab Alexio I., Joanne, Manuele et Alexio II. Comnenis Romanorum, Byzantinorum imperatoribus gestarum, libri iv. Commentatio* (Heidelberg, 1811); Finlay, *History of Greece* (vol. iii., Oxford, 1877); Gibbon, *Decline and Fall of the Roman Empire*, edited with notes, &c., by Prof. J. B. Bury (London, 1898), where further authorities are cited; F. Chalandon, *Essai sur le règne d'Alexis Ier Comnène* (1900). (J. B. B.)

ALEXIUS II. (COMNENUS) (1167–1183), emperor of the East, was the son of Manuel Comnenus and Maria, daughter of Raymund, prince of Antioch, and was born at Constantinople on the 10th of September 1167. On Manuel's death, Maria, who had been immured in a convent under the name of Xene, had herself proclaimed regent (1179–1180), and handing over her son to evil counsellors, who encouraged him in every vice, supported the government of Alexius the protosebastos (nephew of Manuel), who was supposed to be her lover. The young Alexius and his friends now tried to form a party against the empress mother and the protosebastos; and his sister Maria, wife of Caesar John, stirred up riots in the streets of the capital. Their party was defeated (May 2, 1182), but Andronicus Comnenus took advantage of these disorders to aim at the crown, entered Constantinople, where he was received with almost divine honours, and overthrew the regents. His arrival was celebrated by a barbarous massacre of the Latins in Constantinople, which he made no attempt to stop. He allowed Alexius to be crowned, but forced him to consent to the death of all his friends, including his mother, his sister and the Caesar, and refused to allow him the smallest voice in public affairs. The betrothal in 1180 of Alexius with Agnes, daughter of Louis VII. of France, a child of nine, was quashed, and he was married to Irene, daughter of Andronicus. The latter was now formally proclaimed as co-emperor, and not long afterwards, on the pretext that divided rule was injurious to the Empire, he caused Alexius to be strangled with a bow-string (October 1183). (J. B. B.)

ALEXIUS III. (ANGELUS), emperor of the East, was the second son of Andronicus Angelus, nephew of Alexius I. In 1195, while his brother Isaac II. was away hunting in Thrace, he was proclaimed emperor by the troops; he captured Isaac at Stagira in Macedonia, put out his eyes, and kept him henceforth a close prisoner, though he had been redeemed by him from captivity at Antioch and loaded with honours. To compensate for this crime, and to confirm his position as emperor, he had to scatter money so lavishly as to empty his treasury, and to allow such licence to the officers of the army as to leave the Empire practically defenceless. He consummated the financial ruin of the state. The empress Euphrosyne tried in vain to sustain his credit and his court; Vatatzes, the favourite instrument of her attempts at reform, was assassinated by the emperor's orders. Eastward the Empire was overrun by the Turks; from the north Bulgarians and Vlachs descended unchecked to ravage the plains of Macedonia and Thrace; while Alexius squandered the public treasure on his palaces and gardens. Soon he was threatened by a new and yet more formidable danger. In 1202 the Western princes assembled at Venice, bent on a new crusade. To them Alexius, son of the deposed Isaac, made appeal, promising as a crowning bribe to heal the schism of East and West if they would help him to depose his uncle. The crusaders, whose objective had been Egypt, were persuaded to set their course for Constantinople, before which they appeared in June 1203, proclaiming the emperor Alexius IV. and summoning the capital to depose his uncle. Alexius III., sunk in debauchery, took no efficient measures to resist. His son-in-law, Lascaris, who was the only one to do anything, was defeated at Scutari, and the siege of Constantinople began. On the 17th of July the crusaders, the aged doge Dandolo at their head, scaled the walls and took the city by storm. During the fighting and carnage that followed Alexius hid in the palace, and finally, with one of his daughters, Irene, and such treasures as he could collect, got into a boat and escaped to Develton in Thrace, leaving his wife, his other daughters and his Empire to the victors. Isaac, drawn from his prison and robed once more in the imperial purple, received his son in state.

Shortly afterwards Alexius made an effort in conjunction with Murtzuphlos (Alexius V.) to recover the throne. The attempt was unsuccessful and, after wandering about Greece, he surrendered with Euphrosyne, who had meanwhile joined him, to Boniface of Montferrat, then master of a great part of the Balkan peninsula. Leaving his protection he sought shelter with Michael, despot of Epirus, and then repaired to Asia Minor, where his son-in-law Lascaris was holding his own against the Latins. Alexius, joined by the sultan of Iconium (Konieh), now demanded the crown of Lascaris, and on his refusal marched against him. Lascaris, however, defeated and took him prisoner. Alexius was relegated to a monastery at Nicaea, where he died on some date unknown.

AUTHORITIES.—Nicetas Acominatus, George Acropolites, Nicephorus Gregoras; and the sources for the Fourth Crusade (see CRUSADES). (J. B. B.)

ALEXIUS V., eastern Roman emperor, was proclaimed emperor on the 5th of February 1204, during the siege of Constantinople by the Latins (Fourth Crusade). His name was Alexius Ducas Murtzuphlos, and he was a connexion of the imperial house of the Angeli. His elevation was the result of a revolution in the city against Isaac II. and Alexius IV. He conducted the defence with great bravery till it became hopeless (April 12), whereupon he fled. He would then have made common cause with Alexius III. against the Latins, but was blinded by that ex-monarch and fell into the hands of the crusaders, who put him to death by casting him from the top of the Pillar of Theodosius as the murderer of Alexius IV.

ALEXIUS MIKHAILOVICH (1629–1676), tsar of Muscovy, the son of Tsar Michael Romanov and Eudoxia Stryeshnevaya, was born on the 9th of March 1629. A youth at his father's death (1645), he was committed to the care of the *boyarin* Boris Ivanovich Morozov, a shrewd and sensible guardian, sufficiently enlightened to recognize the needs of his country, and by no means inaccessible to Western ideas. Morozov's foreign policy was pacificatory. He secured the truce with Poland and carefully avoided complications with the Porte. His domestic policy was severely equitable, and aimed at relieving the public burdens by limiting the privileges of foreign traders and abolishing a great many useless and expensive court offices. On the 17th of January 1648 he procured the marriage of the tsar with Maria Miloslavskaya, himself marrying her sister, Anna, ten days later. The Miloslavskis were typical self-seeking 17th century boyars, whose extortions made them generally detested. In May 1648 the people of Moscow rose against them, and the young tsar was compelled to dismiss both them and their patron Morozov. The successful issue of the Moscow riots was the occasion of disquieting disturbances all over the tsardom culminating in dangerous rebellions at Pskov and Great Novgorod, with which the government was so unable to cope that they surrendered, practically granting the malcontents their own terms. One man only had displayed equal tact and courage at Great Novgorod, the metropolitan Nikon (*q.v.*), who in consequence became in 1651 the tsar's chief minister. In 1653 the weakness and disorder of Poland, which had just emerged, bleeding at every pore, from the savage Cossack war, encouraged Alexius to attempt to recover from her secular rival the old Russian lands. On the 1st of October 1653 a national assembly met at Moscow to sanction the war and find the means of carrying it on, and in April 1654 the army was blessed by Nikon (now patriarch). The campaign of 1654 was an uninterrupted triumph, and scores of towns, including the important fortress of Smolensk, fell into the hands of the Muscovites. In January 1655 the rout of Ochmatov arrested their progress; but in the summer of the same year, the sudden invasion by Charles X. of Sweden for the moment swept the Polish state out of existence; the Muscovites, unopposed, quickly appropriated nearly everything which was not already occupied by the Swedes, and when at last the Poles offered to negotiate, the whole grand-duchy of Lithuania was the least of the demands of Alexius. Fortunately for Poland, the tsar and the king of Sweden now quarrelled over the apportionment of the spoil, and at the end of May 1656 Alexius, stimulated by the emperor and the other enemies of Sweden, declared war against her. Great things were expected of the Swedish war, but nothing came of it. Dorpat was taken, but countless multitudes were lost in vain before Riga. In the meantime Poland had so far recovered herself as to become a much more dangerous foe than Sweden, and, as it was impossible to wage war with both simultaneously, the tsar resolved to rid himself of the Swedes first. This he did by the peace of Kardis (July 2, 1661), whereby Muscovy retroceded all her conquests. The Polish war dragged on for six years longer and was then concluded by a truce, nominally for thirteen years, which proved the most durable of treaties. By the truce of Andrussowo (February 11, 1667) Vitebsk, Polotsk and Polish Livonia were restored to Poland, but the infinitely more important Smolensk and Kiev remained in the hands of the Muscovite together with the whole eastern bank of the Dnieper. This truce was the achievement of Athanasy Orduin-Nashchokin, the first Russian chancellor and diplomatist in the modern sense, who after the disgrace of Nikon became the tsar's first minister till 1670, when he was superseded by the equally able Artamon Matvyeev, whose beneficent influence prevailed to the end of the reign. It is the crowning merit of the ever amiable and courteous tsar Alexius that he discovered so many great men (like Nikon, Orduin, Matvyeev, the best of Peter's precursors) and suitably employed them. He was not a man of superior strength of character, or he would never have submitted to the dictation of Nikon. But, on the other hand, he was naturally, if timorously, progressive, or he would never have encouraged the great reforming *boyarin* Matvyeev. His education was necessarily narrow; yet he was learned in his way, wrote verses, and even began a history of his own times. His last years, notwithstanding the terrible rebellion of Stenka Razin, were deservedly tranquil. By his first consort he had thirteen children, of whom two sickly sons and eight healthy daughters survived him. By his second consort, Natalia Naruishkina, he had two children, the tsarevich Peter and the tsarevna Natalia.

See Robert Nisbet Bain, *The First Romanovs* (London, 1905). (R. N. B.)

ALEXIUS PETROVICH (1690–1718), Russian tsarevich, the sole surviving son of Peter I. and Eudoxia Lopukhina, was born on the 19th of February 1690. The young tsar married the *boyarinya* Lopukhina at his mother's command. We know nothing of the bride except that she was beautiful, modest and "brought up in the fear of the Lord." She would, doubtless, have made a model tsaritsa of the pre-Petrine period, but, unfortunately, she was no fit wife for such a vagabond of genius as Peter the Great. From the first her society bored Peter unspeakably, and, after the birth of their second short-lived son Alexander, on the 3rd of October 1691, he practically deserted her. The young Alexius was ignored by his father till he was nine years old. Peter was a rare and unwelcome guest in his own family, and a son who loved his mother could have little affection for a father who had ever been that mother's worst persecutor. From his sixth to his ninth year Alexius was educated by the diffuse and pedantic Vyazemsky, but after the removal of his mother to the Suzdal Prokovsky Monastery he was confided to the care of learned foreigners, who taught him history, geography, mathematics and French. In 1703 Alexius was ordered to follow the army to the field as a private in a bombardier regiment. In 1704 he was present at the capture of Narva. At this period the preceptors of the tsarevich had the highest opinion of his ability; but, unfortunately, it was not the sort of ability that his father could make use of. He was essentially a student, with strong leanings towards archaeology and ecclesiology. A monastic library was the proper place for this gentle emotional dreamer, who clung so fondly to the ancient traditions. To a prince of his temperament the vehement activity of his abnormally energetic father was very offensive. He liked neither the labour itself nor its object. Yet Peter, not unnaturally, wished his heir to dedicate himself to the service of new Russia, and demanded from him unceasing labour in order to maintain the brand-new state at the high level of greatness to which it had been raised. Painful relations between father and son, quite apart from the personal antipathies already existing, were therefore inevitable. It was an additional misfortune for Alexius that his father should have been too busy to attend to him just as he was growing up from boyhood to manhood. He was left in the hands of reactionary boyars and priests, who encouraged him to hate his father and wish for the death of the tsar-antichrist. His confessor, Yakov Ignatiev, whom he promised to obey as "an angel and apostle of God," was his chief counsellor in these days.

In 1708 Peter sent Alexius to Smolensk to collect provender and recruits, and thence to Moscow to fortify it against Charles XII. At the end of 1709 he went to Dresden for twelve months for finishing lessons in French and German, mathematics and fortification, and, his education completed, he was married, greatly against his will, to the princess Charlotte of Brunswick-Wolfenbüttel, whose sister espoused, almost simultaneously, the heir to the Austrian throne, the archduke Charles. The wedding was celebrated at Torgau on the 14th of October 1711, in the house of the queen of Poland, and three weeks later the bridegroom was hurried away by his father to Thorn to superintend the provisioning of the Russian troops in Poland. For the next twelve months Alexius was kept constantly on the move. His wife joined him at Thorn in December, but in April 1712 a peremptory ukaz ordered him off to the army in Pomerania, and in the autumn of the same year he was forced to accompany his father on a tour of inspection through Finland. Evidently Peter was determined to tear his son away from a life of indolent ease. Immediately on his return from Finland Alexius was despatched by his father to Staraya Rusya and Ladoga to see to the building of new ships. This was the last commission entrusted to him. On his return to the capital Peter, in order to see what progress his son had made in mechanics and mathematics, asked him to draw something of a technical nature for his inspection. Alexius, in order to escape such an ordeal, resorted to the abject expedient of disabling his right hand by a pistol-shot. In no other way could the tsarevich have offended his father so deeply. He had behaved like a cowardly recruit who mutilates himself to escape military service. After this, Peter seemed for a time to take no further interest in Alexius. He left him entirely to himself. He employed him no more. He no longer pressed him to attend public functions. Alexius rejoiced at this welcome change, but he had cause rather to fear it. It marked the deepening of a hatred which might have been overcome. Alexius was evidently consoling himself with the reflexion that the future belonged to him. He was well aware that the mass of the Russian nation was on his side. Nearly all the prelates were devoted to him. Equally friendly were the great boyar families. All Alexius had to do was to sit still, keep out of his father's way as much as possible and await the natural course of events. But with Peter the present was everything. He could not afford to leave anything to chance. All his life long he had been working incessantly with a single object—the regeneration of Russia. What if his successor refused to tread in his father's footsteps or, still worse, tried to destroy his father's work? By some such process of reasoning as this must the idea of changing the succession to the throne, by setting aside Alexius, have first occurred to the mind of Peter the Great. Nevertheless he made one last effort to reclaim his son. On the 22nd of October 1715 Alexius' consort, the princess Charlotte, died, after giving birth to a son, the grand-duke Peter, afterwards Peter II. On the day of the funeral Peter addressed to Alexius a stern letter of warning and remonstrance, urging him no longer to resemble the slothful servant in the parable, and threatening to cut him off, as though he were a gangrenous swelling, if he did not acquiesce in his father's plans. But it was now that Alexius showed what a poor creature he really was. He wrote a pitiful reply to his father, offering to renounce the succession in favour of his baby half-brother Peter, who had been born the day after the princess Charlotte's funeral. As if this were not enough, in January 1716 he wrote to his father for permission to become a monk. Still Peter did not despair. On the 26th of August 1716 he wrote to Alexius from abroad urging him, if he desired to remain tsarevich, to join him and the army without delay. Rather than face this ordeal Alexius fled to Vienna and placed himself under the protection of his brother-in-law, the emperor Charles VI., who sent him for safety first to the Tirolean fortress of Ahrenberg, and finally to the castle of San Elmo at Naples. He was accompanied throughout his journey by his mistress, the Finnish girl Afrosina. That the emperor sincerely sympathized with Alexius, and suspected Peter of harbouring murderous designs against his son, is plain from his confidential letter to George I. of England, whom he consulted on this delicate affair. Peter's agitation was extreme. The flight of the tsarevich to a foreign potentate was a reproach and a scandal. He must be recovered and brought back to Russia at all hazards. This difficult task was accomplished by Count Peter Tolstoi, the most subtle and unscrupulous of Peter's servants; but terrorized though he was, Alexius would only consent to return on his father solemnly swearing, "before God and His judgment seat," that if he came back he should not be punished in the least, but cherished as a son and allowed to live quietly on his estates and marry Afrosina. On the 31st of January 1718 the tsarevich reached Moscow. Peter had already determined to institute a most searching inquisition in order to get at the bottom of the mystery of the flight. On the 18th of February a "confession" was extorted from Alexius which implicated most of his friends, and he then publicly renounced the succession to the throne in favour of the baby grand-duke Peter Petrovich. A horrible reign of terror ensued, in the course of which the ex-tsaritsa Eudoxia was dragged from her monastery and publicly tried for alleged adultery, while all who had in any way befriended Alexius were impaled, broken on the wheel and otherwise lingeringly done to death. All this was done to terrorize the reactionaries and isolate the tsarevich. In April 1718 fresh confessions were extorted from Alexius, now utterly broken and half idiotic with fright. Yet even now there were no actual facts to go upon. Alexius' "evil designs" were still *in foro conscientiae*, and had not been, perhaps never would be, translated into practice. The worst that could be brought against him was that he had *wished* his father's death. In the eyes of Peter, his son was now a self-convicted and most dangerous traitor, whose life was forfeit. But there was no getting over the fact that his father had sworn "before the Almighty and His judgment seat" to pardon him and let him live in peace if he returned to Russia. From Peter's point of view the question was, did the enormity of the tsarevich's crime absolve the tsar from the oath which he had taken to spare the life of this prodigal son? This question was solemnly submitted to a grand council of prelates, senators, ministers and other dignitaries on the 13th of June 1718. The clergy left the matter to the tsar's own decision. The temporal dignitaries declared the evidence to be insufficient and suggested that Alexius should be examined by torture. Accordingly, on the 19th of June, the weak and ailing tsarevich received twenty-five strokes with the knout (as then administered nobody ever survived thirty), and on the 24th fifteen more. It was hardly possible that he could survive such treatment; the natural inference is that he was not intended to survive it. Anyway, he expired two days later in the guardhouse of the citadel of St Petersburg, two days after the senate had condemned him to death for *imagining* rebellion against his father, and for *hoping* for the co-operation of the common people and the armed intervention of his brother-in-law, the emperor. This shameful sentence was the outcome of mingled terror and obsequiousness. Abominable, unnatural as Peter's conduct to his unhappy and innocent son undoubtedly was, there is no reason to suppose that he ever regretted it. He argued that a single worthless life stood in the way of the regeneration of Russia, and he therefore deliberately removed it.

See Robert Nisbet Bain, *The First Romanovs* (London, 1905). (R. N. B.)

ALFANI, DOMENICO, Italian painter, was born at Perugia towards the close of the 15th century. He was a contemporary of Raphael, with whom he studied in the school of Perugino. The two artists lived on terms of intimate friendship, and the influence of the more distinguished of the two is so clearly traceable in the works of the other, that these have frequently been attributed to Raphael. Towards the close of his life Alfani gradually changed his style and approximated to that of the later Florentine school. The date of his death, according to some, was 1540, while others say he was alive in 1553. Pictures by Alfani may be seen in collections at Florence and in several churches in Perugia.

ALFELD, a town of Germany, in the Prussian province of Hanover, 10 m. W. of Hildesheim, on the river Leine and the Hanover-Cassel main line of railway. Pop. (1900) 4900. It has a handsome church with twin spires, and training colleges for schoolmasters and theological candidates. Its industries are flourishing, and embrace paper-making, agricultural machine-works, iron-founding and flax-spinning.

ALFIERI, VITTORIO, COUNT (1749–1803), Italian dramatist, was born on the 17th of January 1749 at Asti in Piedmont. He lost his father in early infancy; but he continued to reside with his mother, who married a second time, till his tenth year, when he was placed at the academy of Turin. After he had passed a twelvemonth at the academy, he went on a short visit to a relation who dwelt at Coni; and during his stay there he made his first poetical attempt in a sonnet chiefly borrowed from lines in Ariosto and Metastasio, the only poets he had at that time read. When thirteen years of age he was induced to begin the study of civil and canonical law; but the attempt only served to disgust him with every species of application and to increase his relish for the perusal of French romances. By the death of his uncle, who had hitherto taken some charge of his education and conduct, he was left, at the age of fourteen, to enjoy without control his vast paternal inheritance, augmented by the recent accession of his uncle's fortune. He now began to attend the riding-school, where he acquired that rage for horses and equestrian exercise which continued to be one of his strongest passions till the close of his existence.

After some time spent in alternate fits of extravagant dissipation and ill-directed study, he was seized with a desire of travelling; and having obtained permission from the king, he departed in 1766, under the care of an English preceptor. Restless and unquiet, he posted with the utmost rapidity through the towns of Italy; and his improvement was such as was to be expected from his mode of travelling and his previous habits. Hoping to find in foreign countries some relief from the tedium and ennui with which he was oppressed, and being anxious to become acquainted with the French theatre, he proceeded to Paris. But he appears to have been completely dissatisfied with everything he witnessed in France and contracted a dislike to its people, which his intercourse in future years rather contributed to augment than diminish. In Holland he became deeply enamoured of a married lady, who returned his attachment, but who was soon obliged to accompany her husband to Switzerland. Alfieri, whose feelings were of the most impetuous description, was in despair at this separation, and returned to his own country in the utmost anguish and despondency of mind. While under this depression of spirits he was induced to seek alleviation from works of literature; and the perusal of Plutarch's *Lives*, which he read with profound emotion, inspired him with an enthusiastic passion for freedom and independence. Under the influence of this rage for liberty he recommenced his travels; and his only gratification, in the absence of freedom among the continental states, appears to have been derived from contemplating the wild and sterile regions of the north of Sweden, where gloomy forests, lakes and precipices conspired to excite those sublime and melancholy ideas which were congenial to his disposition. Everywhere his soul felt as if confined by the bonds of society; he panted for something more free in government, more elevated in sentiment, more devoted in love and more perfect in friendship. In search of this ideal world he posted through various countries more with the rapidity of a courier than of one who travels for amusement or instruction. During a journey to London he engaged in an intrigue with a married lady of high rank; and having been detected, the publicity of a rencounter with the injured husband, and of a divorce which followed, rendered it expedient and desirable for him to quit England. He then visited Spain and Portugal, where he became acquainted with the Abbé Caluso, who remained through life the most attached and estimable friend he ever possessed. In 1772 Alfieri returned to Turin. This time he became enamoured of the Marchesa Turinetti di Prie, whom he loved with his usual ardour, and who seems to have been as undeserving of a sincere attachment as those he had hitherto adored. In the course of a long attendance on his mistress, during a malady with which she was afflicted, he one day wrote a dialogue or scene of a drama, which he left at her house. On a difference taking place between them the piece was returned to him, and being retouched and extended to five acts, it was performed at Turin in 1775, under the title of *Cleopatra*.

From this moment Alfieri was seized with an insatiable thirst for theatrical fame, and the remainder of his life was devoted to its attainment. His first two tragedies, *Filippo* and *Polinice*, were originally written in French prose; and when he came to versify them in Italian, he found that, from his Lombard origin and long intercourse with foreigners, he expressed himself with feebleness and inaccuracy. Accordingly, with the view of improving his Italian style, he went to Tuscany and, during an alternate residence at Florence and Siena, he completed his *Filippo* and *Polinice*, and conceived the plan of various other dramas. While thus employed he became acquainted with the countess of Albany, who then resided with her husband at Florence. For her he formed an attachment which, if less violent than his former loves, appears to have been more permanent. With this motive to remain at Florence, he could not endure the chains by which his vast possessions bound him to Piedmont. He therefore resigned his whole property to his sister, the countess Cumiana, reserving an annuity which scarcely amounted to a half of his original revenues. At this period the countess of Albany, urged by the ill-treatment she received from her husband, sought refuge in Rome, where she at length received permission from the pope to live apart from her tormentor. Alfieri followed the countess to that capital, where he completed fourteen tragedies, four of which were now for the first time printed at Sienna.

At length, however, it was thought proper that, by leaving Rome, he should remove the aspersions which had been thrown on the object of his affections. During the year 1783 he therefore travelled through different states of Italy, and published six additional tragedies. The interests of his love and literary glory had not diminished his rage for horses, which seems to have been at least the third passion of his soul. He came to England solely for the purpose of purchasing a number of these animals, which he carried with him to Italy. On his return he learned that the countess of Albany had gone to Colmar in Alsace, where he joined her, and resided with her under the same roof during the rest of his life. They chiefly passed their time between Alsace and Paris, but at length took up their abode entirely in that metropolis. While here, Alfieri made arrangements with Didot for an edition of his tragedies, but was soon after forced to quit Paris by the storms of the Revolution. He recrossed the Alps with the countess, and finally settled at Florence. The last ten years of his life, which he spent in that city, seem to have been the happiest of his existence. During that long period his tranquillity was only interrupted by the entrance of the Revolutionary armies into Florence in 1799. Though an enemy of kings, the aristocratic feeling of Alfieri rendered him also a decided foe to the principles and leaders of the French Revolution; and he rejected with the utmost contempt those advances which were made with a view to bring him over to their cause. The concluding years of his life were laudably employed in the study of the Greek literature and in perfecting a series of comedies. His assiduous labour on this subject, which he pursued with his characteristic impetuosity, exhausted his strength, and brought on a malady for which he would not adopt the prescriptions of his physicians, but obstinately persisted in employing remedies of his own. His disorder rapidly increased, and he died on the 8th of October 1803.

The character of Alfieri may be best appreciated from the portrait which he has drawn of himself in his own *Memoirs of his Life*. He was evidently of an irritable, impetuous and almost ungovernable temper. Pride, which seems to have been a ruling sentiment, may account for many apparent inconsistencies of his character. But his less amiable qualities were greatly softened by the cultivation of literature. His application to study gradually tranquillized his temper and softened his manners, leaving him at the same time in perfect possession of those good qualities which he had inherited from nature—a warm and disinterested attachment to his family and friends, united to a generosity, vigour and elevation of character, which rendered him not unworthy to embody in his dramas the actions and sentiments of Grecian heroes.

It is to his dramas that Alfieri is chiefly indebted for the high reputation he has attained. Before his time the Italian language, so harmonious in the *Sonnets* of Petrarch and so energetic in the *Commedia* of Dante, had been invariably languid and prosaic in dramatic dialogue. The pedantic and inanimate tragedies of the 16th century were followed, during the iron age of Italian literature, by dramas of which extravagance in the sentiments and improbability in the action were the chief characteristics. The prodigious success of the *Merope* of Maffei, which appeared in the commencement of the 18th century, may be attributed more to a comparison with such productions than to intrinsic merit. In this degradation of tragic taste the appearance of the tragedies of Alfieri was perhaps the most important literary event that had occurred in Italy during the 18th century. On these tragedies it is difficult to pronounce a judgment, as the taste and system of the author underwent considerable change and modification during the intervals which elapsed between the three periods of their publication. An excessive harshness of style, an asperity of sentiment and total want of poetical ornament are the characteristics of his first four tragedies, *Filippo*, *Polinice*, *Antigone* and *Virginia*. These faults were in some measure corrected in the six tragedies which he gave to the world some years after, and in those which he published along with *Saul*, the drama which enjoyed the greatest success of all his productions—a popularity which may be partly attributed to the severe and unadorned manner of Alfieri being well adapted to the patriarchal simplicity of the age in which the scene of the tragedy is placed. But though there be a considerable difference in his dramas, there are certain observations applicable to them all. None of the plots are of his own invention. They are founded either on mythological fable or history; most of them had been previously treated by the Greek dramatists or by Seneca. *Rosmunda*, the only one which could be supposed of his own contrivance, and which is certainly the least happy effusion of his genius, is partly founded on the eighteenth novel of the third part of Bandello and partly on Prevost's *Mémoires d'un homme de qualité*. But whatever subject he chooses, his dramas are always formed on the Grecian model and breathe a freedom and independence worthy of an Athenian poet. Indeed, his *Agide* and *Bruto* may rather be considered oratorical declamations and dialogues on liberty than tragedies. The unities of time and place are not so scrupulously observed in his as in the ancient dramas; but he has rigidly adhered to a unity of action and interest. He occupies his scene with one great action and one ruling passion, and removes from it every accessory event or feeling. In this excessive zeal for the observance of unity he seems to have forgotten that its charm consists in producing a common relation between multiplied feelings, and not in the bare exhibition of one, divested of those various accompaniments which give harmony to the whole. Consistently with that austere and simple manner which he considered the chief excellence of dramatic composition, he excluded from his scene all *coups de théâtre*, all philosophical reflexions, and that highly ornamented versification which had been so assiduously cultivated by his predecessors. In his anxiety, however, to avoid all superfluous ornament, he has stripped his dramas of the embellishments of imagination; and for the harmony and flow of poetical language he has substituted, even in his best performances, a style which, though correct and pure, is generally harsh, elaborate and abrupt; often strained into unnatural energy or condensed into factitious conciseness. The chief excellence of Alfieri consists in powerful delineation of dramatic character. In his *Filippo* he has represented, almost with the masterly touches of Tacitus, the sombre character, the dark mysterious counsels, the *suspensa semper et obscura verba*, of the modern Tiberius. In *Polinice*, the characters of the rival brothers are beautifully contrasted; in *Maria Stuarda*, that unfortunate queen is represented unsuspicious, impatient of contradiction and violent in her attachments. In *Mirra*, the character of Ciniro is perfect as a father and king, and Cecri is a model of a wife and mother. In the representation of that species of mental alienation where the judgment has perished but traces of character still remain, he is peculiarly happy. The insanity of Saul is skilfully managed; and the horrid joy of Orestes in killing Aegisthus rises finely and naturally to madness in finding that, at the same time, he had inadvertently slain his mother.

Whatever may be the merits or defects of Alfieri, he may be considered as the founder of a new school in the Italian drama. His country hailed him as her sole tragic poet; and his successors in the same path of literature have regarded his bold, austere and rapid manner as the genuine model of tragic composition.

Besides his tragedies, Alfieri published during his life many sonnets, five odes on American independence and the poem of *Etruria*, founded on the assassination of Alexander I., duke of Florence. Of his prose works the most distinguished for animation and eloquence is the *Panegyric on Trajan*, composed in a transport of indignation at the supposed feebleness of Pliny's eulogium. The two books entitled *La Tirannide* and the *Essays on Literature and Government* are remarkable for elegance and vigour of style, but are too evidently imitations of the manner of Machiavel. His *Antigallican*, which was written at the same time with his *Defence of Louis XVI.*, comprehends an historical and satirical view of the French Revolution. The posthumous works of Alfieri consist of satires, six political comedies and the *Memoirs of his Life*—a work which will always be read with interest, in spite of the cold and languid gravity with which he delineates the most interesting adventures and the strongest passions of his agitated life.

See *Mem. di Vit. Alfieri*; Sismondi, *De la lit. du midi de l'Europe*; Walker's *Memoir on Italian Tragedy*; *Giorn. de Pisa*, tom. lviii.;

Life of Alfieri, by Centofanti (Florence, 1842); *Vita, Giornali, Lettere di Alfieri*, by Teza (Florence, 1861); *Vittorio Alfieri*, by Antonini and Cognetti (Turin, 1898).

ALFORD, HENRY (1810–1871), English divine and scholar, was born in London on the 7th of October 1810. He came of a Somersetshire family, which had given five consecutive generations of clergymen to the Anglican church. Alford's early years were passed with his widowed father, who was curate of Steeple Ashton in Wiltshire. He was an extremely precocious lad, and before he was ten had written several Latin odes, a history of the Jews and a series of homiletic outlines. After a peripatetic school course he went up to Cambridge in 1827 as a scholar of Trinity. In 1832 he was 34th wrangler and 8th classic, and in 1834 was made fellow of Trinity. He had already taken orders, and in 1835 began his eighteen years' tenure of the vicarage of Wymeswold in Leicestershire, from which seclusion the twice-repeated offer of a colonial bishopric failed to draw him. He was Hulsean lecturer at Cambridge in 1841–1842, and steadily built up a reputation as scholar and preacher, which would have been enhanced but for his discursive ramblings in the fields of minor poetry and magazine editing. In September 1853 Alford removed to Quebec Chapel, London, where he had a large and cultured congregation. In March 1857 Viscount Palmerston advanced him to the deanery of Canterbury, where, till his death on the 12th of January 1871, he lived the same strenuous and diversified life that had always characterized him. The inscription on his tomb, chosen by himself, is "*Diversorium Viatoris Hierosolymam Proficiscentis.*"

Alford was a not inconsiderable artist, as his picture-book, *The Riviera* (1870), shows, and he had abundant musical and mechanical talent. Besides editing the works of John Donne, he published several volumes of his own verse, *The School of the Heart* (1835), *The Abbot of Muchelnaye* (1841), and a number of hymns, the best-known of which are "Forward! be our watchword," "Come, ye thankful people, come," and "Ten thousand times ten thousand." He translated the *Odyssey*, wrote a well-known manual of idiom, *A Plea for the Queen's English* (1863), and was the first editor of the *Contemporary Review* (1866–1870). His chief fame, however, rests upon his monumental edition of the New Testament in Greek (4 vols.), which occupied him from 1841 to 1861. In this work he first brought before English students a careful collation of the readings of the chief MSS. and the researches of the ripest continental scholarship of his day. Philological rather than theological in character, it marked an epochal change from the old homiletic commentary, and though more recent research, patristic and papyral, has largely changed the method of New Testament exegesis, Alford's work is still a quarry where the student can dig with a good deal of profit.

His *Life*, written by his widow, appeared in 1873 (Rivington).
(A. J. G.)

ALFRED, or ÆLFRED, known as THE GREAT (848–? 900), king of England, was born in 848 at Wantage, and was the fourth son of King Æthelwulf and his first wife (Osburh). He seems to have been a child of singular attractiveness and promise, and stories of his boyhood were remembered. At the age of five (853) he was sent to Rome, where he was confirmed by Leo IV., who is also stated to have "hallowed him as king." Later writers interpreted this as an anticipatory crowning in preparation for his ultimate succession to the throne of Wessex. That, however, could not have been foreseen in 853, as Alfred had three elder brothers living. It is probably to be understood either of investiture with the consular insignia, or possibly with some titular royalty such as that of the under-kingdom of Kent. In 855 Alfred again went to Rome with his father Æthelwulf, returning towards the end of 856. About two years later his father died. During the short reigns of his two eldest brothers, Æthelbald and Æthelberht, nothing is heard of Alfred. But with the accession of the third brother Æthelred (866) the public life of Alfred begins, and he enters on his great work of delivering England from the Danes. It is in this reign that Asser applies to Alfred the unique title of *secundarius*, which seems to indicate a position analogous to that of the Celtic *tanist*, a recognized successor, closely associated with the reigning prince. It is probable that this arrangement was definitely sanctioned by the witenagemot, to guard against the danger of a disputed succession should Æthelred fall in battle. In 868 Alfred married Ealhswith, daughter of Æthelred Mucill, who is called ealdorman of the Gaini, an unidentified district. The same year the two brothers made an unsuccessful attempt to relieve Mercia from the pressure of the Danes. For nearly two years Wessex had a respite. But at the end of 870 the storm burst; and the year which followed has been rightly called "Alfred's year of battles." Nine general engagements were fought with varying fortunes, though the place and date of two of them have not been recorded. A successful skirmish at Englefield, Berks (December 31, 870), was followed by a severe defeat at Reading (January 4, 871), and this, four days later, by the brilliant victory of Ashdown, near Compton Beauchamp in Shrivenham Hundred. On the 22nd of January the English were again defeated at Basing, and on the 22nd of March at Marton, Wilts, the two unidentified battles having perhaps occurred in the interval. In April Æthelred died, and Alfred succeeded to the whole burden of the contest. While he was busied with his brother's exequies, the Danes defeated the English in his absence at an unnamed spot, and once more in his presence at Wilton in May. After this peace was made, and for the next five years the Danes were occupied in other parts of England, Alfred merely keeping a force of observation on the frontier. But in 876 part of the Danes managed to slip past him and occupied Wareham; whence, early in 877, under cover of treacherous negotiations, they made a dash westwards and seized Exeter. Here Alfred blockaded them, and a relieving fleet having been scattered by a storm, the Danes had to submit and withdrew to Mercia. But in January 878 they made a sudden swoop on Chippenham, a royal vill in which Alfred had been keeping his Christmas, "and most of the people they reduced, except the King Alfred, and he with a little band made his way . . . by wood and swamp, and after Easter he . . . made a fort at Athelney, *and from that fort kept fighting against the foe*" (*Chron.*). The idea that Alfred, during his retreat at Athelney, was a helpless fugitive rests upon the foolish legend of the cakes. In reality he was organizing victory. By the middle of May his preparations were complete and he moved out of Athelney, being joined on the way by the levies of Somerset, Wilts and Hants. The Danes on their side moved out of Chippenham, and the two armies met at Edington in Wiltshire. The result was a decisive victory for Alfred. The Danes submitted. Guthrum, the Danish king, and twenty-nine of his chief men accepted baptism. By the next year (879) not only Wessex, but Mercia, west of Watling Street, was cleared of the invader. This is the arrangement known as the peace of Wedmore (878), though no document embodying its provisions is in existence. And though for the present the north-eastern half of England, including London, remained in the hands of the Danes, in reality the tide had turned, and western Europe was saved from the danger of becoming a heathen Scandinavian power. For the next few years there was peace, the Danes being kept busy on the continent. A landing in Kent in 884 or 885,[1] though successfully repelled, encouraged the East Anglian Danes to revolt. The measures taken by Alfred to repress this revolt culminated in the capture of London in 885 or 886, and the treaty known as Alfred and Guthrum's peace, whereby the boundaries of the treaty of Wedmore (with which this is often confused) were materially modified in Alfred's favour. Once more for a time there was a lull; but in the autumn of 892 (893) the final storm burst. The Danes, finding their position on the continent becoming more and more precarious, crossed to England in two divisions, amounting in the aggregate to 330 sail, and entrenched themselves, the larger body at Appledore and the lesser under Haesten at Milton in Kent. The fact that the new invaders brought their wives and children with them shows that this was no mere raid, but a deliberate attempt, in concert with the Northumbrian and East Anglian Danes, to conquer England. Alfred, 893(894), took up a position whence he could observe both forces. While he was negotiating with Haesten the Danes at Appledore broke out and struck north-westwards, but were overtaken by Alfred's eldest son, Edward, and defeated in a general engagement at Farnham, and driven to take refuge in Thorney Island in the Hertfordshire Colne, where they were blockaded and ultimately compelled to submit. They then fell back on Essex, and after suffering another defeat at Benfleet coalesced with Haesten's force at Shoebury. Alfred had been on his way to relieve his son at Thorney when he heard that the Northumbrian and East Anglian Danes were besieging Exeter and an unnamed fort on the coast of North Devon. Alfred at once hurried westwards and raised the siege of Exeter; the fate of the other place is not recorded. Meanwhile the force under Haesten set out to march up the Thames valley, possibly with the idea of assisting their friends in the west. But they were met by a large force under the three great ealdormen of Mercia, Wilts and Somerset, and forced to head off to the north-west, being finally overtaken and blockaded at Buttington, which some identify with Buttington Tump at the mouth of the Wye, others with Buttington near Welshpool. An attempt to break through the English lines was defeated with loss; those who escaped retreated to Shoebury. Then after collecting reinforcements they made a sudden dash across England and occupied the ruined Roman walls of Chester. The English did not attempt a winter blockade, but contented themselves with destroying all the supplies in the neighbourhood. And early in 894 (895) want of food obliged the Danes to retire once more to Essex. At the end of this year and early in 895 (896) the Danes drew their ships up the Thames and Lea and fortified themselves twenty miles above London. A direct attack on the Danish lines failed, but later in the year Alfred saw a means of obstructing the river so as to prevent the egress of the Danish ships. The Danes realized that they were out-manœuvred. They struck off north-westwards and wintered at Bridgenorth. The next year, 896 (897), they abandoned the struggle. Some retired to Northumbria, some to East Anglia; those who had no connexions in England withdrew to the continent. The long campaign was over. The result testifies to the confidence inspired by Alfred's character and generalship, and to the efficacy of the military reforms initiated by him. These were (1) the division of the *fyrd* or national militia into two parts, relieving each other at fixed intervals, so as to ensure continuity in military operations; (2) the establishment of fortified posts (burgs) and garrisons at certain points; (3) the enforcement of the obligations of thanehood on all owners of five hides of land, thus giving the king a nucleus of highly equipped troops. After the final dispersal of the Danish invaders Alfred turned his attention to the increase of the navy, and ships were built according to the king's own designs, partly to repress the ravages of the Northumbrian and East Anglian Danes on the coasts of Wessex, partly to prevent the landing of fresh hordes. This is not, as often asserted, the beginning of the English navy. There had been earlier naval operations under Alfred. One naval engagement was certainly fought under Æthelwulf (851), and earlier ones, possibly in 833 and 840. Nor were the new ships a great success, as we hear of them grounding in action and foundering in a storm. Much, too, was needed in the way of civil re-organization, especially in the districts ravaged by the Danes. In the parts of Mercia acquired by Alfred, the shire system seems now to have been introduced for the first time. This is the one grain of truth in the legend that Alfred was the inventor of shires, hundreds and tithings. The finances also would need careful attention; but the subject is obscure, and we cannot accept Asser's description of Alfred's appropriation of his revenue as more than an ideal sketch. Alfred's care for the administration of justice is testified both by history and legend; and the title "protector of the poor" was his by unquestioned right. Of the action of the witenagemot we do not hear very much under Alfred. That he was anxious to respect its rights is conclusively proved, but both the circumstances of the time and the character of the king would tend to throw more power into his hands. The legislation of Alfred probably belongs to the later part of the reign, after the pressure of the Danes had relaxed. The details of it cannot be discussed here. Asser speaks grandiosely of Alfred's relations with foreign powers, but little definite information is available. He certainly corresponded with Elias III., the patriarch of Jerusalem, and probably sent a mission to India. Embassies to Rome conveying the English alms to the pope were fairly frequent; while Alfred's interest in foreign countries is shown by the insertions which he made in his translation of Orosius. His relations to the Celtic princes in the southern half of the island are clearer. Comparatively early in his reign the South Welsh princes, owing to the pressure on them of North Wales and Mercia, commended themselves to Alfred. Later in the reign the North Welsh followed their example, and the latter co-operated with the English in the campaign of 893 (894). The Celtic principality in Cornwall, which seems to have survived at least till 926, must long have been practically dependent on Wessex. That Alfred sent alms to Irish as well as to continental monasteries may be accepted on Asser's authority; the visit of the three pilgrim "Scots" (*i.e.* Irish) to Alfred in 891 is undoubtedly authentic; the story that he himself in his childhood was sent to Ireland to be healed by St Modwenna, though mythical, may point to Alfred's interest in that island. The history of the church under Alfred is most obscure. The Danish inroads had told heavily upon it; the monasteries had been special points of attack, and though Alfred founded two or three monasteries and imported foreign monks, there was no general revival of monasticism under him. To the ruin of learning and education wrought by the Danes, and the practical extinction of the knowledge of Latin even among the clergy, the preface to Alfred's translation of Gregory's *Pastoral Care* bears eloquent testimony. It was to remedy these evils that he established a court school, after the example of Charles the Great; for this he imported scholars like Grimbald and John the Saxon from the continent and Asser from South Wales; for this, above all, he put himself to school, and made the series of translations for the instruction of his clergy and people, most of which still survive. These belong unquestionably to the later part of his reign, not improbably to the last four years of it, during which the chronicles are almost silent. Apart from the lost *Handboc* or *Encheiridion*, which seems to have been merely a commonplace-book kept by the king, the earliest work to be translated was the *Dialogues of Gregory*, a book enormously popular in the middle ages. In this case the translation was made by Alfred's great friend Werferth, bishop of Worcester, the king merely furnishing a preface. The next work to be undertaken was Gregory's *Pastoral Care*, especially for the benefit of the clergy. In this Alfred keeps very close to his original; but the introduction which he prefixed to it is one of the most interesting documents of the reign, or indeed of English history. The next two works taken in hand were historical, the *Universal History* of Orosius and Bede's *Ecclesiastical History of the English People*. The priority should probably be assigned to the *Orosius*, but the point has been much debated. In the *Orosius*, by omissions and additions, Alfred so remodels his original as to produce an almost new work; in the *Bede* the author's text is closely adhered to, no additions being made, though most of the documents and some other less interesting matters are omitted. Of late years doubts have been raised as to Alfred's authorship of the *Bede* translation. But the sceptics cannot be regarded as having proved their point. We come now to what is in many ways the most interesting of Alfred's works, his translation of Boethius' *Consolation of Philosophy*, the most popular philosophical manual of the middle ages. Here again Alfred deals very freely with his original and though the late Dr G. Schepss showed that many of the additions to the text are to be traced not to Alfred himself, but to the glosses and commentaries which he used, still there is much in the work which is solely Alfred's and highly characteristic of his genius. It is in the *Boethius* that the oft-quoted sentence occurs: "My will was to live worthily as long as I lived, and after my life to leave to them that should come after, my memory in good works." The book has come down to us in two MSS. only. In one of these the poems with which the original is interspersed are rendered into prose, in the other into alliterating verse. The authorship of the latter has been much disputed; but probably they also are by Alfred. Of the authenticity of the work as a whole there has never been any doubt. The last of Alfred's works is one to which he gave the title *Blostman*, *i.e.* "Blooms" or Anthology. The first half is based mainly on the *Soliloquies* of St Augustine, the remainder is drawn from various sources, and contains much that is Alfred's own and highly characteristic of him. The last words of it may be quoted; they form a fitting epitaph for the noblest of English kings. "Therefore he seems to me a very foolish man, and very wretched, who will not increase his understanding while he is in the world, and ever wish and long to reach that endless life where all shall be made clear." Besides these works of Alfred's, the *Saxon Chronicle* almost certainly, and a Saxon *Martyrology*, of which fragments only exist, probably owe their inspiration to him. A prose version of the first fifty Psalms has been attributed to him; and the attribution, though not proved, is perfectly possible. How Alfred passed to "the life where all things are made clear" we do not know. The very year is uncertain. The arguments on the whole are in favour of 900. The day was the 26th of October. Alike for what he did and for what he was, there is none to equal Alfred in the whole line of English sovereigns; and no monarch in history ever deserved more truly the epithet of Great.

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[1] Where alternative dates are given the later date is that of the *Saxon Chronicle*. But the evidence of the Continental Chronicles makes it probable that the *Saxon Chronicle* is a year in advance of the true chronology in this part.

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ALFRED ERNEST ALBERT, duke of Saxe-Coburg and Gotha, and duke of Edinburgh (1844–1900), second son and fourth child of Queen Victoria, was born at Windsor Castle on the 6th of August 1844. In 1856 it was decided that the prince, in accordance with his own wishes, should enter the navy, and a separate establishment was accordingly assigned to him, with Lieutenant Sowell, R. E., as governor. He passed a most creditable examination for midshipman in August 1858, and being appointed to the "Euryalus," at once began to work hard at the practical part of his profession. In July 1860, while on this ship, he paid an official visit to the Cape, and made a very favourable impression both on the colonials and on the native chiefs. On the abdication of Otto, king of Greece, in 1862, Prince Alfred was chosen by the whole people to succeed him, but political conventions of long standing rendered it impossible for the British government to accede to their wishes. The prince therefore remained in the navy, and was promoted lieutenant on the 24th of February 1863 and captain on the 23rd of February 1866, being then appointed to the command of the "Galatea." On attaining his majority in 1865 the prince was created duke of Edinburgh and earl of Ulster, with an annuity of £15,000 granted by parliament. While still in command of the "Galatea" the duke started from Plymouth on the 24th of January 1867 for his voyage round the world. On the 11th of June 1867 he left Gibraltar and reached the Cape on the 24th of July, and landed at Glenelg, South Australia, on the 31st of October. Being the first English prince to visit Australia, the duke was received with the greatest enthusiasm. During his stay of nearly five months he visited Adelaide, Melbourne, Sydney, Brisbane and Tasmania; and it was on his second visit to Sydney that, while attending a public picnic at Clonfert in aid of the Sailors' Home, an Irishman named O'Farrell shot him in the back with a revolver. The wound was fortunately not dangerous, and within a month the duke was able to resume command of his ship and return home. He reached Spithead on the 26th of June 1868, after an absence of seventeen months. The duke's next voyage was to India, where he arrived in December 1869. Both there and at Hong Kong, which he visited on the way, he was the first British prince to set foot in the country. The native rulers of India vied with one another in the magnificence of their entertainments during the duke's stay of three months. On the 23rd of January 1874 the marriage of the duke to the grand-duchess Marie Alexandrovna, only daughter of Alexander II., emperor of Russia, was celebrated at St Petersburg, and the bride and bridegroom made their public entry into London on the 12th of March. The duke still devoted himself to his profession, showing complete mastery of his duties and unusual skill in naval tactics. He was promoted rear-admiral on the 30th of December 1878; vice-admiral, 10th of November 1882; admiral, 18th of October 1887; and received his baton as admiral of the Fleet, 3rd of June 1893. He commanded the Channel fleet, 1883–1884; the Mediterranean fleet, 1886–1889; and was commander-in-chief at Davenport, 1890–1893. He always paid the greatest attention to his official duties and was most efficient as an admiral.

On the death of his uncle, Ernest II., duke of Saxe-Coburg and Gotha, on the 22nd of August 1893, the vacant duchy fell to the duke of Edinburgh, for the prince of Wales had renounced his right to the succession. At first regarded with some coldness as a "foreigner," he gradually gained popularity, and by the time of his death, on the 30th of July 1900, he had completely won the good opinion of his subjects. The duke was exceedingly fond of music and an excellent violinist, and took a prominent part in establishing the Royal College of Music. He was also a keen collector of glass and ceramic ware, and his collection, valued at half a million of marks, was presented by his widow to the "Veste Coburg," near Coburg. When he became duke of Saxe-Coburg he surrendered his English allowance of £15,000 a year, but the £10,000 granted in addition by parliament on his marriage he retained in order to keep up Clarence House. The duke had one son, who died unmarried on the 6th of February 1899, and four daughters. The third daughter, Princess Alexandra Louisa Olga Victoria, married the hereditary prince Ernest of Hohenlohe-Langenburg, who became regent of the duchy of Coburg during the minority of the deceased duke's nephew, the young duke of Albany, to whom the succession fell. (G. F. B.)

ALFRED, a village in the township of Alfred, Allegany county, New York, U.S.A., about 75 m. S.W. of Buffalo. Pop. of the township, including the village (1900), 1615; (1905, state census) 1784. Pop. of the village (1900) 756; (1905, state census) 966. The township is served, at Alfred station, by the Erie railway. The village, which is connected by stage with the station, is situated at the junction of two valleys and commands delightful views of mountain scenery. On the west slope of Pine Hill is Alfred University (co-educational), which embraces a college (non-sectarian), an academy (non-sectarian) and a theological seminary (Seventh-Day Baptist). Closely associated with it also, and under the management of the university trustees, is the New York State School of Clay-Working and Ceramics (1900), one of the most efficient schools of the kind in the country. In 1908 the legislature of New York appropriated $80,000 for the establishment of a state school of agriculture in connexion with the university. The institution had its beginning in 1836 in a private school. This developed into an academy, which in 1843 was incorporated as Alfred Academy and Teachers' Seminary; in 1857 the university was chartered under its present name. The principal industry of the village is the manufacture of roofing tiles. The township of Alfred lies within the territory purchased by Robert Morris in 1791. He sold it in the same year to a company resident in London, England. Their agent sold most of it to settlers and, it is said, named the township, when it was organized in 1806, in honour of Alfred the Great. The first settlement within its present limits was made in 1807. For several years most of the settlers were Seventh-Day Baptists, and in 1812 they organized a church here. The village of Alfred was chartered in 1887.

J. S. Minard, *Allegany County and its People* (Alfred, 1896).

ALFRETON, a market town in the mid-parliamentary division of Derbyshire, England, 14 m. N. by E. of Derby, on the Midland railway. Pop. of urban district (1901) 17,505. It lies at a considerable elevation above the valley of a small stream tributary to the Derwent. The church of St Martin is Early English and later. The neighbourhood abounds in ironworks, collieries, quarries and potteries, and is thickly populated. To the northeast of Alfreton are South Normanton (pop. 5170), Blackwell (4144) and Tibshelf (3432); to the north Shirland (3929), to the south Ironville and other busy industrial villages. The foundation of Alfreton is traditionally ascribed to King Alfred.

ALFUROS (ALFURES, HORAFORAS), a term of no ethnological value applied by the Malays to all the uncivilized non-Mahommedan peoples in the eastern portion of the Malay Archipelago. Its origin is uncertain, but its meaning is "wild" or "uncivilized." The term is not restricted to the aborigines, but is far more frequently used to describe the tribes of Malayan blood.

ALGAE. The Latin word *alga* seems to have been the equivalent of the English word "seaweed" and probably stood for any or all of the species of plants which form the "wrack" of a seashore. When the word "Algae" came to be employed in botanical classification as the name of a class, an arbitrary limitation had to be set to its signification, and this was not always in keeping with its original meaning. The absence of differentiation into root, stem and leaf which prevails among seaweeds, seems, for example, to have led Linnaeus to employ the term in the *Genera Plantarum* for a sub-class of Cryptogamia, the members of which presented this character in a greater or less degree. Of the fifteen genera included by Linnaeus among algae, not more than six—viz. *Chara*, *Fucus*, *Ulva* and *Conferva*, and in part *Tremella* and *Byssus*—would to-day, in any sense in which the term is employed, be regarded as algae. The excluded genera are distributed among the liverworts, lichens and fungi; but notwithstanding the great advance in knowledge since the time of Linnaeus, the difficulty of deciding what limits to assign to the group to be designated *Algae* still remains. It arises from the fact that algae, as generally understood, do not constitute a homogeneous group, suggesting a descent from a common stock. Among them there exist, as will be seen hereafter, many well-marked but isolated natural groups, and their inclusion in the larger group is generally felt to be a matter of convenience rather than the expression of a belief in their close inter-relationship. Efforts are therefore continually being made by successive writers to exclude certain outlying sub-groups, and to reserve the term *Algae* for a central group reconstituted on a more natural basis within narrower limits.

Classification.

It is perhaps desirable, in an article like this, to treat of algae in the widest possible sense in which the term may be used, an indication being at the same time given of the narrower senses in which it has been proposed to employ it. Interpreted in this way, the place of algae in the vegetable kingdom may be shown by means of a table:—

- The Vegetable Kingdom
    - Cryptogamia
        - Thallophyta
            - Myxomycetes
            - Fungi
            - Algae
        - Bryophyta
        - Pteridophyta
    - Phanerogamia
        - Gymnosperms
        - Angiosperms

Algae in this wide sense may be briefly described as the aggregate of those simpler forms of plant life usually devoid, like the rest of the Thallophyta, of differentiation into root, stem and leaf; but, unlike other Thallophyta, possessed of a colouring matter; by means of which they are enabled, in the presence of sunlight, to make use of the carbonic acid gas of the atmosphere as a source of carbon. It is true that certain Bryophyta (Marchantiaceae, Anthoceroteae) possess a thalloid structure similar to that of Thallophyta, and are at the same time possessed of the colouring matter of the Green Algae. Their life-cycle, however, the structure of the reproductive organs and their whole organization proclaim them to be Bryophyta (*q.v.*). On the other hand, certain undoubted animals (*Stentor*, *Hydra*, *Bonellia*) are provided with a green colouring matter by means of which they make use of atmospheric carbonic acid. A more important consideration is the occasional absence of this colour in species, or groups of species, with, in other respects, algal affinities. Such aberrant forms are to be regarded in the same light as Cuscuta and Orobanchaceae, for example, among Phanerogams. As these non-green plants do not cease to be classed with other Phanerogams, so must the forms in question be retained among algae. In all cases the loss of the colouring matter is associated with an incapacity to take up carbon from so simple a compound as carbonic acid.

It might be mentioned here that the whole group of the Fungi (*q.v.*), with its many thousands of species, is now generally regarded as having been derived from algae, and the system of classification of fungi devised by Brefeld is based upon this belief. The similarity of the morphological characters of one group of fungi to those of certain algae has earned for it the name of Phycomycetes or *alga-fungi*.

Further discussion of the general characters of algae will be deferred in order to take a brief survey of the subdivisions of the group. For this purpose there will be adopted the classification of algae into four sub-groups, founded on the nature the colouring matters present in the plant:—

I. CYANOPHYCEAE, or Blue-green Algae.
II. CHLOROPHYCEAE, or Green Algae.
III. PHAEOPHYCEAE, or Brown Algae.
IV. RHODOPHYCEAE, or Red Algae.

The merits and demerits of this system will appear during the description of the characters of the members of the several subdivisions.

I. CYANOPHYCEAE.—This group derives its name from the circumstance that the cells contain in addition to the green colouring matter, chlorophyll, a blue-green colouring matter to which the term phycocyanin has been applied. To the eye, however, members of this group present a greater variety of colour than those of any other—yellow, brown, olive, red, purple, violet and variations of all these being known. They undoubtedly represent the lowest grade of algal life, and their distribution rivals that of the Green Algae. They occur in the sea, in fresh water, on moist earth, on damp rocks and on the bark of trees. Certain species are regularly found in the intercellular spaces of higher plants; such are species of *Nostoc* in the thallus of *Anthoceros*, the leaves of *Asolla* and the roots of Cycads. Many of them enter into the structure of the lichen-thallus, as the so-called gonidia. It is remarkable that species belonging to the Oscillatoriaceae are known to flourish in hot springs, the temperature of which rises as high as 85°C.

Sub-divisions.

The thallus may be unicellular or multicellular. When unicellular, it may consist of isolated cells, but more commonly the cells are held together in a common jelly (Chroococcaceae) derived from the outer layers of the cell-wall. The multicellular species consist of filaments, branched or unbranched, which arise by the repeated divisions of the cells in parallel planes, no formation of mucilage occurring in the dividing walls. Such filaments may not give rise to mucilage on the lateral surface either, in which case they are said to be free; when mucilage does occur on the lateral wall, it appears as the sheath surrounding either the single filament, or a sheaf of filaments of common origin. The mucilage may also form an embedding substance similar to that of Chroococcaceae, in which the filaments lie parallel or radiate from a common centre (Rivulariaceae). The cells of the filament may be all alike, and growth may occur equally in all parts (Oscillatoriaceae); or certain cells (heterocysts) may become marked off by their larger size and the transparency of their contents; in which case growth may still be distributed equally throughout (*Nostoc*), or the filament may be attached where the heterocyst arises, and grow out at the opposite extremity into a fine hair (Rivulariaceae). An African form (*Camptothrix*), devoid of heterocysts and hair-like at both extremities, has recently been described. Branching has been described as "false" and "true." The former arises when a filament in a sheath, either in consequence of growth in length beyond the capacity of the sheath to accommodate it, or because of the decay of a cell, becomes interrupted by breaking, and the free ends slip past one another. "True" branching arises only by the longitudinal division of a cell of a filament and the lateral outgrowth of one of the cells resulting from the division (Sirosiphonaceae).

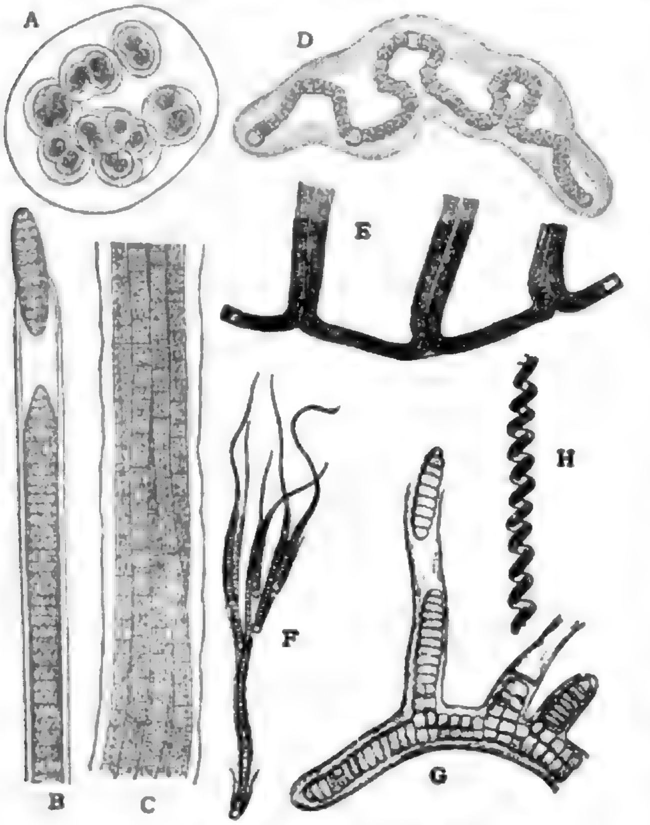


FIG. 1.—Cyanophyceae, variously magnified.

A. *Gloeocapsa sp.*, colony in mucilage.
B. *Phormidium sp.*, single filament with hormogonium.
C. *Microcoleus sp.*, several filaments in common sheath.
D. *Nostoc sp.*, young colony-filament with heterocysts.
E. *Scytonema sp.*, false branching.
F. *Rivularia sp.*
G. *Stigonema sp.*, with hormogonium and true branching.
H. *Spirulina sp.*

(From Engler and Prantl, *Pflanzenfamilien*, by permission of Wilhelm Engelmann.)

The nature of the contents of the cells of Cyanophyceae has given rise to considerable controversy. The cells are for the most part exceedingly minute, and are not easy to free from their colouring matters, so that investigation has been attended with great difficulty. Occupying as these algae do perhaps the lowest grade of plant life, it is a matter of interest to ascertain whether a nucleus or chromatophore is differentiated in their cells, or whether the functions and properties of these bodies are diffused through the whole protoplast. It is certain that the centre of the cell, which is usually non-vacuolated, is occupied by protoplasm of different properties from the peripheral region; and A. Fischer has further established the fact that the peripheral mass, which is a hollow sphere in spherical cells, and either a hollow cylinder or barrel-shaped body in filamentous forms, must be regarded as the single chromatophore of the Cyanophyceous cell. But what precisely is the nature of the central mass is still uncertain. Some investigators, such as R. Hegler, F. G. Kohl and E. W. Olive, claim that this body is a true nucleus comparable with that of the higher plants. It is said to undergo division by a mitosis essentially of the same character, with the formation of a spindle and the differentiation of chromosomes. It is further stated by Olive that the chromosomes undergo longitudinal fission, and that for the same species the same number of chromosomes appear at each division. H. Wager speaks with greater reserve, acknowledging, however, the central body to be a nucleus of a rudimentary type, but devoid of nuclear membrane and nucleolus. He thinks it may possibly originate in the vacuolization of the central region, and the accumulation of chromatin granules therein. He finds no spindle fibres or true chromosomes, and considers the division direct, not indirect. With reference to the existence of a chromatophore, he with others finds the colouring matter localized in granules in the peripheral region, but does not consider these individually or in the aggregate as chromatophores. Among other contents of the cell, fatty substances and tannin are known. A curious adaptation seems to occur in certain floating forms, in the presence of a gas-vacuole, which may be made to vary its volume with varying pressure. There is evidence that the dividing wall of filamentous forms is deeply pitted, as is found to be the case in red algae. Reproduction is chiefly effected by the vegetative method. Asexual reproductive cells are not infrequent, but sexual reproduction even in its initial stages is unknown. Nor is motility by means of cilia known in the group. In the unicellular forms, cell-division involves multiplication of the plant. In all the multicellular plants of this group which have been adequately investigated, vegetative multiplication by means of what are known as hormogonia has been found to occur. These are short segments of filaments consisting of a few cells which disengage themselves from the ambient jelly, if it be present, in virtue of a peculiar creeping movement which they possess at this stage. After a time they come to rest and give rise to new colonies. True reproduction of the asexual kind occurs, however, in the formation of sporangia, particularly in the Chamaesiphonaceae. Here the contents of certain cells break up endogenously into a great number of spores, which are distributed as a fine dust. Resting spores are also known. In these cases, certain cells of a colony of unicellular plants or of the filaments of multicellular plants enlarge greatly and thicken their wall. When unfavourable external conditions supervene and the ordinary cells become atrophied, these cells persist and reproduce the plant with the return of more favourable conditions. The Oscillatoriaceae are capable of a peculiar oscillatory movement, which has earned for them their name, and which enables them to move through considerable distances. It is not clear how the movement is effected, though it has frequently been the subject of careful investigation.

With the Cyanophyceae must be included, as their nearest allies, the Bacteriaceae (see BACTERIOLOGY). Notwithstanding the absence of chlorophyll, and the consequent parasitic or saprophytic habit, Bacteriaceae agree in so many morphological features with Cyanophyceae that the affinity can hardly be doubted.

A census of the Cyanophyceae with their two main groups is given below:—

1. Coccogoneae—2 families, 29 genera, 253 species.
2. Hormogoneae—6 families, 59 genera, 701 species.

(Engler and Prantl's *Pflanzenfamilien*, 1900.)

II. CHLOROPHYCEAE.—This group includes those algae in which the green colouring matter, chlorophyll, is not accompanied by a second colouring matter, as it is in other groups. It consists of three subdivisions—Conjugatae, Euchlorophyceae and Characeae. Of these the first and last are relatively small and sharply defined families, distinguished from the second family, which forms the bulk of the group, by characters so diverse that their inclusion with them in one larger group can only be justified on the ground of convenience. Chlorophyceae include both marine and freshwater plants.

Euchlorophyceae in their turn have been until recently regarded as made up of the three series of families—Protococcales, Confervales and Siphonales. As the result of recent investigations by two Swedish algologists, Bohlin and Luther, it has been proposed to make a re-classification of a far-reaching nature. Algae are withdrawn from each of the three series enumerated above and consolidated into an entirely new group. In these algae, the colouring matter is said to be yellowish-green, not strictly green, and contained in numerous small discoid chromatophores which are devoid of pyrenoids. The products of assimilation are stored up in the form of a fatty substance and not starch. A certain inequality in the character of the two cilia of the zoospores of some of the members of the group has earned for it the title Heterokontae, from the Greek κοντός, a punting-pole. In consonance with this name, its authors propose to re-name the Conjugatae; Akontae and Oedogoniaceae with a chaplet of cilia become Stephanokontae, and the algae remaining over in the three series from which the Heterokontae and Stephanokontae are withdrawn become Isokontae. Conjugatae, Protococcales and Characeae are exclusively freshwater; Confervales and Siphonales are both freshwater and marine, but the latter group attains its greatest development in the sea. Some Chlorophyceae are terrestrial in habit, usually growing on a damp substratum, however. *Trentepohlia* grows on rocks and can survive considerable desiccation. *Phycopeltis* grows on the surface of leaves, *Phyllobium* and *Phyllosiphon* in their tissues. *Gomontia* is a shell-boring alga.

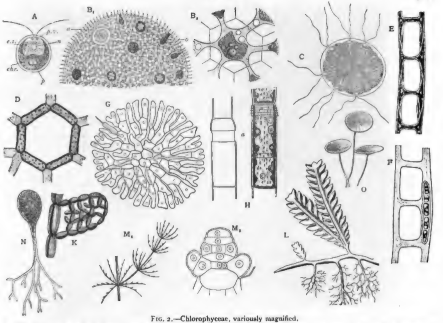


FIG. 2.—Chlorophyceae, variously magnified.

A. *Chlamydomonas sp.*, unicellular; *chr.*, chromatophore; *p.*, pyrenoid; *n.*, nucleus; *p.v.*, pulsating vacuoles; *e.s.*, eyespot.
B_1. *Volvox sp.*, with *a*, antheridia, and *o*, oogonia.
B_2. *Volvox sp.*, surface view of a single cell showing connexions.
C. *Pandorina sp.*, a 16-celled colony.
D. *Hydrodictyon*, a single mesh surrounded by 6 cells.
E. *Microspora sp.*, showing H-pieces in the wall.
F. *Entoderma sp.*, endophytic in *Ectocarpus*.
G. *Coleochaete sp.*, growing as a plate.
H. *Oedogonium sp.*, intercalated growth by insertion of new piece(*a*) leaving caps.
K. *Struvea sp.*, showing branches forming a net-work.
L. *Caulerpa sp.*, showing portion of axis with leaf-like and root-like appendages.
M_1. *Chara sp.*, axis with leaf-like appendages and a branch.
M_2. *Chara sp.*, apical region.
N. *Botrydium*, a simple siphonaceous alga with root-like attachment.
O. *Acetabularia Mediterranea*, mushroom-like calcareous siphonaceous alga.

(A, C, E, F, G, H, K, L, M_1, M_2 from Engler and Prantl, *Pflanzenfamilien*, by permission of Wilhelm Engelmann; B_1, N from Vines, *Students' Text Book of Botany*, by permission of Swan Sonnenschein and Co.; B_2, D, O from Oltmanns, *Morphologie u. Biologie der Algen*, by permission of Gustav Fischer.)

Dermatophyton grows on the carapace of the tortoise and *Trichophilus* in the hairs of the sloth. Certain Protococcales and Confervales exist as the gonidia of the lichenthallus.

The thallus is of more varied structure in this group than in any other. In the simplest case it may consist of a single cell, which may remain free during the whole of the greater part of its existence, or be loosely aggregated together within a common mucilage, or be held together by the adhesion of the cell-walls at the surface of contact. These aggregations or colonies, as they are termed, may assume the form of a plate, a ring, a solid sphere, a hollow sphere, a perforate sphere, a closed net, or a simple or branched filament. It is not easy in all cases to draw a distinction between a colony of plants and a multicellular individual. In a *Volvox* sphere, for example, there is a marked protoplasmic continuity between all the cells of the colony. The Ulvaceae, the thallus of which consists of laminae, one or more cells thick, or hollow tubes, probably represent a still more advanced stage in the passage of a colony into a multicellular plant. Here there is some amount of localization of growth and distinction of parts. It is only in such cases as *Volvox* and Ulvaceae that there is any pretension to the formation of a true parenchyma within the limits of the Chlorophyceae. In the whole series of the Confervales, the thallus consists of filaments branched or unbranched, attached at one extremity, and growing almost wholly at the free end. The branches end in fine hairs in Chaetophoraceae. In Coleochaetaceae the branches are often welded into a plate, simulating a parenchyma. In all Conjugatae and most Protococcales, and in the bulk of the Confervales, the thallus consists of a cell or cells, the protoplast of which contains a single nucleus. In Hydrodictyaceae, Cladophoraceae, Sphaeropleaceae and Gomontiaceae this is no longer the case. Instead of a single relatively large nucleus, each cell is found to contain many small nuclei, and is spoken of as a coenocyte. This character becomes still more pronounced in the large group of the Siphonales. Valoniaceae and Dasycladaceae are partially septate, but elsewhere no cellulose partitions occur, and the thallus is more or less the continuous tube from which the group is named. Yet the siphonaceous algae may assume great variety of form and reach a high degree of differentiation. *Protosiphon* and *Botrydium*, on the one hand, are minute vesicles attached to muddy surfaces by rhizoids; *Caulerpa*, on the other, presents a remarkable instance of the way in which much the same external morphology as that of cormophytes has been reached by a totally different internal structure. Many Siphonales are encrusted with lime like *Corallina* among Red Algae. *Penicillus* is brush-like, *Halimeda* and *Cymopolia* are jointed, *Acetabularia* has much the same external form as an expanded *Coprinus*, *Neomeris* simulates the fertile shoot of *Equisetum* with its densely packed whorled branches, and in *Microdictyon*, *Anadyomene*, *Struvea* and *Boodlea* the branches, spreading in one plane, become bound together in a more or less close network. Characeae are separated from other Chlorophyceae by a long interval, and present the highest degree of differentiation of parts known among Green Algae. Attached to the bottom of pools by means of rhizoids, the thallus of Characeae grows upwards by means of an apical cell, giving off whorled appendages at regular intervals. The appendages have a limited growth; but in connexion with each whorl there arise, singly or in pairs, branches which have the same unlimited growth as the main axis. There is thus a close approach to the external morphology of the higher plants. The streaming of the protoplasm, known elsewhere among Chlorophyceae, is a conspicuous feature of the cells of Characeae.

The Chlorophyceae excel all other groups of algae in the magnitude and variety of form of the chlorophyll-bodies. In *Ulva* and *Mesocarpus* the chromatophore is a single plate, which in the latter genus places its edge towards the incident light; in *Spirogyra* they are spiral bands embedded in the primordial utricle; in *Zygnema* they are a pair of stellate masses, the rays of which branch peripherally; in *Oedogonium* they are longitudinally-disposed anastomosing bands; in Desmids plates with irregular margins; in *Cladophora* polyhedral plates; in *Vaucheria* minute elliptical bodies occurring in immense numbers. Embedded in the chromatophore, much in the same way as the nucleus is embedded in the cytoplasm, are the pyrenoids. Unknown in Cyanophyceae and Phoeophyceae, known only in Bangiaceae and *Nemalion* among Rhodophyceae, they are of frequent occurrence among Chlorophyceae, excepting Characeae. Sometimes several pyrenoids occur in each chloroplast, as in *Mesocarpus* and *Spirogyra*; sometimes only an occasional chloroplast contains pyrenoid at all, as in *Cladophora*. The pyrenoid seems to be of proteid nature and gelatinous consistency, and to arise as a new formation or by division of pre-existing pyrenoids. When carbon-assimilation is active, starch-granules crowd upon the surface of the pyrenoid and completely obscure it from view.

Special provision for vegetative multiplication is not common among Chlorophyceae. *Valonia* and *Caulerpa* among Siphonales detach portions of their thallus, which are capable of independent growth. In *Caulerpa* no other means of multiplication is as yet known. In Characeae no fewer than four methods of vegetative reproduction have been described, and the facility with which buds and branches are in these cases detached has been adduced as an evidence of affinity with Bryophyta, which, as a class, are distinguished by their ready resort to vegetative reproduction.

With regard to true reproduction, which is characterized by the formation of special cells, the group Euchlorophyceae is characterized by the production of zoospores (Gr. ζῷον, animal, σπορά, seed); that is to say, cells capable of motility through the agency of cilia. Such ciliary motion is known in the adult condition of the cells of Volvocaceae, but where this is not the case the reproductive cells are endowed with motility for a brief period. The zoospore is usually a pyriform mass of naked protoplasm, the beaked end of which where the cilia arise is devoid of colouring matter. A reddish-brown body, known as the eyespot, is usually situated near the limits of the hyaline portion, and in the protoplasm contractile vacuoles similar to those of lower animals have been occasionally detected. The movement of the zoospore is effected by the lashing of the cilia and is in the direction of the beak, while the zoospore slowly rotates on its long axis at the same time. Usually two cilia are present; in *Botrydium* and *Hydrodictyon* only one is present; in certain species of *Cladophora* four; in *Dasycladus* a chaplet, and in *Oedogonium* a ring of many cilia. The so-called zoospore of *Vaucheria* is a coenocyte covered over with paired cilia corresponding in position to nuclei lying below. In all other cases, zoospores are uninucleate bodies. Zoospores arise in cells of ordinary size and form termed zoosporangia. In unicellular forms (*Sphaerella*) the thallus becomes transformed into a zoosporangium at the reproductive stage. In the zoosporangia of *Oedogonium*, *Tetraspora* and *Coleochaete* the contents become transformed into a single zoospore. In most cases repeated division seems to take place, and the final number is represented by some power of two. In coenocytic forms the zoospores would seem to arise simultaneously, probably because many nuclei are already present. The escape of zoospores is effected by the degeneration of the sporangial wall (*Chaetophora*), or by a pore (*Cladophora*), a slit (*Pediastrum*), or a circular fracture (*Oedogonium*). Zoospores are of two kinds: (1) Those which come to rest and germinate to form a new plant; these are asexual and are zoospores proper. (2) Those which are unable to germinate of themselves, but fuse with another cell, the product giving rise to a new individual; these are sexual and are zoogametes (Gr. ζῷον, animal, and γαμέτης, γαμετή, husband, wife). When two similar zoogametes fuse, the process is conjugation, and the product a zygospore (Gr. ζυγόν, yoke). Usually, however, only one of the fusing cells is a zoogamete, the other gamete being a much larger resting cell. In such a case the zoogamete is male, is called an antherozoid or spermatozoid, and arises in an antheridium; the larger gamete is an oosphere and arises in an oogonium. The fusion is now known as fertilization, and the product is an oospore. Reproduction by conjugation is also known as isogamy, by fertilization as oogamy. When zoospores come to rest, a new cell is formed and germination ensues at once. When zygospores and oospores are produced a new cell-wall is also formed, but a long period of rest ensues. All investigation goes to show that an essential part of sexual union is the fusion of the two nuclei concerned. It is interesting to know, on the authority of Oltmanns, that when the oosphere is forming in the oogonium of *Vaucheria*, there is a retrocession of all the included nuclei but one. That the antherozoid of *Vaucheria* contains a single nucleus had been inferred before.

From a comparison of those Euchlorophyceae which have been most closely investigated, it appears probable that sexual reproductive cells have in the course of evolution arisen as the result of specialization among asexual reproductive cells, and that in turn oogamous reproduction has arisen as the result of differentiation of the two conjugating cells into the smaller male gamete and the larger male gamete. It would further appear that oogamous reproduction has arisen independently in each of the three main groups of Euchlorophyceae, viz. Protococcales, Siphonales and Confervales. Thus among Volvocaceae, a family of Protococcales, while in some of the genera (*Chloraster*, *Sphondylomorum*) no sexual union has as yet been observed, in others (*Pandorina*, *Chlorogonium*, *Stephanosphaera*, *Sphaerella*) conjugation of similar gametes takes place, in others still (*Phacotus*, *Eudorina*, *Volvox*) the union is of the nature of fertilization. No other family of Protococcales has advanced beyond the stage of isogamous reproduction. Again, among Siphonales only one family (Vaucheriaceae) has reached the stage of oogamy, although an incipient heterogamy is said to occur in two other families (Codiaceae, Bryopsidaceae). Elsewhere among Siphonales, in those cases where reproductive cells are known, the reproduction is either isogamous or asexual. Among Confervales there is no family in which sexual reproduction—isogamy or oogamy—is not known to occur among some of the component species, and as many as four families (Cylindrocapsaceae, Sphaeropleaceae, Oedogoniaceae, Coleochaetaceae) are oogamous. On these, as well as other grounds, Confervales are regarded as having attained to the highest rank among Euchlorophyceae. Although the phenomena attending isogamous and oogamous reproduction respectively are essentially the same in all cases, slight variations in both instances appear in different families, attributable doubtless to the independent origin of the process in different groups. Thus, although isogamy consists in typical cases of a union of naked motile gametes by a fusion which begins at the beaked ends, and results in the formation of an immotile spherical zygote surrounded by a cell-wall, in *Leptosira* it is noticeable that the fusion begins at the blunt end; in a species of *Chlamydomonas* the two gametes are each included in a cell-wall before fusion; and in many cases the zygote retains for some time its motility with the double number of cilia. Again, in oogamous reproduction, while in general only one oosphere is differentiated in the oogonium, in *Sphaeroplea* several oospheres arise in each oogonium; and while the oospheres usually contract away from the oogonial wall, acquiring for themselves a new cell-wall after fertilization, in *Coleochaete* the oosphere remains throughout in contact with the oogonial wall. The oosphere is in all cases fertilized while still within the oogonium, the antherozoids being admitted by means of a pore. There is usually distinguishable upon the surface of the oosphere an area free from chlorophyll, known as the receptive spot, at which the fusion with the antherozoid takes place; and in many cases, before fertilization, a small mucilaginous mass has been observed to separate itself off from the oosphere at this point and to escape through the pore. In *Coleochaete* the oogonial wall is drawn out into a considerable tube, which is provided with an apical pore, and this tube has a somewhat similar appearance to the imperforate trichogyne of Florideae to be hereafter described. In certain species of *Oedogonium* minute male plantlets, known as dwarf males, become attached to the female plant in the neighbourhood of the oogonia, thus facilitating fertilization. Indeed the genus *Oedogonium* exhibits a high degree of specialization in its reproductive system, considering that its thallus has not advanced beyond the stage of an unbranched filament.

Many Euchlorophyceae are endowed with both asexual and sexual reproduction. Such are *Coleochaete*, *Oedogonium*, *Cylindrocapsa*, *Ulothrix*, *Vaucheria*, *Volvox*, &c. In others only the asexual method is yet known. When a species resorts to both methods, it is generally found that the asexual method prevails in the early part of the vegetative period and the sexual towards the close of that period. This is in consonance with the facts already mentioned that zoospores germinate forthwith, and that the sexually-produced cell or zygote enters upon a period of rest. It is known that zoogametes, which usually conjugate, may, when conjugation fails, germinate directly (*Sphaerella*). In rare cases the oosphere has been known to germinate without fertilization (*Oedogonium*, *Cylindrocapsa*). The germination of a zygospore or oospore is effected by the rupture of an outer cuticularized exosporium; then the cell may protrude an inner wall, the endosporium, and grow out into the new plant (*Vaucheria*), or the contents may break up into a first brood of zoospores. It is held that in *Coleochaete* a parenchyma results from the division of the oospore, from each cell of which a zoospore arises.

Reproduction is also effected among Euchlorophyceae by means of aplanospores and akinetes. Aplanospores would seem to represent zoospores arrested in their development; without reaching the stage of motility, they germinate within the sporangium. Akinetes are ordinary thallus cells, which on account of their acquisition of a thick wall are capable of surviving unfavourable conditions. Both aplanospores and akinetes may germinate with or without the formation of zoospores at the initial stage.

Among Conjugatae reproduction is effected solely by means of conjugation of what are literally aplanospores. Among those Desmidiaceae which live a free life, two plants become surrounded by a common mucilage, in which they lie either parallel (*Closterium*) or crosswise (*Cosmarium*). Gaps then appear in the apposed surfaces, usually at the isthmus; the entire protoplasts either pass out to melt into one another clear of the old walls, or partly pass out and fuse without complete detachment from the old walls. Among colonial Desmidiaceae, the break-up of the filament is a preliminary to this conjugation; otherwise the process is the same. The zygospore becomes surrounded with its own wall, consisting finally of three layers, the outer of which is furnished with spicular prominences of various forms. In Zygnemaceae there is no dissolution of the filaments, but the whole contents of one cell pass over by means of a conjugation-tube into the cavity of a cell of a neighbouring filament, where the zygospore is formed by the fusion of the two protoplasts. In these cases the activity of one of the gametes, and the passivity of the other, is regarded as evidence of incipient sex. In *Sirogonium* there is cell-division in the parent-cell prior to conjugation; and as two segments are cut off in the case of the active gamete, and only one in the case of the passive gamete, there is a corresponding difference of size, marking another step in the sexual differentiation. In *Zygogonium*, although no cell-division takes place, the gametes consist of a portion only of the contents of a cell, and this is regularly the case in Mesocarpaceae, which occupy the highest grade among Conjugatae. Some Zygnemaceae and Mesocarpaceae form either a short conjugating tube, or none at all, but the filaments approach each other by a knee-like bend, and the zygospore is formed at the point of contact, often being partially contained within the walls of the parent-cell. It would seem that in some cases the nuclei of the gametes remain distinct in the zygospore for a considerable time after conjugation. It is probable that in all cases nuclear fusion takes place sooner or later. In Zygnemaceae and Mesocarpaceae the zygospore, after a period of rest, germinates, to form a new filamentous colony; in Desmidiaceae its contents divide on germination, and thus give rise to two or more Desmids. Gametes which fail to conjugate sometimes assume the appearance of zygospores and germinate in due course. They are known as azygospores.

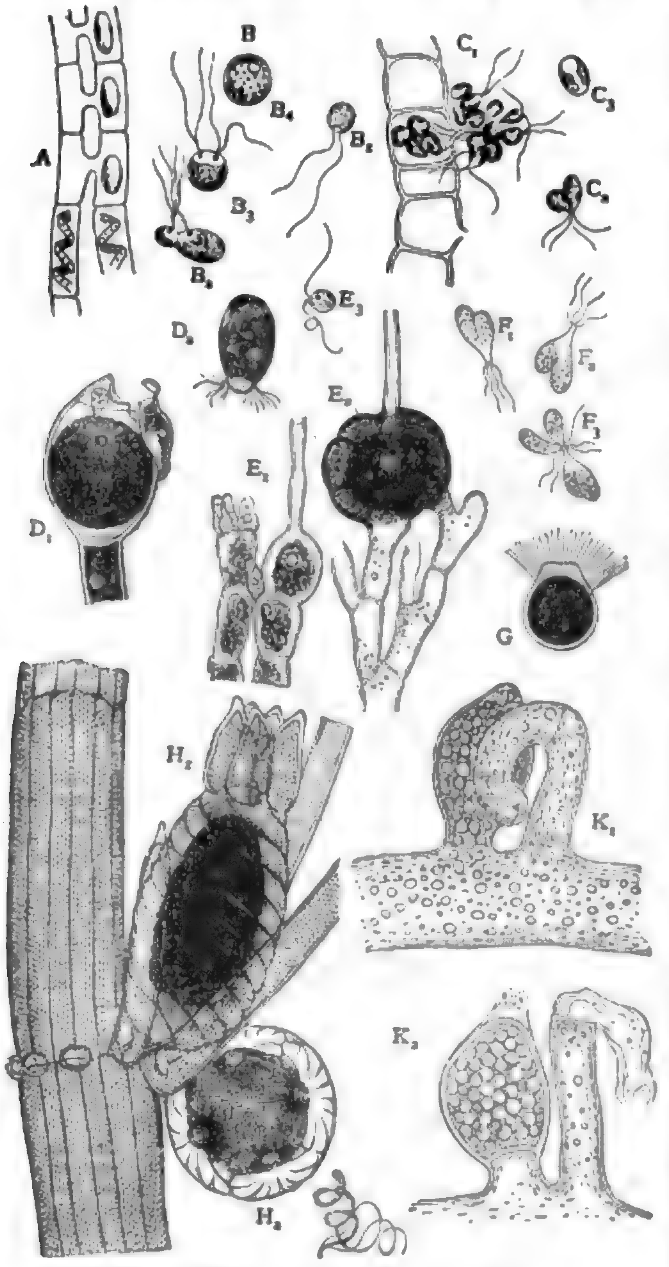


FIG. 3.—Chlorophyceae, variously magnified.

A. *Spirogyra sp.*, in conjugation.
B. Zoospore of *Pandorina*. $B_{2\,3\,4}$, stages of conjugation.
C. *Ulothrix sp.*, zoospores escaping. $C_{2\,3}$, stages of conjugation.
D_1. *Oedogonium sp.*, oogonium at moment of fertilization with dwarf male attached.
D_2. *Oedogonium sp.*, zoospore with crown of cilia.
E_1. *Coleochaete sp.*, with antheridia and an oogonium.
E_2. *Coleochaete sp.*, fertilized egg with investment of filaments.
E_3. *Coleochaete sp.*, zoospore.
$F_{1\,2\,3}$. *Protosiphon*, conjugation of zoogametes.
G. *Derbesia sp.*, zoospore with chaplet of cilia.
H_1. *Chara sp.*, oogonium and antheridium at a node on a lateral appendage.
H_2. *Chara sp.*, antherozoid.
K_1. *Vaucheria sp.*, oogonium and antheridium before fertilization.
K_2. *Vaucheria sp.*, after fertilization.

(A from Cooke, *British Freshwater Algae*, by permission of Kegan Paul, Trench, Trübner and Co.; C, E, F, G, H, K from Engler and Prantl, by permission of Wilhelm Engelmann; B_1 from Vines, by permission of Swan Sonnenschein and Co.; B_2, D from Oltmanns, by permission of Gustav Fischer.)

The reproduction of Characeae is characterized by a pronounced oogamy, the reproductive organs being the most highly differentiated among Chlorophyceae. The antheridia and oogonia are formed at the nodes of the appendages. The oogonium, seated on a stalk cell, is surrounded by an investment consisting of five spirally-wound cells, from the projecting ends of which segments are cut off, constituting the so-called stigma. The oosphere is not differentiated within the wall of the oogonium, but certain cells known as *wendungszellen*, the significance of which has given rise to much speculation, are cut off from the basal portion of the parent-cell during its development. The antheridia are spherical orange-coloured bodies of very complex structure. The antherozoid is a spirally-coiled thread of protoplasm, furnished at one end with a pair of cilia. It much more resembles the antherozoids of Bryophyta and certain Pteridophyta than any known among other algae. The fertilized egg charged with food reserves rests for a considerable period, surrounded by its cortex, the whole having assumed a reddish-brown colour. On germination it gives rise to a row of cells in which short (nodal) and long (internodal) cells alternate. From the first node arise rhizoids; from the second a lateral bud, which becomes the new plant. This peculiar product of germination, which intervenes between the oospore and the adult form, is the proembryo. It will be remembered that in Musci, the asexual spore somewhat similarly gives rise to a protonema, from which the adult plant is produced as a lateral bud. The proembryonic branches of Characeae, one of the means of vegetative reproduction already referred to, are so called because they repeat the characters of the proembryo.

Before leaving the Chlorophyceae, it should be mentioned that the genus *Volvox* has been included by some zoologists (Bütschli, for example) among Flagellata; on the other hand, certain green Flagellata, such as *Euglena*, are included by some botanists (for example, van Tieghem) among unicellular plants. A similar uncertainty exists with reference to certain groups of Phaeophyceae, and the matter will thus arise again.

A census of the Chlorophyceae is furnished below:—

1. Confervoideae—12 families, 77 genera, 1021 species.
2. Siphoneae—9 families, 26 genera, 271 species.
3. Protococcoideae—2 families, 90 genera, 342 species.
4. Conjugateae—2 families, 33 genera, 1296 species.
   (De Toni's *Sylloge Algarum*, 1889.)
5. Characeae—2 families, 6 genera, 181 species.
   (Engler and Prantl's *Pflanzenfamilien*, 1897.)

III. PHAEOPHYCEAE.—The Phaeophyceae are distinguished by the possession of a brown colouring matter, phycophaein, in addition to chlorophyll. They consist of the following groups:—Fucaceae, Phaeosporeae, Dictyotaceae, Cryptomonadaceae, Peridiniaceae and Diatomaceae. Of these the first three include multicellular plants, some of them of great size; the last three are unicellular organisms, with little in common with the rest excepting the possession of a brown colouring matter. Fucaceae and Phaeosporeae are doubtless closely allied, and to these Dictyotaceae may be joined, though the relationship is less close. They constitute the Euphaeophyceae, and will be dealt with in the first place.

Euphaeophyceae are almost exclusively marine, growing on rocks and stones on the coast, or epiphytic upon other algae. In tidal seas they range from the limits of high water to some distance beyond the low-water line. On the British coasts zones are observable in passing from high to low water mark, characterized by the prevalence of different species, thus:—*Pelvetia canaliculata*, *Fucus platycarpus*, *Fucus vesiculosus*, *Ascophyllum nodosum*, *Fucus serratus*, *Laminaria digitata*. Some species are minute filamentous plants, requiring the microscope for their detection; others, like *Lessonia*, are of considerable bulk, or, like *Macrocystis*, of enormous length. In Fucaceae, Dictyotacea, and in Laminariaceae and Sphacelariaceae, among Phaeosporeae, the thallus consists of a true parenchyma; elsewhere it consists of free filaments, or filaments so compacted together, as in Cutleriaceae and Desmarestiaceae, as to form a false parenchyma. In Fucaceae and Laminariaceae the inner tissue is differentiated into a conducting system. In Laminariaceae the inflation of the ends of conducting cells gives rise to the so-called trumpet-hyphae. In *Nereocystis* and *Macrocystis* a zone of tubes occurs, which present the appearance of sieve-tubes even to the eventual obliteration of the perforations by a callus. While there is a general tendency in the group to mucilaginous degeneration of the cell-wall, in *Laminaria digitata* there are also glands secreting a plentiful mucilage. Secondary growth in thickness is effected by the tangential division of superficial cells. The most fundamental external differentiation is into holdfast and shoot. In Laminariaceae secondary cylindrical props arise obliquely from the base of the thallus. In epiphytic forms the rhizoids of the epiphyte often penetrate into the tissue of the host, and certain epiphytes are not known to occur excepting in connexion with a certain host; but to what extent, if any, there is a partial parasitism in these cases has not been ascertained. In filamentous forms there is a differentiation into branches of limited and branches of unlimited growth (*Sphacelaria*). In Laminariaceae there is a distinction of stipe and blade. The blade is centrally-ribbed in *Alaria* and laterally-ribbed in *Macrocystis*. It is among the Sargassaceae that the greatest amount of external differentiation, rivalling that of the higher leafy plants, is reached. A characteristic feature of the more massive species is the occurrence of air-vesicles in their tissues. In *Fucus vesiculosus* they arise in lateral pairs; in *Ascophyllum* they are single and median; in *Macrocystis* one vesicle arises at the base of each thallus segment; in *Sargassum* and *Halidrys* the vesicles arise on special branches. They serve to buoy up the plant when attached to the sea-bottom, and thus light is admitted into the forest-like growths of the gregarious species. When such plants are detached they are enabled to float for great distances, and the great Sargasso Sea of the North Atlantic Ocean is probably only renewed by the constant addition of plants detached from the shores of the Caribbean Sea and Gulf of Mexico.

Growth in length is effected in a variety of ways. In *Dictyota*, Sphacelariaceae and Fucaceae there is a definite apical cell. In the first it is a biconvex lens, from which segments are continually cut off parallel to the posterior surface; and in the second an elongated dome, from which segments are cut off by a transverse wall. While, however, in *Dictyota* the product of the subsequent division in the segment enlarges with each subdivision, the divisions in the cylindrical segment of Sphacelariaceae are such that the whole product after subdivision, however many cells it may consist of, does not exceed in bulk the segment as cut off from the apical cell. In Dictyotaceae the apical cell occasionally divides longitudinally, and thus the dichotomous branching is provided for. In some Sphacelariaceae branches may appear at their inception as lateral protuberances of the apical cell itself. In Fucaceae an apical cell is situate at the surface of the thallus in a slit-like depression at the apex. From this cell segments are cut off in three or four lateral oblique planes.

A peculiar manner of growth in length is that to which the term trichothallic has been applied. It may readily be observed that in the hair-like branches of Ectocarpaceae, the point at which most rapid division occurs is situate near the base of the hair. In *Desmarestia* and *Arthrocladia*, for example, it is found that the thallus ends in a tuft of such hairs, each of them growing by means of an intercalated growing point. In these cases, however, the portions of the hairs behind the growing region become agglutinated together into a solid cylindrical pseudo-parenchymatous axis. In *Cutleria* the laminated thallus is formed in the same way. The intercalated growing region of *Laminaria* affords an example of another variety of growth in Phaeophyceae. While the laminated portion of the thallus is being gradually worn off in our latitudes during the autumnal storms, a vigorous new growth appears at the junction of the stipe and the blade, as the result of which a new piece is added to the stipe and the lamina entirely renovated.

Both asexual and sexual reproduction occur among Euphaeophyceae. Fucaceae are marked by an entire absence of the asexual method. The sexual organs—oogonia and antheridia—are borne on special portions of the thallus in cavities known as conceptacles. Both organs may occur in one conceptacle, as in *Pelvetia*, or each may be confined to one conceptacle or even one plant, as in *Fucus vesiculosus*. The oogonia arise on a stalk cell from the lining layer of the cavity, the contents dividing to form eight oospheres as in *Fucus*, four as in *Ascophyllum*, two as in *Pelvetia*, or one only as in *Halidrys*. It would seem that eight nuclei primarily arise in all Fucaceae, and that a number corresponding to the number of oospheres subsequently formed is reserved, the rest being discharged to the periphery, where they may be detected at a late stage. On the maturation of the oospheres the outer layer of the oogonial wall ruptures, and the oospheres, still surrounded by a middle and inner layer, pass out through the mouth of the conceptacle. Then usually these layers successively give way, and the spherical naked oospheres float free in the water. The antheridia, which arise in the conceptacular cavity as special cells of branched filaments, are similarly discharged whole, the antherozoids only escaping when the antheridia are clear of the conceptacle. The antherozoids are attracted to the oospheres, round each of which they swarm in great numbers. Suddenly the attraction ceases, and the oosphere is fertilized, probably at that moment, by the entry of a single antherozoid into the substance of the oosphere; a cell-wall is formed thereupon, in some cases in so short an interval as five minutes. Remarkable changes of size and outline of the oosphere have recently been described as accompanying fertilization in *Halidrys*. Probably the act of fertilization in plants has nowhere been observed in such detail as in Fucaceae. Dictyotaceae resemble Fucaceae in their pronounced oogamy. They differ, however, in being also asexually reproduced. The asexual cells are immotile spores arising in fours in sporangia from superficial cells of the thallus. In *Dictyota* the oospheres arise singly in oogonia, crowded together in sori on the surface of the female plant. The antheridia have a similar origin and grouping on the male plant. Until the recent discovery by Williams of motility, by means of a single cilium, of the antherozoids of *Dictyota* and *Taonia*, they were believed to be immotile bodies, like the male cells of red seaweeds. In *Dictyota* the unfertilized oosphere is found to be capable of undergoing a limited number of divisions, but the body thus formed appears to atrophy sooner or later.

Of the small family of the Tilopteridaceae our knowledge is as yet inadequate, but they probably present the only case of pronounced oogamy among Phaeosporeae. They are filamentous forms, exhibiting, however, a tendency to division in more than one plane, even in the vegetative parts. The discovery by Brebner of the specific identity of *Haplospora globosa* and *Scaphospora speciosa* marks an important step in the advance of our knowledge of the group. Three kinds of reproductive organs are known: first, sporangia, which each give rise to a single tetra-, or multi-nucleate non-motile, probably asexual spore; second, plurilocular sporangia, which are probably antheridia, generating antherozoids; and third, sporangia, which are probably oogonia, giving rise to single uninucleate non-motile oospheres. No process of fertilization has as yet been observed.

The Cutleriaceae exhibit a heterogamy in which the female sexual cell is not highly specialized, as it is in the groups already described. From each locule of a plurilocular sporangium there is set free an oosphere, which, being furnished with a pair of cilia, swarms for a time. In similar organs on separate plants the much smaller antherozoids arise. Fertilization has been observed at Naples; but it apparently depends on climatic conditions, as at Plymouth the oospheres have been observed to germinate parthenogenetically. The asexual organs in the case of *Cutleria multifida* arise on a crustaceous form, *Aglaozonia reptans*, formerly considered to be a distinct species. They are unilocular, each producing a small number of zoospores.

The possession of two kinds of reproductive organs, unilocular and plurilocular sporangia, is general among the rest of the Phaeosporeae. Bornet, however, called attention in 1871 to the fact that two kinds of plurilocular sporangia occurred in certain species of the genus *Ectocarpus*—somewhat transparent organs of an orange tint producing small zoospores, and also more opaque organs of a darker colour producing relatively larger zoospores. On the discovery of another such species by F. H. Buffham, Batters in 1892 separated the three species, *Ectocarpus secundus*, *E. fenestratus*, *E. Lebelii*, together with the new species, into a genus, *Giffordia*, characterized by the possession of two kinds of plurilocular sporangia. The suspicion that a distinction of sex accompanied this difference of structure has been justified by the discovery by Sauvageau of undoubted fertilization in *Giffordia secunda* and *G. fenestrata*. The conjugation of similar gametes, arising from distinct plurilocular sporangia, was observed by Berthold in *Ectocarpus siliculosus* and *Scytosiphon lomentarius* in 1880; and these observations have been recently confirmed in the case of the former species by Sauvageau, and in the case of the latter by Kuckuck. In these cases, however, the potential gametes may, failing conjugation, germinate directly, like the zoospores derived from unilocular sporangia. The assertion of Areschoug that conjugation occurs among zoospores derived from unilocular sporangia, in the case of *Dictyosiphon hippuroides*, is no doubt to be ascribed to error of observation. It would thus seem that the explanation of the existence of two kinds of sporangia, unilocular and plurilocular, among Phaeosporeae, lies in the fact that unilocular sporangia are for asexual reproduction, and that plurilocular sporangia are gametangia—potential or actual. It must, however, be remembered that so important a generalization is as yet supported upon a somewhat narrow base of observation. Moreover, for the important family of the Laminariaceae only unilocular sporangia are known to occur; and for many species of other families, only one or other kind, and in some cases neither kind, has hitherto been observed. The four species—*Ectocarpus siliculosus*, *Giffordia secunda*, *Cutleria multifida* and *Haplospora globosa*—may be taken to represent, within the Phaeosporeae, successive steps in the advance from isogamy to oogamy.

The Peridiniaceae have been included among **Flagellata** under the title of Dinoflagellata. The majority of the species belong to the sea, but many are found in fresh water. The thallus is somewhat spherical and unicellular, exhibiting a distinction between anterior and posterior extremities, and dorsal and ventral surfaces. The wall consists of a basis of cellulose, and in some cases readily breaks up into a definite number of plates, fitting into one another like the plates of the carapace of a tortoise; it is, moreover, often finely sculptured or coarsely ridged and flanged. Two grooves are a constant feature of the family, one running transversely and another longitudinally. In these grooves lie two cilia, attached at the point of meeting on the dorsal surface. The protoplast is uninucleate and vacuolate, and contains chromatophores of a brownish colour. It is not clear that

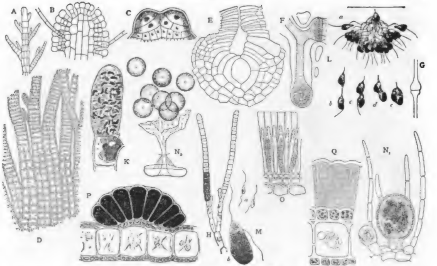


FIG. 4.—Phaeophyceae, variously magnified.

A. *Halopteris*, apical region.
B. *Chordaria sp.*, apical region showing so-called trichothallic growth.
C. *Dictyota sp.*, apical cells immediately after dichotomy.
D. *Cutleria sp.*, margin of thallus showing trichothallic growth.
E. *Halidrys*, apical depression with leading cell.
F. *Macrocystis sp.*, tubular elements from the medulla, with sieve-like transverse walls.
G. *Laminaria sp.*, hyphae with trumpet-like ends also from medulla.
H. *Elachistea sp.*, plurilocular sporanges.
K. *Ectocarpus sp.*, unilocular sporange.
L. *Ectocarpus siliculosus*, female gamete surrounded by male gametes. *a*, *b*, *c*, *d*, *e*, stages of conjugation.
M. *Cutleria multifida*. *a*, antherozoids, *b*, a female gamete.
N_1. *Fucus vesiculosus*, young oogonium.
N_2. *Fucus vesiculosus*, discharge of eight oospheres from oogonium.
O. *Laminaria sp.*, sporanges among paraphyses.
P. *Dictyota dichotoma*, a sorus of oogonia.
Q. *Dictyota dichotoma*, part of a sorus of antheridia.

(A, B, C, D, E, H, L, M, P, from Engler and Prantl, by permission of Wilhelm Engelmann; F, G, K, O, from Oltmanns, by permission of Gustav Fischer; Q, from *The Annals of Botany*, by permission of the Clarendon Press; N_1, N_2, from Hauck, *Meeresalgen*, by permission of Eduard Kummer.)

the brown colouring matter which is added to chlorophyll is identical with phycophaein; two varieties of it have been termed phycopyrrin and peridinine. Certain species, such as *Gymnodinium spirale*, are colourless and therefore saprophytic in their method of nutrition. Multiplication takes place in some cases by the endogenous formation of zoospores, the organism having come to rest; in others by longitudinal division, when the organism is still motile. No method of sexual reproduction is known with certainty.

The Cryptomonadaceae also are unicellular, and live free or in colonies. Each cell contains a flattened chromatophore of a brown or yellow colour. *Hydrurus* forms a branched gelatinous colony attached to stones in mountain streams. *Chromophyton* forms an eight-celled colony. Both plants multiply solely by means of zoospores. The Cryptomonadeae and Chromulineae are motile through the greater part of their life. *Cryptomonas*, when dividing in a mucilage after encystment, recalls the condition in *Gloeocystis*. In *Synura* and *Chromulina* the cells form a spherical motile colony, recalling Volvocaceae. *Chromulina* is uniciliate, and is contained in a hyaline capsule. Like the Peridiniaceae, the Cryptomonadaceae have been included among Flagellata. They have no close affinity with Euphaeophyceae. Such colonial forms as *Hydrurus* and *Phaeocystis* are supposed, however, to indicate a stage in the passage to the multicellular condition.

Diatomaceae have long been recognized as plants. Together with Peridiniaceae they constitute the bulk of marine plankton, and thus play an important part in the support of marine animal life. They exhibit striking adaptations in these circumstances to the floating habit. (See DIATOMACEAE.)

A census of Phaeophyceae is given below:—

(1) Cyclosporinae (Fucaceae)—4 families, 32 genera, 347 species.
(2) Tetrasporinae (Dictyotaceae)—1 family, 17 genera, 130 species.
(3) Phaeozoosporineae (Phaeosporeae)—24 families, 143 genera, 571 species.

(De Toni's *Sylloge Algarum*.)

(4) Peridiniales—3 families, 32 genera, 167 species.
(5) Cryptomonadaceae (including Chrysomonadaceae)—2 families, 28 genera, 50-60 species.
(6) Bacillariales (Diatomaceae)—about 150 genera and 5000 species, fossil and recent.

(Engler and Prantl's *Pflanzenfamilien*.)

IV. RHODOPHYCEAE, or FLORIDEAE.—The members of this group are characterized by the possession of a red colouring matter, phycoerythrin, in addition to chlorophyll. There is, however, a considerable amount of difference in the shades of red which mark different species. The brightest belongs to those species which grow near low-water mark, or under the shade of larger algae at higher levels; species which grow near high-water mark are usually of so dark a hue that they are easily mistaken for brown seaweeds. Rhodophyceae are mostly marine, but not exclusively so. *Thorea*, *Lemanea*, *Tuomeya*, *Stenocladia*, *Batrachospermum*, *Balbiania* are genera belonging entirely to fresh water; and *Bangia*, *Chantransia*, *Caloglossa*, *Bostrychia* and *Delesseria* contain each one or more freshwater species. Most of the larger species of marine Rhodophyceae are attached by means of a disc to rocks, stones or shells. Many are epiphytic on other algae, more especially the larger Phaeophyceae and Rhodophyceae. As in the case of epiphytic brown seaweeds, the rhizoids of the epiphyte often penetrate the substance of the supporting alga. Some Red Algae find a home in the gelatinous substance of *Flustra*, *Alcyonidium* and other polyzoa, only emerging for the formation of the reproductive organs. Some are perforating algae and burrow into the substance of molluscan shells, in company with certain Green and Blue-green Algae. Some species belonging to the families Squamariaceae and Corallinaceae grow attached through their whole length and breadth, and are often encrusted with lime. The forms which grow away from the substratum vary greatly in external configuration. In point of size the largest cannot rival the larger Brown Algae, while the majority require the aid of the microscope for their investigation.

No unicellular Rhodophyceae are known, although a flagellate organism, *Rhodomonas*, has recently been described as possessed of the same red colouring matter. If the sub-group, Bangiaceae, be excluded, they may be said to consist exclusively of branched filaments. Growth in these cases takes place by means of an apical cell, from which successive segments are cut off by means of a transverse wall. The segment so cut off does not usually divide again by means of a transverse wall, nor indeed by a longitudinal wall which passes through the organic axis of the cell. New cells may be cut off laterally, which become the apical cells of branches. When the new cells grow no further, but constitute a palisading round the central cell covering its whole length, the condition is reached which characterizes the species of *Polysiphonia*, the "siphons" of which may be regarded as one-celled branches. To the law that no subsequent transverse division takes place in segments cut off from the apical cell, there seem to be two exceptions: first, the calcareous genus *Corallina*, in the pliable joints of which intercalated division occurs; and, second, the *Nitophylleae*, in which, moreover, median longitudinal division of axial cells is said to occur. Like the Fungi, therefore, the Red Algae consist for the most part of branched filaments, even where the thallus appears massive to the eye, and, as in the case of Fungi, this fact is not inconsistent with a great variety of external morphology. In the great majority the thallus is obviously filamentous, as in some species of *Callithamnion*. In other species of that genus an apparent cortication arises by the downward growth of rhizoids, which are retained within the gelatinous wall of the axial cells. In *Batrachospermum* the whole system of branches are retained within a diffluent gelatinous substance derived from the outer layers of the cell-walls. In other cases the mucilage is denser and the branches more closely compacted (*Helminthora*). In such cases as *Lemanea*, the terminal cells of the lateral branches form a superficial layer which has all the appearance of a parenchyma when viewed from the surface. In *Champia* and allied genera, the cylindrical axis is due not to the derivatives of one axial filament, but of several, the growth of which is co-ordinated to form a septated tube. The branching of the thallus, which meets the eye in all these cases, is due to the unlimited growth of a few branches. When such a lateral branch overtops the main axis whose growth has become limited, as in *Plocamium* and *Dasya*, a sympodium is formed. For the most part the branching is monopodial. Besides the differentiation into holdfast and shoot, and into branches of limited and branches of unlimited growth, there appear superficial structures of the nature of hairs. These are for the most part long, thin-walled, unicellular and colourless, and arise from the outer cells of the pseudo-cortex, or from the terminal cells of branches when the filaments are free. Among Rhodomelaceae, hair-like structures of a higher order are known. These arise from the axial cell, and are multicellular and branched. They soon fall off, and it is from the persistent basal cell that the branches of unlimited growth arise. Upon them also the reproductive organs arise in this family. It is not surprising, therefore, that they have been regarded as the rudiments of leaves. In *Iridaea* the thallus is an entire lamina; in *Callophyllis* a lobed lamina; in *Delesseria* it is provided with midrib and veins, simulating the appearance of a leaf of the higher plants; in *Constantinea* the axis remains cylindrical, and the lateral branches assume the form of leaves. In the compact thalli a secondary development often takes place by the growth of rhizoid-like internal filaments. They present a hypha-like appearance, running longitudinally for considerable distances. It is not difficult in such compact species to distinguish between superficial cells, whose chief function is assimilation, subjacent cells charged with reserve material, and a core of tissue engaged in the convection of elaborated material from part to part.

An interesting feature of the minute anatomy of Euflorideae, as the Red Algae, exclusive of the Bangiaceae, have been termed, is the existence of the so-called *Floridean pit*. When a cell divides it is found that there remains in the middle of the new wall a single large circular pit, which persists throughout the life of the cells, becoming more and more conspicuous with the progress of the thickening of the wall. These pits serve to indicate the genetic relationship of adjacent cells, when they form a compact pesudo-parenchyma, notwithstanding the fact that somewhat smaller secondary pits appear later between any contiguous cells. Protoplasmic continuity has been observed in the delicate membrane closing the pit.

Vegetative multiplication occurs only sparingly in Rhodophyceae. *Melobesia callithamnioides* gives rise to multicellular propagula; *Griffithsia corallina* is said to give rise to new individuals, by detaching portions of the thallus from the base of which new attachment organs have already arisen. The spores of *Monospora* are by some regarded as unicellular propagula. Reproduction is both asexual and sexual. It is noteworthy that although all the members of the group are aquatic no zoospores are produced, a negative character common to them and the Blue-green Algae. As a rule the asexual cells, and the male and female sexual cells arise upon different plants, so that the species may be said to be trioecious. Numerous exceptions, however, occur. Thus in Lemaneaceae asexual spores are unknown; in *Batracho-spermum*, *Bonnemaisonia* and *Polysiphonia byssoides* both kinds of sexual cells appear on the same plant; and in some cases the asexual cells may occur in conjunction with either the male or female sexual cells. The asexual cells are termed tetraspores on account of the usual occurrence of four in each sporangium. What may be termed monospores, bispores and octospores, however, are not unknown. The sporangia may be terminal or intercalated. When they are confined to special branches such branches are spoken of as stichidia. The tetraspores may arise by the simultaneous division of the contents of a sporangium, when they are arranged tetrahedrally, or they may arise by two successive divisions, in which case the arrangement may be zonate when the spores are in a row, or cruciate when the second divisions are at right angles to the first, or tetrahedral when the second divisions are at right angles to the first and also to one another. Tetraspores are at first naked, but soon acquire a cell-wall and germinate without a period of rest. The male sexual cells are produced singly in the terminal cells of branches. They are spoken of as spermatia. Great numbers of antheridia are usually crowded together, when the part is distinguishable by the absence of the usual red colour. In *Polysiphonia* they cover the joints of the so-called leaves; in *Chondria* they arise on flattened disks; in the more massive forms they arise in patches on the ordinary surface; in a few cases (*Gracilaria*, *Corallina*, *Galaxaura*) they line the walls of conceptacle-like depressions. The female sexual cell is represented by the contents of a cell which is terminal on ordinary or specialized branches. This is the carpogonium; it consists of a ventral portion which contains a nucleus, but in which no oosphere is differentiated, and an elongated tubular portion known as the trichogyne, into which the cytoplasm extends. Fertilization is effected by the passive convection of a spermatium from the antheridium to the trichogyne, to which it adheres, and to which it passes over its nucleus through an open communication set up at the point of contact. The nucleus then passes down the trichogyne and fuses with that of the egg. This fusion has been observed by Wille in *Nemalion multifidim*, and by Schmidle in *Batrachospermum*. It is singular that in the last-named species two nuclei occur regularly in the spermatium. The ventral portion of the carpogonium may be imbedded deep in the thallus in the massive species; the trichogyne, however, always reaches the surface. The first effect of fertilization is the occlusion of the trichogyne from the fertilized carpogonium. The subsequent course of development is characteristic of the Florideae. The carpogonium germinates forthwith, drawing its nourishment almost wholly from the parent plant. The ultimate product in all cases is a number of carpospores, but before this stage is reached the development is different in different sub-groups. In *Batrachospermum* filaments arise from the carpogonium on all sides; in *Chantransia* and *Scinaia* on one side only; in *Helminthora* the filaments are enclosed in a dense mucilage; in *Nemalion*, prior to the formation of the filaments, a sterile segment is cut off below. In all these cases, however, the end-cells of the filaments each give rise to a carpospore, and the aggregate of such sporiferous filaments is a cystocarp. Again, in the family of the Gelidiaceae, the single filament arising from the carpogonium grows back into the tissue and preys upon the cells of the axis and larger branches, after which the end-cells give rise to carpospores and a diffused cystocarp is formed. In the whole group of the Cryptonemiales the parasitism becomes more marked still. The filaments arising from the carpogonia grow into long thin tubes, which fuse with special cells rich in protoplasm contents; and from these points issue isolated tufts of sporogenous filaments, several of which may form the product of one fertilized female cell. In *Naccaria*, one of the Gelidiaceae, it is observable that the ooblastema filament, as the tube arising from the fertilized carpogonium has been called, fuses completely with a cell contiguous to the carpogonium before giving rise to the foraging filaments already refered to. This is also the case among Cryptonemiales. In a whole series of Red Algaé, the existence of a highly specialized auxiliary cell in the neighbourhood of the carpogonium is a characteristic feature. In the Gigartinales it is already differentiated previous to fertilization; in Rhodymeniales it arises subsequent to fertilization. In the Gigartinales, the filaments which arise from the auxiliary cell may spread and give rise to isolated tufts of sporogenous filaments, as in the Cryptonemiales. In the Rhodymeniales a single tuft arises directly from the auxiliary cell. The carpospores are in all cases bright red naked masses of protoplasm when first discharged. They soon acquire a cell-wall, and germinate without a period of rest. When the cystocarps or segments of cystocarps are formed in the substance of a thallus, the site is marked merely by a swelling of the substance. When the cystocarp is produced externally, it may form a berry-like mass without an envelope, in which case it is known as a favella. In Rhodomelaceae there is a special urn-shaped envelope surrounding the sporogenous filaments. This is a ceramidium.

The attachment of the cell of an ooblastema filament to a cell of the thallus may be effected by means of a minute pore, or the two cells may fuse their contents into one protoplasmic mass. In the latter case, and especially where the union is with a special auxiliary cell, it is of importance to know what happens to the nuclei of the fusing cells. Schmitz was of opinion that in the cases of open union there occurred a fusion of nuclei similar to that which occurs in the sexual union of two cells. He founded his generalization to a large extent upon the observation that in *Gloeosiphonia capillaris* two cells completely fuse, and that only one nucleus can be detected in the fused mass. Oltmanns has recently re-investigated the phenomena in this plant, among others, and has shown that the nucleus of the cell which is being preyed upon recedes to the wall and gradually atrophies. The nucleus of the ooblastema filament dominates the

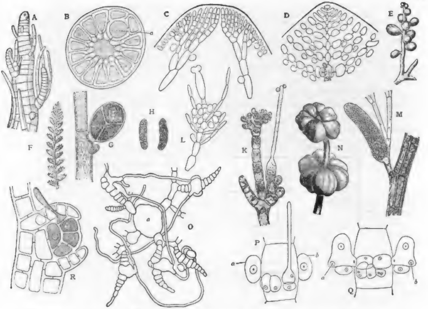


FIG. 5.—Rhodophyceae, variously magnified.

A. *Polysiphonia sp.*, apical region showing leading cell and cutting off of pericentral cell.
B. *Polysiphonia sp.*, transverse section through a branch, and at *a*, mother-cell of tetraspores.
C. *Lomentaria sp.*, apex showing growth in length through co-ordinated growth of many filaments.
D. *Delesseria sp.*, showing apical region with leading cell.
E. *Chrysymenia uvaria*, axis with swollen leaf-like appendages.
F. *Polyzonia sp.*, branch with leaf-like branches of limited growth.
G. *Callithamnion sp.*, tetrasporangium with spores arranged in a tetrad.
H. *Corallina sp.*, tetrasporangia with zonate arrangement of tetraspores.
K. *Nemalion sp.*, carpogonial and antheridial branches.
L. *Batrachospermum sp.*, trichogyne with spermatia attached; carpospores arising from fertilized carpogonium.
M. *Polysiphonia sp.*, antheridium.
N. *Constantinea sp.*, with flattened leaf-like appendages.
O. *Dudresnaya coccinea*, fusion of ooblastema filaments with auxiliary cells; *a* is an axial cell in transverse section with four appendages.
P. *Callithamnion corymbosum*, a joint cell with carpogonial branch and *a*, *b*, two auxiliary cells.
Q. *Callithamnion corymbosum*, fusion of products of fertilization with auxiliary cells, the nuclei of which *a* and *b* retire to the wall.
R. *Polysiphonia sp.*, section through young cystocarp.

(A, C, D, E, F, G, H, K, L, M, P, Q, from Oltmanns, by permission of Gustav Fischer; B, N, O, R, from Engler and Prantl, by permission of Wilhelm Engelmann.)

mass and from it all the nuclei of the carpospores are thus derived. There thus seems to be no justification for believing, as Schmitz taught, that a second sexual act occurs in the life-cycle of these Florideae.

The Bangiales are a relatively small group of Red Algae, to which much of the description now given does not apply. Structurally they are either a plate of cells, as in *Porphyra*, or filaments, as in *Bangia*. There is no exclusive apical growth, and the cells divide in all directions. The characteristic pit is also absent. Sexual and asexual reproduction prevail. The male cell is a spermatium, but the female cell bears no such receptive trichogyne as occurs in other Rhodophyceae. After fertilization the equivalent of the oospore divides directly to form a group of carpospores. There is thus a certain resemblance to Eufloridae, but sufficient difference to necessitate their being grouped apart. Fertilization by means of non-motile spermatia and a trichogyne are known among the Fungi in the families Collemaceae and Laboulbeniaceae.

A census of Rhodophyceae is furnished below: —

(1) Bangiaceae—4 families, 9 genera, 58 species.
(2) Nemalioninae—4 families, 33 genera, 343 species.
(3) Gigartininae—3 families, 54 genera, 409 species.
(4) Rhodymeninae—4 families, 92 genera, 602 species.
(De Toni's *Sylloge Algarum*, 1897.)

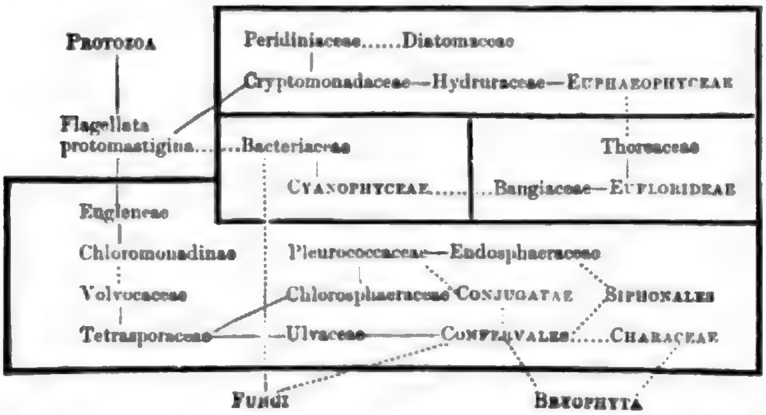
After this survey of the four groups comprised under Algae it is easier to indicate the variations in the limits of the class as defined by different authorities. To consider the Cyanophyceae first, either the marked contrast in the method of nutrition of the generally colourless Bacteriaceae to that of the blue-green Cyanophyceae is regarded as sufficient ground for excluding Bacteriaceae from algae altogether, notwithstanding their acknowledged morphological affinity with Cyanophyceae, or, in recognition of the incongruity of effecting such a separation, the whole group of the Schizophyta —that is to say, the Cyanophyceae in the narrow sense, together with Bacteriaceae, is included or excluded together. Again, while Conjugatae may be shut out from Chlorophyceae as an independent group co-ordinate with them in rank, the Characeae constitute so aberrant a group that it has even been proposed to raise them as Charophyta to the dignity of a main division co-ordinate with Thallophyta. Similarly, while Diatomaceae may be excluded from among Phaeophyceae, though retained among algae, the Cryptomonadaceae and Peridiniaceae, like *Euglena* and other Chlorophyceae, may be excluded from Thallophyta and ranged among the flagellate Protozoa. It is doubtful, however, whether the conventional distinction between plants and animals will continue to be urged; and the suggestion of Haeckel that a class Protista should be established to receive the forms exhibiting both animal and plant affinities has much

Limits of the algae.

to recommend it on phylogenetic grounds. To adopt a figure, it is probable that the sources from which the two streams of life—animal and vegetable—spring may not be separable by a well-defined watershed at all, but consist of a great level upland, in which the waterways anastomose. Finally, while Chlorophyceae and Phaeophyceae exhibit important affinities, the Rhodophyceae are so distinct that the term "algae" cannot be made to include them, except when used in its widest sense.

Phylogeny.

It has been well said that the attempt to classify plants according to their natural affinities is an attempt to construct for them the genealogical tree by which their relationships can be traced. Algae are, however, so heterogeneous a class, of which the constituent groups are so inadequately known, that it is at present futile to endeavour thus to exhibit their pedigree. A synoptical representation of the present state of knowledge would be expressed by a network rather than by a tree. The following table is an adaptation of a scheme devised by Klebs, and indicates the inter-relationships of the various constituent groups. The area included in the thick boundary line represents algae in the widest sense in which the term is used, and the four included areas the four main subdivisions. A continuous line indicates a close affinity, and a dotted line a doubtful relationship.


Protozoa
Peridiniaceae......Diatomaceae
Cryptomonadaceae—Hydruraceae—Euphaeophyceae
Flagellata protomastigina......Bacteriaceae
Thoraceae
Cyanophyceae......Bangiaceae—Eufloridae
Eugleneae
Chloromonadinae
Pleurococcaceae—Endosphaeraceae
Volvocaceae
Chlorosphaeraceae
Conjugatae
Siphonales
Tetrasporaceae
Ulvaceae
Confervales......Characeae
Fungi
Bryophyta

Alternation of generations.

In comparing algae with the great archegoniate series which has doubtless sprung from them, it is natural to inquire to what extent, if any, they present evidence of the existence of the marked alternation of generations which dominates the life-history of the higher plants. Turning first to the Rhodophyceae, both on account of the high place which they occupy among algae and also the remarkable uniformity in their reproductive processes, it is clear that, as is the case among Archegoniatae, the product of the sexual act never germinates directly into a plant which gives rise to the sexual organs. Even among Bangiaceae the carpospores arise from the fertilized cell by division, while in all other Rhodophyceae the oospore, as it may be called, gives rise to a filamentous structure, varying greatly in its dimensions, epiphytic, and to a large extent parasitic upon the egg-bearing parent plant, and in the end giving rise to carpospores in the terminal cells of certain branches. There is here obviously a certain parallelism with the case of Bryophyta, where the sporogonium arising from the oospore is epiphytic and partially parasitic upon the female plant, and always culminates in the production of spores. Not even *Riccia*, with its rudimentary sporogonium, has so simple a corresponding stage as *Bangia*, for, while there is some amount of sterile tissue in *Riccia*, in *Bangia* the oospore completely divides to form carpospores. Excluding Bangiaceae, however, from consideration, the Eufiorideae present in the product of the development of the oospore like Bryophyta a structure partly sterile and partly fertile. There is, nevertheless, this important difference between the two cases. While the spore of Bryophyta on germination gives rise to the sexual plant, the carpospore of the alga may give rise on germination to a plant bearing a second sort of asexual cells, viz. the tetraspores, and the sexual plant may only be reached after a series of such plants have been successively generated. It is possible, however, that the tetraspore formation should be regarded as comparable with the prolific vegetative reproduction of Bryophyta, and in favour of this view there is the fact that the tetraspores originate on the thallus in a different way from carpospores with which the spores of Bryophyta are in the first place to be compared; moreover, in certain Nemalionales the production of tetraspores does not occur, and the difficulty referred to does not arise in such cases. Altogether it is difficult on morphological grounds to resist the conclusion that Florideae present the same fundamental phenomenon of alternation of generations as prevails in the higher plants. It is by means of the cytological evidence, however, that this problem will finally be solved. As is well known, the dividing nuclei of the cells of the sporophyte generation of the higher plants exhibit a double number of chromosomes, while the dividing nuclei of the cells of the gametophyte generation exhibit the single number. In a fern-plant, for example, which is a sporophyte, every karyokinesis divulges the double number, while in the prothallium, which is the gametophyte generation, the single number appears. The doubling process is provided by the act of fertilization, where an antherozoid with the single number of chromosomes fuses with an oosphere also with the single number to provide a fertilized egg with the double number. The reduction stage, on the other hand, is the first division of the mother-cell of the spore. From egg to spore-mother-cell is sporophyte; from spore-mother-cell to egg is gametophyte. And since this rule has been found to hold good for all the archegoniate series and also for the flowering plants where, however, the gametophyte generation has become so extremely reduced as to be only with difficulty discerned, it is natural that when alternation of generation is stated to occur in any group of Thallophyta it should be required that the cytological evidence should support the view. The genus *Nemalion* has been recently investigated by Wolfe with the object of examining the cytological evidence. He finds that eight chromosomes appear in karyokinesis in the ordinary thallus cells, but sixteen in the gonimoblast filaments derived from the fertilized carpogonium. Eight chromosomes appear again in the ultimate divisions which give rise to the carpospores. Upon the evidence it would seem therefore that so far as *Nemalion* is concerned an alternation occurs comparable with that existing in the lower Bryophyta where the sporophyte is relatively small, being attached to and to some extent parasitic upon the gametophyte. *Nemalion* is, however, one of those Florideae in which tetraspores do not occur. What is the case with those Florideae which have been described as trioecious? If the sporophyte generation is confined to the cystocarp, is the tetrasporiferous plant, as has been suggested, merely a potential gametophyte reproducing by a process analogous to the bud-formation of the Bryophyta? In answer to this question a recent writer, Yamanouchi, states in a preliminary communication that he has found that in *Polysiphonia violacea* the germinating carpospores exhibit forty chromosomes, and the germinating tetraspores twenty chromosomes. From this it would seem that in this plant reduction takes place in the tetraspore mother-cell, and that the tetrasporiferous plants are sporophytes which alternate with sexual plants. Novel as this result may seem, the tetraspores of Florideae become hereby comparable with the tetraspores of *Dictyota*, to which reference will be made hereafter. But it is clear that it becomes on this view increasingly difficult to explain the occasional occurrence of tetraspores on male, female and monoecious plants or the rôle of the carpospores in the life-cycle of Florideae. The results of future research on the cytology of the group will be awaited with interest.

Among Phaeophyceae it is well known that the oospore of Fucaceae germinates directly into the sexual plant, and there is thus only one generation. Moreover, it is known that the reduction in the number of chromosomes which occurs at the initiation of the gametophyte generation in Pteridophyta occurs in the culminating stage of *Fucus*, where the oogonium is separated from the stalk-cell, so that unless it be contended that the *Fucus* is really a sporophyte which does not produce spores, and that the gametophyte is represented merely by the oogonium and antheridium, there is no semblance of alternation of generation in this case. The only case among Phaeophyceae which has been considered to point to the existence of such a phenomenon is *Cutleria*. Here the asexual cells are borne upon the so-called *Aglaozonia reptans* and the sexual cells upon the plants known as *Cutleria*. The spores of the *Aglaozonia* form are known to give rise to sexual plants, and the oospore of *Cutleria* has been observed to grow into rudimentary *Aglaozonia*. Latterly, however, as the result of the cytological investigations of Mottier and Lloyd Williams, great advance has been made in our knowledge of the conditions existing in *Dictyota*. Mottier first observed that a reduction in the number takes place in the mother-cells of the tetraspore. It will be remembered that, as in most Florideae, the male, female and asexual plants are distinct in this genus. Mottier's observation has been confirmed by Lloyd Williams, who has shown, moreover, that the single number occurs in germlings from the tetraspore, and also in the adult stages of all sexual plants, while the double number occurs in germlings from the oospore, and in adult stages of all asexual plants. It is probable, therefore, that we have here a sharp alternation of generations, both generations being, however, precisely similar to the eye up to point of reproduction. Among Chlorophyceae it is often the case that the oospore on germination divides up directly to form a brood of zoospores. In *Coleochaete* this seems to be preceded by the formation of a minute parenchymatous mass, in each cell of which a zoospore is produced. In *Sphaeroplea* it is only at this stage that zoospores are formed at all; but in most cases, such as *Oedogonium*, *Ulothrix*, *Coleochaete*, similar zoospores are produced again and again upon the thallus, and the product of the oospore may be regarded as merely a first brood of a series. It has been held by some, however, that the first brood corresponds to the sporophyte generation of the higher plants, and that the rest of the cycle is the gametophyte generation. Were the case of *Sphaeroplea* to stand alone, the phenomenon might perhaps be regarded as an alteration of generations, but still only comparable with the case of *Bangia*, and not the case of the Florideae. But it is difficult to apply such a term at all to those cases in which there intervene between the oospore and the next sexual stage a series of generations, the zoospores of which are all precisely similar.

Polymorphism.

The difficulty of tracing the relationships of algae is largely due to the inadequacy of our knowledge of the conditions under which they pass through the critical stages of their life-cycle. Of the thousands of species which have been distinguished, relatively few have been traced from spore to spore, as the flowering plants have been observed from seed to seed. The aquatic habit of most of the species and the minute size of many of them are difficulties which do not exist in the case of most seed-plants. From the analogy of the higher plants observers have justly argued that when they have seen and marked the characters of the reproductive organs they have found the plant at the stage when it exhibits its most noteworthy features, and they have named and classified the species in accordance with these observations. While even in such cases it is obvious that interesting stages in the life of the plant may escape notice altogether, in the cases of those plants the reproduction of which is unknown, and which have been named and placed on the analogy of the vegetative parts alone, there is considerable danger that a plant may be named as a distinct species which is only a stage in the life of another distinct and perhaps already known species. To take an example, *Lemanea* and *Batrachospermum* are Florideae which bear densely-whorled branches, but which, on the germination of the carpospore, give rise to a laxly-filamentous, somewhat irregularly-branched plant, from which the ordinary sexual plants arise at a later stage. This filamentous structure has been attributed to the genus *Chantransia*, which it greatly resembles, especially when, as is said to be the case in *Batrachospermum*, it bears similar monospores. The true *Chantransia*, however, bears its own sexual organs as well as monospores. To the specific identity of *Haplospora globosa* and *Scaphospora speciosa*, and of *Cutleria multifida* and *Aglaozonia reptans*, reference has already been made. Again, many Green Algae—some unicellular, like *Sphaerella* and *Chlamydomonas*; some colonial forms, like *Volvox* and *Hormotila*: some even filamentous forms, like *Ulothrix* and *Stigeoclonium*—are known to pass into a condition resembling that of a *Palmella*, and might escape identification on this account.

It is, on the other hand, a danger in the opposite sense to conclude that all *Chantransia* species are stages in the life-cycle of other plants, and, similarly, that all irregular colonial forms, like *Palmella*, represent phases in the life of other Green Algae. Long ago Kützing went so far as to express the belief that the lower algae were all capable of transformations into higher forms, even into moss-protonemata. Later writers have also thought that in all four groups of algae transformations of a most far-reaching character occur. Thus Borzi finds that *Protoderma viride* passes through a series of changes so varied that at different times it presents the characters of twelve different genera. Chodat does not find so general a polymorphism, but nevertheless holds that *Raphidium* passes through stages represented by *Protococcus*, *Characium*, *Dactylococcus* and *Sciadium*. Klebs has, however, recently canvassed the conclusions of both these investigators; and as the result of his own observations declares that algae, so far from being as polymorphic as they have been described, vary only within relatively narrow limits, and present on the whole as great fixity as the higher plants. It certainly supports his view to discover, on subjecting to a careful investigation *Botrydium granulatum*, a siphonaceous alga whose varied forms had been described by J. Rostafinski and M. Woronin, that these authors had included in the life-cycle stages of a second alga described previously by Kützing, and now described afresh by Klebs as *Protosiphon botryoides*. In *Botrydium* the chromatophores are small, without pyrenoids, and oil-drops are present; in *Protosiphon* the chromatophores form a net-work with pyrenoids, and the contents include starch. Klebs insists that the only solution of such problems is the subjection of the algae in question to a rigorous method of pure culture. It is interesting to learn that G. Senn, pursuing the methods described by Klebs, has confirmed Chodat's observation of the passage of *Raphidium* into a *Dactylococcus*-stage, although he was unable to observe further metamorphosis. He has also seen *Pleurococcus viridis* dividing so as to form a filament, but has not succeeded in seeing the formation of zoospores as described by Chodat. While, therefore, there is much evidence of a negative character against the existence of an extensive polymorphism among algae, some amount of metamorphosis is known to occur. But until the conditions under which a particular transformation takes place have been ascertained and described, so that the observation may be repeated by other investigators, scant credence is likely to be given to the more extreme polymorphistic views.

Physiology.

In comparison with the higher plants, algae exhibit so much simplicity of structure, while the conditions under which they grow are so much more readily controlled, that they have frequently been the subject of physiological investigation with a view chiefly to the application of the results to the study of the higher plants. (See PLANTS: *Physiology of*.) In the literature of vegetable physiology there has thus accumulated a great body of facts relating not only to the phenomena of reproduction, but also to the nutrition of algae. With reference to their chemical physiology, the gelatinization of the cell-wall, which is so marked a feature, is doubtless attributable to the occurrence along with cellulose of pectic compounds. There is, however, considerable variation in the nature of the membrane in different species; thus the cell-wall of *Oedogonium*, treated with sulphuric acid and iodine, turns a bright blue, while the colour is very faint in the case of *Spirogyra*, the wall of which is said to consist for the most part of pectose. While starch occurs commonly as a cell-content in the majority of the Green Algae no trace of it occurs in *Vaucheria* and some of its allies, nor is it known in the whole of the Phaeophyceae and Rhodophyceae. In certain Euphaeophyceae bodies built up of concentric layers, and attached to the chromatophores, were described by Schmitz as phaeophycean-starch; they do not, however, give the ordinary starch reaction. Other granules, easily mistaken for the "starch" granules, are also found in the cells of Phaeophyceae; these possess a power of movement apart from the protoplasm, and are considered to be vesicles and to contain phloroglucin. The colourless granules of Florideae, which are supposed to constitute the carbohydrate reserve material, have been called floridean-starch. A white efflorescence which appears on certain Brown Algae (*Saccorhiza bulbosa*, *Laminaria saccharina*), when they are dried in the air, is found to consist of mannite. Mucin is known in the cell-sap of *Acetabularia*. Some Siphonales (*Codium*) give rise to proteid crystalloids, and they are of constant occurrence among Florideae. The presence of tannin has been established in the case of a great number of freshwater algae.

Colouring matters.

By virtue of the possession of chlorophyll all algae are capable of utilizing carbonic acid gas as a source of carbon in the presence of sunlight. The presence of phycocyanin, phycophaein and phycoerythrin considerably modifies the absorption spectra for the plants in which they occur. Thus in the case of phycoerythrin the maximum absorption, apart from the great absorption at the blue end of the spectrum, is not, as in the case where chlorophyll occurs alone, near the Fraunhofer line B, but farther to the right beyond the line D. By an ingenious method devised by Engelmann, it may be shown that the greatest liberation of oxygen, and consequently the greatest assimilation of carbon, occurs in that region of the spectrum represented by the absorption bands. In this connexion Pfeffer points out that the penetrating power of light into a clear sea varies for light of different colours. Thus red light is reduced to such an extent as to be insufficient for growth at a depth of 34 metres, yellow light at a depth of 177 metres and green light at 322 metres. It is thus an obvious advantage to Red Algae, which flourish at considerable depths, to be able to utilize yellow light rather than the red, which is extinguished so much sooner. The experiment of Engelmann referred to deserves to be mentioned here, if only in illustration of the use to which algae have been put in the study of physiological problems. Engelmann observed that certain bacteria were motile only in the presence of oxygen, and that they retained their motility in a microscopic preparation in the neighbourhood of an algal filament when they had come to rest elsewhere on account of the exhaustion of oxygen. After the bacteria had all been brought to rest by being placed in the dark, he threw a spectrum upon the filament, and observed in what region the bacteria first regained their motility, owing to the liberation of oxygen in the process of carbon-assimilation. He found that these places corresponded closely with the region of the absorption band for the algae under experiment.

Although algae generally are able to use carbonic acid gas as a source of carbon, some algae, like certain of the higher plants, are capable of utilizing organic compounds for this purpose. Thus *Spirogyra* filaments, which have been denuded of starch by being placed in the dark, form starch in one day if they are placed in a 10 to 20% solution of dextrose. According to T. Bokorny, moreover, it appears that such filaments will yield starch from formaldehyde when they are supplied with sodium oxymethyl sulphonate, a salt which readily decomposes into formaldehyde and hydrogen sodium sulphite, an observation which has been taken to mean that formaldehyde is always a stage in the synthesis of starch. With reference to the assimilation of nitrogen, it would seem that algae, like other green plants, can best use it when it is presented to them in the form of a nitrate. Some algae, however, seem to flourish better in the presence of organic compounds. In the case of *Scenedesmus acutus* it is said that the alga is unable to take up nitrogen in the form of a nitrate or ammoniacal salt, and requires some such substance as an amide or a peptone. On the other hand, it has been held by Bernhard Frank and other observers that atmospheric nitrogen is fixed by the agency of Green Algae in the soil. (For the remarkable symbiotism between algae and fungi see FUNGI and LICHENS.)

Habitat.

Most algae, particularly Phaeophyceae and Rhodophyceae, spend the whole of the life-cycle immersed in water. In the case of the freshwater algae, however, belonging to the Chlorophyceae and Cyanophyceae, although they required to be immersed during the vegetative period, the reproductive cells are often capable of resisting a considerable degree of desiccation, and in this condition are dispersed through great distances by various agencies. Again, as is well known, many species of marine algae growing in the region between the limits of high and low water are so constituted that they are exposed to the air twice a day without injury. The occurrence of characteristic algae at different levels constituting the zones to which reference has already been made, is probably in part an expression of the fact that different species vary in the capacity to resist desiccation from exposure. Thus *Laminaria digitata*, which characterizes the lowest zone, is only occasionally exposed at all, and then only for short periods of time. On the other hand, *Pelvetia canaliculata*, which marks the upper belt, is exposed for longer periods, and during neap tides may not be reached by the water for many days. Algae of more delicate texture than either Fucaceae or Laminariaceae also occur in the region exposed by the ebb of the tide, but these secure their exemption from desiccation either by retaining water in their meshes by capillary attraction, as in the case of *Pilayella*, or by growing among the tangles of the larger Fucaceae, as in the case of *Polysiphonia fastigiata*, or by growing in dense masses on rocks, as in the case of *Laurencia pinnatifida*. Such a species as *Delesseria sanguinea* or *Callophyllis laciniata* would on the contrary run great risk by exposure for even a short period. A few algae approach the ordinary terrestrial plants in their capacity to live in a sub-aerial habitat subject only to such occasional supplies of water as is afforded by the rainfall. Of this nature are some of the species of *Vaucheria*. A very few species, like *Chroolepus*, which grows on rock surfaces, are comparable with the land plants which have been termed xerophilous.

Plankton.

The great majority of the aquatic algae, both freshwater and marine, are attached plants. Some, however, are wanderers, either swimming actively with the aid of cilia, or floating inertly as the result of a specific weight closely approaching that of the medium. To the aggregate of such forms, both animal and vegetable, the term *plankton* has been applied, and the investigation of the vegetable plankton, both freshwater and marine, has been pursued in recent times with energy and success. The German Plankton Expedition of 1889 added greatly to our knowledge of the floating vegetable life of the North Atlantic Ocean, while many laboratories established on the shores of inland seas and lakes have rendered a similar service in the case of our freshwater phyto-plankton. The quantitative estimate of the amount of this flora has revealed its enormous aggregate amount and therefore its great importance in the economy of oceanic and lacustrine animal life. The organisms constituting this plankton are mostly unicellular, often aggregated together in colonies, and the remarkable structure which they exhibit has added a new chapter to the story of adaptation to environment. The families Diatomaceae, Peridiniaceae and Protococcaceae are best represented in the pelagic plankton, while in addition the Volvocaceae are an important element in freshwater plankton.

Benthos.

The great majority of algae, however, grow like land-plants attached to a substratum, and to these the term *benthos* is now generally applied. While the root of land-plants serves for the double purpose of attachment and the supply of water, it is attachment only that is usually sought in the case of algae. Immersed as they usually are in a medium containing in solution the inorganic substances which they require for their nutrition, the absorption of these takes place throughout their whole extent. The elaborate provision for the conduct of water from part to part which has played so important a rôle in the morphological development of land plants is entirely wanting in algae, such conducting tissues as do exist in the larger Phaeophyceae and Rhodophyceae serving rather for the convection of elaborated organic substance, and being thus comparable with the phloem of the higher plants. The attachment organ of algae is thus more properly called a *holdfast*, and is found to be of very varied structure. It generally takes the form of a single flattened disc as in the Fucaceae, or a group of finger-like processes as in Laminariaceae, or a tuft of filaments as in many instances. When the attachment is in sand or mud, it often simulates the appearance of a true root as in *Chara* or *Caulerpa*. It is clear that where the bottom of a lake or sea consists of oozy mud or shifting sand, it is impossible for algae to secure a foothold. Thus a rock emerging from a sandy beach may often be observed to stand covered with vegetation like an oasis in a desert. The rapidity with which walls, piles and pontoons—stone, wood and iron—become covered with marine plants is well known, while the discovery of some effective means of preventing the fouling of the bottoms of ships by the growth of algae would be hailed as a boon by shipowners. While rocks and boulders are the favoured situation for the growth of marine algae, those which readily disintegrate, like the coarser sandstones, are naturally less favoured than the hard and resistant. A large number of algae again live as epiphytes or endophytes. In the case of the freshwater species the host-plants are mostly species of aquatic Graminaceae, Naiadaceae or Nymphaeaceae. In the case of marine algae, the hosts are chiefly the larger Phaeophyceae and Rhodophyceae. A bed of *Zostera* near the level of low water is, however, on the British coast a favourite collecting ground for the smaller red and brown epiphytes. Of endophytes a distinction must be made between those which occupy the cell-wall only and those which perforate the cells, bringing about their destruction. There can be little doubt that in some cases the epiphytism approaches parasitism. In one case described by Kuckuck the chromaphores of the infesting algae are absent, a circumstance which points to a complete parasitism. Allusion has already been made to the peculiar habit of the shell-boring algae.

Habit.

In many algae certain branches of limited growth bear a remarkable resemblance to leaves. The Characeae among freshwater algae and the Sargassaceae among marine algae might be cited as examples. Surveying the whole range of algae life, Oltmanns distinguishes bush-forms, whip-forms, net-forms, leaf-forms, sack-forms, dorsi-ventral forms, and cushions, plates and crusts. The similarity of outline in many species to that of trees and shrubs will strike any one who examines algae mounted for the herbarium. *Cladophora* and *Bryopsis* among monosiphonous forms, *Chara*, *Polysiphonia*, *Ceramium* and *Cystoseira* among larger algae, are illustrations of this. The whip-forms are represented by *Spirogyra*, *Chaetomorpha*, *Scytosiphon*, *Nemalion*, *Himanthalia* and *Chorda*. Net-forms are found in *Hydrodictyon* and *Microdictyon*. The leaf-forms are very varied and owe their existence to the advantage accruing from the exposure of a large surface to the influence of the light. In some cases such as *Delesseria*, *Neurymenia*, *Fucus*, *Alaria*, the leaf-like structure is provided with a strengthening mid-rib, and when as in *Delesseria* it is also richly veined the resemblance to the leaf of a flowering plant is striking. *Laminaria*, *Padina*, *Cutleria*, *Punctaria*, *Iridaea*, *Ulva*, *Porphyra*, are leaf-like with a rigidity varying from a fleshy lamina to the thin and pliable. *Agarum*, *Claudea* and *Struvea* are leaf-forms which are perforated like *Aldrovanda* among flowering plants. *Enteromorpha*, *Asperococcus* and *Adenocystis* are sack-forms. Dorsi-ventral algae are rare. *Leveillea jungermanneoides* bears a remarkable resemblance to a leafy liverwort. In the next group of forms the simplest are crusts attached to the substratum throughout their extent, and growing at the margin. Such are *Myrionema*, *Ralfsia*, *Melobesia* and *Hildebrandtia*. Others are attached throughout their extent, but also grow vertical filaments so as to form a velvety pile. Such are *Coleochaete*, *Ochlochaete*, *Elachistea*, *Ascocyclus* and *Rhododermis*. *Peysonellia squamaria*, *Melobesia lichenoides*, *Leathesia difformis* are forms which are not attached throughout but grow in plates like the foliaceous lichens.

Ecology.

When it is sought to consider algae with a view to the correlation of the external form to the conditions of life, a subject the study of which under the name of ecology has been latterly pursued with great success among land plants, it is difficult as yet to arrive at generalizations which are trustworthy. Among land plants, as is well known, similarity of environment has often called forth similar adaptations among plants of widely separated families. The similarity of certain xerophilous Euphorbiaceae to Cactaceae is a ready illustration of this phenomenon. From what has been already said it is evident that among algae also strikingly similar forms exist in widely different groups. Instances might be multiplied. Compare, for example, the blue-green *Gloeocapsa* with the green *Gloeocystis*, the red *Batrachospermum* with the green *Draparnaldia*, the red *Corallina* with the green *Cymopolia*, the green *Enteromorpha* with the brown *Asperococcus*, the green *Ulva* with the red *Porphyra*, the red *Nemalion* with the brown *Castagnea*, and so on. But on the one hand similar forms seem to grow often under different conditions, while on the other hand different forms flourish under the same conditions. The conceivable variations in the conditions which would count in algal life are variations in the chemical character of the water—whether fresh, brackish or salt; or in the rate of movement of the water, whether relatively quiet, or a stream or a surf; or in the degree of illumination with the depth and transparency of the water. But the laws which determine the associations of various algae under one environment are as yet little understood. The occurrence of a plentiful mucilage in many freshwater forms is, however, doubtless a provision against desiccation on exposure. The fine subdivision of filamentous and net-forms is similarly a provision for easy access of water and light to all parts. The calcareous deposits in Characeae, Corallinaceae and Siphonaceae are at once a protection against attack and a means of support. The whip-forms would seem to be designed to resist injury from surf or current. The vesicles of Fucaceae and Laminariaceae prevent the sinking of the bulkier forms. But why certain Fucaceae favour certain zones in the littoral region, why certain epiphytes are confined to certain hosts, why Red and Brown Algae are not better represented in fresh water or Green Algae in salt,—these are problems to which it is difficult to find a ready answer.

Uses.

Algae cannot be regarded as directly important in the industries. On the coasts of Europe marine algae detached by the autumnal gales are commonly carted on to the land as a convenient manure. *Porphyra laciniata* and *Rhodymenia palmata* are locally used as food, the latter being known as dulse. Agar-agar is a gelatinous substance derived from an eastern species of *Gracilaria*. The ash of seaweeds, known in Scotland as kelp, and in Brittany as varec, was formerly used as a source of iodine to a greater extent than is at present the case.

Occurrence in the rocks.

Excepting where the thallus is impregnated with silica, as in Diatomaceae, or carbonate of lime, as in Corallinaceae, Characeae and some Siphonales, it is perhaps not surprising that algae should not have been extensively preserved in the fossil form. Considering, however, that it is generally believed that Bryophyta and vascular plants are descended from an algal ancestry, it is natural to suppose that, prior to the luxuriant vegetable growths of the Carboniferous period, there must have existed an age of algae. It was doubtless this expectation that has led to the description of a number of Silurian and Devonian remains as algae upon what is now regarded as inadequate evidence. The geologic record is, as perhaps is to be expected, exceedingly poor, except as regards the calcareous Siphonales, which are well represented at various horizons, from the Silurian to the Tertiary; even the Diatomaceae, which are found in great quantities in the Tertiary deposits, do not occur at all earlier than the chalk. It is believed, however, that the Devonian fossil, *Nematophycus*, is a Laminarian alga, but it is not until the late Secondary and the Tertiary formations that fossil remains of algae become frequent. (See PALAEOBOTANY.)

The subjoined list included the larger standard works on algae, together with a number of papers to which reference is made in this article. For a detailed catalogue of Algological literature, see the "Bibliotheca Phycologica" in de Toni's *Syllope Algarum*, vol. i. (1889), with the addendum thereto in vol. iv. (1897) of the same work.

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ALGARDI, ALESSANDRO (1602–1654), Italian sculptor, was born at Bologna in 1602. While he was attending the school of the Caracci his preference for the plastic art became evident, and he placed himself under the instruction of the sculptor Conventi. At the age of twenty he was brought under the notice of Duke Ferdinand of Mantua, who gave him several commissions. He was also much employed about the same period by jewellers and others in modelling in gold, silver and ivory. After a short residence in Venice he went to Rome in 1625 with an introduction from the duke of Mantua to the pope's nephew, Cardinal Ludovisi, who employed him for a time in the restoration of ancient statues. The death of the duke of Mantua left him to his own resources, and for several years he earned a precarious maintenance from these restorations and the commissions of goldsmiths and jewellers. In 1640 he executed for Pietro Buoncompagni his first work in marble, a colossal statue of San Filippo Neri, with kneeling angels. Immediately after, he produced a similar group, representing the execution of St Paul, for the church of the Barnabite Fathers in Bologna. These works, displaying great technical skill, though with considerable exaggeration of expression and attitude, at once established Algardi's reputation, and other commissions followed in rapid succession. The turning point in Algardi's fortune was the accession of Innocent X., of the Bolognese house of Panfili, to the papal throne in 1644. He was employed by Camillo Panfili, nephew of the pontiff, to design the Villa Doria Panfili outside the San Pancrazio gate. The most important of Algardi's other works were the monument of Leo XI., a bronze statue of Innocent X. for the capitol, and, above all, *La Fuega d'Attila*, the largest alto-relievo in the world, the two principal figures being about 10 ft. high. In 1650 Algardi met Velasquez, who obtained some interesting orders for his Italian companion in Spain. Thus there are four chimneys by Algardi in the palace of Aranjuez, where also the figures on the fountain of Neptune were executed by him. The Augustine monastery at Salamanca contains the tomb of the count and countess de' Monterey, which was also the work of Algardi. From an artistic point of view, he was most successful in his portrait-statues and groups of children, where he was obliged to follow nature most closely. In his later years he became very avaricious and amassed a great fortune. He died in Rome on the 10th of June 1654.

See *Le arti di Bologna disegnate da A. Caracci ed intagliati da S. Giulini, con' assistenza d Alessandro A. Algardi* (1740).

ALGAROTH, POWDER OF, a basic chloride of antimony. It was known to Basil Valentine, and was used medicinally by the Veronese physician Victor Algarotus about the end of the 16th century. Its composition is probably $Sb_4O_5Cl_2$, and it may be prepared by the addition of much water to a solution of antimony chloride; a bulky amorphous precipitate being formed, which, on standing, gradually becomes crystalline. It is soluble in hydrochloric acid and tartaric acid, but insoluble in alcohol.

On its composition and preparation see E. Péligot, *Annalen*, 1847, lxiv. 280; L. Schäffer, *Annalen*, 1869, clii. 314; and R. W. E. MacIvor, *Chem. News*, 1875, xxxii. 229.

ALGAROTTI, FRANCESCO, Count (1712–1764), Italian philosopher and writer on art, was born on the 11th of December 1712 at Venice, and died at Pisa in 1764. He studied at Rome and Bologna, and at the age of twenty went to Paris, where he enjoyed the friendship of Voltaire and produced his great work *Neutonianismo per le dame*, a work on optics. Voltaire called him his *cher cygne de Padoue.* Returning from a journey to Russia, he met Frederick the Great who made him a count of Prussia (1740) and court chamberlain (1747). Augustus III. of Poland honoured him with the title of councillor. In 1754, after seven years' residence partly in Berlin and partly in Dresden, he returned to Italy, living at Venice and then at Pisa, where he died on the 3rd of May 1764. Frederick the Great erected to his memory a monument on the Campo Santo at Pisa. He was a man of wide knowledge, a connoisseur in art and music, and the friend of most of the leading authors of his time. His chief work on art is the *Saggi sopra le belle arti* ("Essays on the Fine Arts"). Among his other works may be mentioned *Poems, Travels in Russia, Essay on Painting, Correspondence.*

The best complete edition with biography was published by D. Michelessi (1791–1794).

ALGARVE, or ALGARVES, an ancient kingdom and province in the extreme S. of Portugal, corresponding with the modern administrative district of Faro, and bounded on the N. by Alemtejo, E. by the Spanish province of Huelva, and S. and W. by the Atlantic Ocean. Pop. (1900) 255,191; area, 1937 sq. m. The greatest length of the province is about 85 m. from E. to W.; its average breadth is about 22 m. from N. to S. The Serra de Malhão and the Serra de Monchique extend in the form of a crescent across the northern part of the province, and, sweeping to the south-west, terminate in the lofty promontory of Cape St Vincent, the south-west extremity of Europe. This headland is famous as the scene of many sea-fights, notably the defeat inflicted on the Spanish fleet in February 1797 by the British under Admiral Jervis, afterwards Earl St Vincent. Between the mountainous tracts in the north and the southern coast stretches a narrow plain, watered by numerous rivers flowing southward from the hills. The coast is fringed for 30 m. from Quarteira to Tavira, with long sandy islands, through which there are six passages, the most important being the Barra Nova, between Faro and Olhão. The navigable estuary of the Guadiana divides Algarve from Huelva, and its tributaries water the western districts. From the Serra de Malhão flow two streams, the Silves and Odelouca, which unite and enter the Atlantic below the town of Silves. In the hilly districts the roads are bad, the soil unsuited for cultivation, and the inhabitants few. Flocks of goats are reared on the mountain-sides. The level country along the southern coast is more fertile, and produces in abundance grapes, figs, oranges, lemons, olives, almonds, aloes, and even plantains and dates. The land is, however, not well suited for the production of cereals, which are mostly imported from Spain. On the coast the people gain their living in great measure from the fisheries, tunny and sardines being caught in considerable quantities. Salt is also made from sea-water. There is no manufacturing or mining industry of any importance. The harbours are bad, and almost the whole foreign trade is carried on by ships of other nations, although the inhabitants of Algarve are reputed to be the best seamen and fishermen of Portugal. The chief exports are dried fruit, wine, salt, tunny, sardines and anchovies. The only railway is the Lisbon-Faro main line, which passes north-eastward from Faro, between the Monchique and Malhão ranges. Faro (11,789), Lagos (8291), Loulé (22,478), Monchique (7345), Olhão (10,009), Silves (9687) and Tavira (12,175), the chief towns, are described in separate articles.

The name of Algarve is derived from the Arabic, and signifies a land lying to the west. The title "king of Algarve," held by the kings of Portugal, was first assumed by Alphonso III., who captured Algarve from the Moors in 1253.

ALGÄU, or ALLGÄU, the name now given to a comparatively small district forming the south-western corner of Bavaria, and belonging to the province of Swabia and Neuburg, but formerly applied to a much larger territory, which extended as far as the Danube on the N., the Inn on the S. and the Lech on the W. The Algäu Alps contain several lofty peaks, the highest of which is Mädelegabel (8681 ft.). The district is celebrated for its cattle, milk, butter and cheese.

ALGEBRA (from the Arab. *al-jebr wa'l-muqābala*, transposition and removal [of terms of an equation], the name of a treatise by Mahommed ben Musa al-Khwarizmi), a branch of mathematics which may be defined as the generalization and extension of arithmetic.

The subject-matter of algebra will be treated in the following article under three divisions:—A. Principles of ordinary algebra; B. Special kinds of algebra; C. History. Special phases of the subject are treated under their own headings, *e.g.* ALGEBRAIC FORMS; BINOMIAL; COMBINATORIAL ANALYSIS; DETERMINANTS; EQUATION; CONTINUED FRACTION; FUNCTION; GROUPS, THEORY OF; LOGARITHM; NUMBER; PROBABILITY; SERIES.

A. PRINCIPLES OF ORDINARY ALGEBRA

1. The above definition gives only a partial view of the scope of algebra. It may be regarded as based on arithmetic, or as dealing in the first instance with formal results of the laws of arithmetical number; and in this sense Sir Isaac Newton gave the title *Universal Arithmetic* to a work on algebra. Any definition, however, must have reference to the state of development of the subject at the time when the definition is given.

2. The earliest algebra consists in the solution of equations. The distinction between algebraical and arithmetical reasoning then lies mainly in the fact that the former is in a more condensed form than the latter; an unknown quantity being represented by a special symbol, and other symbols being used as a kind of shorthand for verbal expressions. This form of algebra was extensively studied in ancient Egypt; but, in accordance with the practical tendency of the Egyptian mind, the study consisted largely in the treatment of particular cases, very few general rules being obtained.

3. For many centuries algebra was confined almost entirely to the solution of equations; one of the most important steps being the enunciation by Diophantus of Alexandria of the laws governing the use of the minus sign. The knowledge of these laws, however, does not imply the existence of a conception of negative quantities. The development of symbolic algebra by the use of general symbols to denote numbers is due to Franciscus Vieta (François Viète, 1540–1603). This led to the idea of algebra as generalized arithmetic.

4. The principal step in the modern development of algebra was the recognition of the meaning of negative quantities. This appears to have been due in the first instance to Albert Girard (1595–1632), who extended Vieta's results in various branches of mathematics. His work, however, was little known at the time, and later was overshadowed by the greater work of Descartes (1596–1650).

5. The main work of Descartes, so far as algebra was concerned, was the establishment of a relation between arithmetical and geometrical measurement. This involved not only the geometrical interpretation of negative quantities, but also the idea of continuity; this latter, which is the basis of modern analysis, leading to two separate but allied developments, viz. the theory of the function and the theory of limits.

6. The great development of all branches of mathematics in the two centuries following Descartes has led to the term algebra being used to cover a great variety of subjects, many of which are really only ramifications of arithmetic, dealt with by algebraical methods, while others, such as the theory of numbers and the general theory of series, are outgrowths of the application of algebra to arithmetic, which involve such special ideas that they must properly be regarded as distinct subjects. Some writers have attempted unification by treating algebra as concerned with functions, and Comte accordingly defined algebra as the *calculus of functions*, arithmetic being regarded as the *calculus of values*.

7. These attempts at the unification of algebra, and its separation from other branches of mathematics, have usually been accompanied by an attempt to base it, as a deductive science, on certain fundamental laws or general rules; and this has tended to increase its difficulty. In reality, the variety of algebra corresponds to the variety of phenomena. Neither

mathematics itself, nor any branch or set of branches of mathematics, can be regarded as an isolated science. While, therefore, the logical development of algebraic reasoning must depend on certain fundamental relations, it is important that in the early study of the subject these relations should be introduced gradually, and not until there is some empirical acquaintance with the phenomena with which they are concerned.

8. The extension of the range of subjects to which mathematical methods can be applied, accompanied as it is by an extension of the range of study which is useful to the ordinary worker, has led in the latter part of the 19th century to an important reaction against the specialization mentioned in the preceding paragraph. This reaction has taken the form of a return to the alliance between algebra and geometry (§5), on which modern analytical geometry is based; the alliance, however, being concerned with the application of graphical methods to particular cases rather than to general expressions. These applications are sometimes treated under arithmetic, sometimes under algebra; but it is more convenient to regard *graphics* as a separate subject, closely allied to arithmetic, algebra, mensuration and analytical geometry.

9. The association of algebra with arithmetic on the one hand, and with geometry on the other, presents difficulties, in that geometrical measurement is based essentially on the idea of continuity, while arithmetical measurement is based essentially on the idea of discontinuity; both ideas being equally matters of intuition. The difficulty first arises in elementary mensuration, where it is partly met by associating arithmetical and geometrical measurement with the cardinal and the ordinal aspects of number respectively (see ARITHMETIC). Later, the difficulty recurs in an acute form in reference to the continuous variation of a function. Reference to a geometrical interpretation seems at first sight to throw light on the meaning of a differential coefficient; but closer analysis reveals new difficulties, due to the geometrical interpretation itself. One of the most recent developments of algebra is the *algebraic theory of number*, which is devised with the view of removing these difficulties. The harmony between arithmetical and geometrical measurement, which was disturbed by the Greek geometers on the discovery of irrational numbers, is restored by an unlimited supply of the causes of disturbance.

10. Two other developments of algebra are of special importance. The theory of *sequences* and *series* is sometimes treated as a part of elementary algebra; but it is more convenient to regard the simpler cases as isolated examples, leading up to the general theory. The treatment of equations of the second and higher degrees introduces *imaginary* and *complex* numbers, the theory of which is a special subject.

11. One of the most difficult questions for the teacher of algebra is the stage at which, and the extent to which, the ideas of a negative number and of continuity may be introduced. On the one hand, the modern developments of algebra began with these ideas, and particularly with the idea of a negative number. On the other land, the lateness of occurrence of any particular mathematical idea is usually closely correlated with its intrinsic difficulty. Moreover, the ideas which are usually formed on these points at an early stage are incomplete; and, if the incompleteness of an idea is not realized, operations in which it is implied are apt to be purely formal and mechanical. What are called negative numbers in arithmetic, for instance, are not really negative numbers but negative quantities (§ 27 (i.)); and the difficulties incident to the ideas of continuity have already been pointed out.

12. In the present article, therefore, the main portions of elementary algebra are treated in one section, without reference to these ideas, which are considered generally in two separate sections. These three sections may therefore be regarded as to a certain extent concurrent. They are preceded by two sections dealing with the introduction to algebra from the arithmetical and the graphical sides, and are followed by a section dealing briefly with the developments mentioned in §§ 9 and 10 above.

I. *Arithmetical Introduction to Algebra.*

13. *Order of Arithmetical Operations.*—It is important, before beginning the study of algebra, to have a clear idea as to the meanings of the symbols used to denote arithmetical operations.

(i.) Additions and subtractions are performed from left to right. Thus 3 ℔ + 5 ℔ − 7 ℔ + 2 ℔ means that 5 ℔ is to be added to 3 ℔, 7 ℔ subtracted from the result, and 2 ℔ added to the new result.

(ii.) The above operation is performed with 1 ℔ as the unit of counting, and the process would be the same with any other unit; *e.g.* we should perform the same process to find 3s.+5s.−7s.+2s. Hence we can separate the numbers from the common unit, and replace 3 ℔+5 ℔ − 7 ℔+2 ℔ by (3+5−7+2) ℔, the additions and subtractions being then performed by means of an addition-table.

(iii.) Multiplications, represented by ×, are performed from right to left. Thus 5×3×7×1 ℔ means 5 times 3 times 7 times 1 ℔; *i.e.* it means that 1 ℔ is to be multiplied by 7, the result by 3, and the new result by 5. We may regard this as meaning the same as 5×3×7 ℔, since 7 ℔ itself means 7×1 ℔, and the ℔ is the unit in each case. But it does not mean the same as 5×21 ℔, though the two are equal, *i.e.* give the same result (see § 23).

This rule as to the meaning of × is important. If it is intended that the first number is to be multiplied by the second, a special sign such as ⋋ should be used.

(iv.) The sign ÷ means that the quantity or number preceding it is to be divided by the quantity or number following it.

(v.) The use of the *solidus* / separating two numbers is for convenience of printing fractions or fractional numbers. Thus 16/4 does not mean 16÷4, but $\frac{16}{4}$.

(vi.) Any compound operation not coming under the above descriptions is to have its meaning made clear by brackets, the use of a pair of brackets indicating that the expression between them is to be treated as a whole. Thus we should not write 8×7+6, but (8×7)+6, or 8×(7+6). The sign × coming immediately before, or immediately after, a bracket may be omitted; *e.g.* 8×(7+6) may be written 8(7+6).

This rule as to using brackets is not always observed, the convention sometimes adopted being that multiplications or divisions are to be performed before additions or subtractions. The convention is even pushed to such an extent as to make "$4\frac{1}{3}+3\frac{3}{8}$ of 7+5" mean "$4\frac{1}{3}+(3\frac{3}{8}$ of 7)+5"; though it is not clear what "Find the value of $4\frac{1}{3}+3\frac{3}{8}$ times 7+5" would then mean. There are grave objections to an arbitrary rule of this kind, the chief being the useless waste of mental energy in remembering it.

(vii.) The only exception that may be made to the above rule is that an expression involving multiplication-dots only, or a simple fraction written with the solidus, may have the brackets omitted for additions or subtractions, provided the figures are so spaced as to prevent misunderstanding. Thus 8+(7×6)+3 may be written 8+7.6+3, and $8+\frac{7}{6}+3$ may be written 8+7/6+3. But $\frac{3\cdot5}{2\cdot4}$ should be written (3.5)/(2.4), not 3.5/2.4.

14. *Latent Equations.*—The equation exists, without being shown as an equation, in all those elementary arithmetical processes which come under the head of *inverse operations*; *i.e.* processes which consist in obtaining an answer to the question "Upon what has a given operation to be performed in order to produce a given result?" or to the question "What operation of a given kind has to be performed on a given quantity or number in order to produce a given result?"

(i.) In the case of subtraction the second of these two questions is perhaps the simpler. Suppose, for instance, that we wish to know how much will be left out of 10s. after spending 3s., or how much has been spent out of 10s. if 3s. is left. In either case we may put the question in two ways:—(*a*) What must be added to 3s. in order to produce 10s., or (*b*) To what must 3s. be added in order to produce 10s. If the answer to the question is X, we have either (*a*) 10s. = 3s. + X, ∴ X = 10s. − 3s.
or (*b*) 10s. = X + 3s., ∴ X = 10s. − 3s.

(ii.) In the above case the two different kinds of statement lead to arithmetical formulae of the same kind. In the case of division we get two kinds of arithmetical formula, which, however, may be regarded as requiring a single kind of numerical process in order to determine the final result.

(*a*) If 24d. is divided into 4 equal portions, how much will each portion be?

Let the answer be X; then

$$24\text{d.} = 4 \times \text{X}, \therefore \text{X} = \tfrac{1}{4} \text{ of } 24\text{d.}$$

(*b*) Into how many equal portions of 6d. each may 24d. be divided?

Let the answer be x; then

$$24\text{d.} = x \times 6\text{d.}, \therefore x = 24\text{d.} \div 6\text{d.}$$

(iii.) Where the direct operation is evolution, for which there is no commutative law, the two inverse operations are different in kind.

(*a*) What would be the dimensions of a cubical vessel which would exactly hold 125 litres; a litre being a cubic decimetre?

Let the answer be X; then

$$125 \text{ c.dm.} = \text{X}^3, \therefore \text{X} = \sqrt[3]{125 \text{ c.dm.}} = \sqrt[3]{125} \text{ dm.}$$

(*b*) To what power must 5 be raised to produce 125?

Let the answer be x; then

$$125 = 5^x, \therefore x = \log_5 125.$$

15. With regard to the above, the following points should be noted.

(1) When what we require to know is a quantity, it is simplest to deal with this quantity as a whole. In (i.), for instance, we want to find the amount by which 10s. exceeds 3s., not the number of shillings in this amount. It is true that we obtain this result by subtracting 3 from 10 by means of a subtraction-table (concrete or ideal); but this table merely gives the generalized results of a number of operations of addition or subtraction performed with concrete units. We must count with something; and the successive somethings obtained by the addition of successive units are in fact numerical quantities, not numbers.

Whether this principle may legitimately be extended to the notation adopted in (iii.) (*a*) of § 14 is a moot point. But the present tendency is to regard the early association of arithmetic with linear measurement as important; and it seems to follow that we may properly (at any rate at an early stage of the subject) multiply a length by a length, and the product again by another length, the practice being dropped when it becomes necessary to give a strict definition of multiplication.

(2) The results may be stated briefly as follows, the more usual form being adopted under (iii.) (*a*):—

(i.) If $\text{A} = \text{B} + \text{X}$, or $= \text{X} + \text{B}$, then $\text{X} = \text{A} - \text{B}$.
(ii.) (*a*) If $\text{A} = m$ times X, then $\text{X} = \frac{1}{m}$ of A.
(*b*) If $\text{A} = x$ times M, then $x = \text{A} \div \text{M}$.
(iii.) (*a*) If $n = x^p$, then $x = \sqrt[p]{n}$.
(*b*) If $n = a^x$, then $x = \log_a n$.

The important thing to notice is that where, in any of these five cases, one statement is followed by another, the second is not to be regarded as obtained from the first by logical reasoning involving such general axioms as that "if equals are taken from equals the remainders are equal"; the fact being that the two statements are merely different ways of expressing the same relation. To say, for instance, that X is equal to A − B, is the same thing as to say that X is a quantity such that X and B, when added, make up A; and the above five statements of necessary connexion between two statements of equality are in fact nothing more than definitions of the symbols −, $\frac{1}{m}$ of, ÷, $\sqrt[p]{}$, and $\log_a$.

An apparent difficulty is that we use a single symbol − to denote the result of the two different statements in (i.) (*a*) and (i.) (*b*) of § 14. This is due to the fact that there are really two kinds of subtraction, respectively involving counting forwards (complementary addition) and counting backwards (ordinary subtraction); and it suggests that it may be wise not to use the one symbol − to represent the result of both operations until the commutative law for addition has been fully grasped.

16. In the same way, a statement as to the result of an inverse operation is really, by the definition of the operation, a statement as to the result of a direct operation. If, for instance, we state that $\text{A} = \text{X} - \text{B}$, this is really a statement that $\text{X} = \text{A} + \text{B}$. Thus, corresponding to the results under § 15 (2), we have the following:—

(1) Where the inverse operation is performed on the unknown quantity or number:—

(i.) If $\text{A} = \text{X} - \text{B}$, then $\text{X} = \text{A} + \text{B}$.
(ii.) (*a*) If $\text{M} = \frac{1}{m}$ of X, then $\text{X} = m$ times M.
(*b*) If $m = \text{X} \div \text{M}$, then $\text{X} = m$ times M.
(iii.) (*a*) If $a = \sqrt[p]{x}$, then $x = a^p$.
(*b*) If $p = \log_a x$, then $x = a^p$.

(2) Where the inverse operation is performed with the unknown quantity or number:—

(i.) If $\text{B} = \text{A} - \text{X}$, then $\text{A} = \text{B} + \text{X}$.
(ii.) (*a*) If $m = \text{A} \div \text{X}$, then $\text{A} = m$ times X.
(*b*) If $\text{M} = \frac{1}{x}$ of A, then $\text{A} = x$ times M.
(iii.) (*a*) If $p = \log_x n$, then $n = x^p$.
(*b*) If $a = \sqrt[x]{n}$, then $n = a^x$.

In each of these cases, however, the reasoning which enables us to replace one statement by another is of a different kind from the reasoning in the corresponding cases of § 15. There we proceeded from the direct to the inverse operations; *i.e.* so far as the nature of arithmetical operations is concerned, we launched out on the unknown. In the present section, however, we return from the inverse operation to the direct; *i.e.* we rearrange our statement in its simplest form. The statement, for instance, that $32 - x = 25$, is really a statement that 32 is the sum of x and 25.

17. The five equalities which stand first in the five pairs of equalities in § 15 (2) may therefore be taken as the main types of a simple statement of equality. When we are familiar with the treatment of quantities by equations, we may ignore the units and deal solely with numbers; and (ii.) (*a*) and (ii.) (*b*) may then, by the commutative law for multiplication, be regarded as identical. The five processes of deduction then reduce to four, which may be described as (i.) subtraction, (ii.) division, (iii.) (*a*) taking a root, (iii.) (*b*) taking logarithms. It will be found that these (and particularly the first three) cover practically all the processes legitimately adopted in the elementary theory of the solution of equations; other processes being sometimes liable to introduce roots which do not satisfy the original equation.

18. It should be noticed that we are still dealing with the elementary processes of arithmetic, and that all the numbers contemplated in §§ 14-17 are supposed to be positive integers. If, for instance, we are told that $15 = \frac{3}{4}$ of $(x - 2)$, what is meant is that (1) there is a number u such that $x = u + 2$, (2) there is a number v such that $u = 4$ times v, and (3) $15 = 3$ times v. From these statements, working backwards, we find successively that $v = 5$, $u = 20$, $x = 22$. The deductions follow directly from the definitions, and such mechanical processes as "clearing of fractions" find no place (§ 21 (ii.)). The extension of the methods to fractional numbers is part of the establishment of the laws governing these numbers (§ 27 (ii.)).

19. *Expressed Equations.*—The simplest forms of arithmetical equation arise out of abbreviated solutions of particular problems. In accordance with § 15, it is desirable that our statements should be statements of equality of quantities rather than of numbers; and it is convenient in the early stages to have a distinctive notation, *e.g.* to represent the former by capital letters and the latter by small letters.

As an example, take the following. I buy 2 lb of tea, and have 6s. 8d. left out of 10s.; how much per lb did tea cost?

(1) In ordinary language we should say: Since 6s. 8d. was left, the amount spent was 10s. − 6s. 8d., *i.e.* was 3s. 4d. Therefore 2 lb of tea cost 3s. 4d. Therefore 1 lb of tea cost 1s. 8d.

(2) The first step towards arithmetical reasoning in such a case is the introduction of the sign of equality. Thus we say:—

Cost of 2 lb tea + 6s. 8d. = 10s.
∴ Cost of 2 lb tea = 10s. − 6s. 8d. = 3s. 4d.
∴ Cost of 1 lb tea = 1s. 8d

(3) The next step is to show more distinctly the unit we are dealing with (in addition to the money unit), viz. the cost of 1 lb tea. We write:—

$$(2\times\text{cost of 1 lb tea})+6\text{s. }8\text{d.}=10\text{s.}$$
$$\therefore 2\times\text{cost of 1 lb tea}=10\text{s.}-6\text{s. }8\text{d.}=3\text{s. }4\text{d.}$$
$$\therefore \text{Cost of 1 lb tea}=1\text{s. }8\text{d.}$$

(4) The stage which is introductory to algebra consists merely in replacing the unit "cost of 1 lb tea" by a symbol, which may be a letter or a mark such as the mark of interrogation, the asterisk, &c. If we denote this unit by X, we have

$$(2\times X)+6\text{s. }8\text{d.}=10\text{s.}$$
$$\therefore 2\times X=10\text{s.}-6\text{s. }8\text{d.}=3\text{s. }4\text{d.}$$
$$\therefore X=1\text{s. }8\text{d.}$$

20. *Notation of Multiples.*—The above is arithmetic. The only thing which it is necessary to import from algebra is the notation by which we write 2X instead of $2\times X$ or $2\,.\,X$. This is rendered possible by the fact that we can use a single letter to represent a single number or numerical quantity, however many digits are contained in the number.

It must be remembered that, if a is a number, $3a$ means 3 times a, not a times 3; the latter must be represented by $a\times 3$ or $a\,.\,3$.

The number by which an algebraical expression is to be multiplied is called its *coefficient*. Thus in $3a$ the coefficient of a is 3. But in $3\,.\,4a$ the coefficient of $4a$ is 3, while the coefficient of a is $3\,.\,4$.

21. *Equations with Fractional Coefficients.*—As an example of a special form of equation we may take

$$\tfrac{1}{2}x+\tfrac{1}{3}x=10.$$

(i.) There are two ways of proceeding.

(*a*) The statement is that (1) there is a number u such that $x=2u$, (2) there is a number v such that $x=3v$, and (3) $u+v=10$. We may therefore conveniently take as our unit, in place of x, a number y such that $x=6y$.

We then have $3y+2y=10$,

whence $5y=10,\ y=2,\ x=6y=12$.

(*b*) We can *collect coefficients*, *i.e.* combine the separate quantities or numbers expressed in terms of x as unit into a single quantity or number so expressed, obtaining

$$\tfrac{5}{6}x=10.$$

By successive stages we obtain (§ 18) $\tfrac{1}{6}x=2$, $x=12$; or we may write at once $x=\frac{1}{5/6}$ of $10=\frac{6}{5}$ of $10=12$. The latter is the more advanced process, implying some knowledge of the laws of fractional numbers, as well as an application of the associative law (§ 26 (i.)).

(ii.) Perhaps the worst thing we can do, from the point of view of intelligibility, is to "clear of fractions" by multiplying both sides by 6. It is no doubt true that, if $\tfrac{1}{2}x+\tfrac{1}{3}x=10$, then $3x+2x=60$ (and similarly if $\tfrac{1}{2}x+\tfrac{1}{3}x+\tfrac{1}{6}x=10$, then $3x+2x+x=60$); but the fact, however interesting it may be, is of no importance for our present purpose. In the method (*a*) above there is indeed a multiplication by 6; but it is a multiplication arising out of subdivision, not out of repetition (see ARITHMETIC), so that the total (viz. 10) is unaltered.

22. *Arithmetical and Algebraical Treatment of Equations.*—The following will illustrate the passage from arithmetical to algebraical reasoning. "Coal costs 3s. a ton more this year than last year. If 4 tons last year cost 104s., how much does a ton cost this year?"

If we write X for the cost per ton this year, we have

$$4(X-3\text{s.})=104\text{s.}$$

From this we can deduce successively $X-3\text{s.}=26\text{s.}$, $X=29\text{s.}$ But, if we transform the equation into

$$4X-12\text{s.}=104\text{s.},$$

we make an essential alteration. The original statement was with regard to X − 3s. as the unit; and from this, by the application of the distributive law (§ 26 (i.)), we have passed to a statement with regard to X as the unit. This is an algebraical process.

In the same way, the transition from $(x^2+4x+4)-4=21$ to $x^2+4x+4=25$, or from $(x+2)^2=25$ to $x+2=\sqrt{25}$, is arithmetical; but the transition from $x^2+4x+4=25$ to $(x+2)^2=25$ is algebraical, since it involves a change of the number we are thinking about.

Generally, we may say that algebraic reasoning in reference to equations consists in the alteration of the form of a statement rather than in the deduction of a new statement; *i.e.* it cannot be said that "If A = B, then E = F" is arithmetic, while "If C = D, then E = F" is algebra. Algebraic treatment consists in replacing either of the terms A or B by an expression which we know from the laws of arithmetic to be equivalent to it. The subsequent reasoning is arithmetical.

23. *Sign of Equality.*—The various meanings of the sign of equality (=) must be distinguished.

(i.) 4×3 lb = 12 lb.

This states that the *result* of the operation of multiplying 3 lb by 4 is 12 lb.

(ii.) 4×3 lb = 3×4 lb.

This states that the two operations give the same result; *i.e.* that they are *equivalent*.

(iii.) A's share = 5s., or
3 times A's share = 15s.

Either of these is a statement of fact with regard to a particular quantity; it is usually called an *equation*, but sometimes a *conditional equation*, the term "equation" being then extended to cover (i.) and (ii.).

(iv.) $x^3=x\times x\times x$.

This is a definition of x^3; the sign = is in such cases usually replaced by ≡.

(v.) 24d. = 2s.

This is usually regarded as being, like (ii.), a statement of equivalence. It is, however, only true if 1s. is equivalent to 12d., and the correct statement is then

$$\frac{1\text{s.}}{12\text{d.}}\times 24\text{d.}=2\text{s.}$$

If the operator $\frac{1\text{s.}}{12\text{d.}}\times$ is omitted, the statement is really an equation, giving 1s. in terms of 1d. or *vice versa*.

The following statements should be compared:—

$$X=\text{A's share}=\tfrac{3}{2}\text{ of }£10=3\times£5=£15.$$
$$X=\text{A's share}=\tfrac{3}{2}\text{ of }£10=\tfrac{1}{2}\text{ of }£30=£15.$$

In each case, the first sign of equality comes under (iv.) above, the second under (iii.), and the fourth under (i.); but the third sign comes under (i.) in the first case (the statement being that $\tfrac{1}{2}$ of £10 = £5) and under (ii.) in the second.

It will be seen from § 22 that the application of algebra to equations consists in the interchange of equivalent expressions, and therefore comes under (i.) and (ii.). We replace $4(x-3)$, for instance, by $4x-4\,.\,3$, because we know that, whatever the value of x may be, the result of subtracting 3 from it and multiplying the remainder by 4 is the same as the result of finding $4x$ and $4\,.\,3$ separately and subtracting the latter from the former.

A statement such as (i.) or (ii.) is sometimes called an *identity*.

The two expressions whose equality is stated by an equation or an identity are its *members*.

24. *Use of Letters in General Reasoning.*—It may be assumed that the use of letters to denote quantities or numbers will first arise in dealing with equations, so that the letter used will in each case represent a definite quantity or number; such general statements as those of §§ 15 and 16 being deferred to a later stage. In addition to these, there are cases in which letters can usefully be employed for general arithmetical reasoning.

(i.) There are statements, such as A + B = B + A, which are particular cases of the laws of arithmetic, but need not be expressed as such. For multiplication, for instance, we have the statement that, if P and Q are two quantities, containing respectively p and q of a particular unit, then $p\times Q=q\times P$; or the more abstract statement that $p\times q=q\times p$.

(ii.) The general theory of ratio and proportion requires the use of general symbols.

(iii.) The general statement of the laws of operation of fractions is perhaps best deferred until we come to fractional numbers, when letters can be used to express the laws of multiplication and division of such numbers.

(iv.) *Variation* is generally included in text-books on algebra, but apparently only because the reasoning is general. It is part of the general theory of quantitative relation, and in its elementary stages is a suitable subject for graphical treatment (§ 31).

25. *Preparation for Algebra.*—The calculation of the values of simple algebraical expressions for particular values of letters involved is a useful exercise, but its tediousness is apt to make the subject repulsive.

What is more important is to verify particular examples of general formulae. These formulae are of two kinds:—(*a*) the general properties, such as $m(a+b)=ma+mb$, on which algebra is based, and (*b*) particular formulae such as $(x-a)(x+a)=x^2-a^2$. Such verifications are of value for two reasons. In the first place, they lead to an understanding of what is meant by the use of brackets and by such a statement as $3(7+2)=3.7+3.2$. This does not mean (cf. § 23) that the algebraic result of performing the operation $3(7+2)$ is $3.7+3.2$; it means that if we convert $7+2$ into the single number 9 and then multiply by 3 we get the same result as if we converted 3.7 and 3.2 into 21 and 6 respectively and added the results. In the second place, particular cases lay the foundation for the general formula.

Exercises in the collection of coefficients of various letters occurring in a complicated expression are usually performed mechanically, and are probably of very little value.

26. *General Arithmetical Theorems.*

(i.) The fundamental laws of arithmetic (*q.v.*) should be constantly borne in mind, though not necessarily stated. The following are some special points.

(*a*) The commutative law and the associative law are closely related, and it is best to establish each law for the case of two numbers before proceeding to the general case. In the case of addition, for instance, suppose that we are satisfied that in $a+b+c+d+e$ we may take any two, as b and c, together (association) and interchange them (commutation). Then we have $a+b+c+d+e=a+c+b+d+e$. Thus any pair of adjoining numbers can be interchanged, so that the numbers can be arranged in any order.

(*b*) The important form of the distributive law is $m(\mathrm{A}+\mathrm{B})=m\mathrm{A}+m\mathrm{B}$. The form $(m+n)\mathrm{A}=m\mathrm{A}+n\mathrm{A}$ follows at once from the fact that A is the unit with which we are dealing.

(*c*) The fundamental properties of subtraction and of division are that $\mathrm{A}-\mathrm{B}+\mathrm{B}=\mathrm{A}$ and $m\times\frac{1}{m}$ of $\mathrm{A}=\mathrm{A}$, since in each case the second operation restores the original quantity with which we started.

(ii.) The elements of the theory of numbers belong to arithmetic. In particular, the theorem that if n is a factor of a and of b it is also a factor of $pa\pm qb$, where p and q are any integers, is important in reference to the determination of greatest common divisor and to the elementary treatment of continued fractions. Graphic methods are useful here (§ 34 (iv.)). The law of relation of successive convergents to a continued fraction involves more advanced methods (see § 42 (iii.) and CONTINUED FRACTION).

(iii.) There are important theorems as to the relative value of fractions; *e.g.*

(*a*) If $\frac{a}{b}=\frac{c}{d}$, then each $=\frac{pa\pm qc}{pb\pm qd}$.

(*b*) $\frac{a+n}{b+n}$ is nearer to 1 than $\frac{a}{b}$ is; and, generally, if $\frac{a}{b}\neq\frac{c}{d}$, then $\frac{pa+qc}{pb+qd}$ lies between the two. (All the numbers are, of course, supposed to be positive.)

27. *Negative Quantities and Fractional Numbers.*—(i.) What are usually called "negative numbers" in arithmetic are in reality not negative numbers but *negative quantities*. If a person has to receive 7s. and pay 5s., with a net result of +2s., the order of the operations is immaterial. If he pays first, he then has −5s. This is sometimes treated as a debt of 5s.; an alternative method is to recognize that our zero is really arbitrary, and that in fact we shift it with every operation of addition or subtraction. But when we say "−5s." we mean "−(5s.)," not "(−5)s."; the idea of (−5) as a number with which we can perform such operations as multiplication comes later (§ 49).

(ii.) On the other hand, the conception of a *fractional number* follows directly from the use of fractions, involving the subdivision of a unit. We find that fractions follow certain laws corresponding exactly with those of integral multipliers, and we are therefore able to deal with the fractional numbers as if they were integers.

28. *Miscellaneous Developments in Arithmetic.*—The following are matters which really belong to arithmetic; they are usually placed under algebra, since the general formulae involve the use of letters.

(i.) *Arithmetical Progressions* such as 2, 5, 8, . . .—The formula for the rth term is easily obtained. The problem of finding the sum of r terms is aided by graphic representation, which shows that the terms may be taken in pairs, working from the outside to the middle; the two cases of an odd number of terms and an even number of terms may be treated separately at first, and then combined by the ordinary method, viz. writing the series backwards.

In this, as in almost all other cases, particular examples should be worked before obtaining a general formula.

(ii.) The law of *indices* (positive integral indices only) follows at once from the definition of a^2, a^3, a^4, . . . as abbreviations of $a.a$, $a.a.a$, $a.a.a.a$, . . ., or (by analogy with the definitions of 2, 3, 4, . . . themselves) of $a.a$, $a.a^2$, $a.a^3$, . . . successively. The treatment of roots and of logarithms (all being positive integers) belongs to this subject; $a=\sqrt[p]{n}$ and $p=\log_a n$ being the inverses of $n=a^p$ (cf. §§ 15, 16). The theory may be extended to the cases of $p=1$ and $p=0$; so that a^3 means $a.a.a.1$, a^2 means $a.a.1$, a^1 means $a.1$, and a^0 means 1 (there being then none of the multipliers a).

The terminology is sometimes confused. In $n=a^p$, a is the *root* or *base*, p is the *index* or *logarithm*, and n is the *power* or *antilogarithm*. Thus a, a^2, a^3, . . . are the first, second, third, . . . powers of a. But a^p is sometimes incorrectly described as "a to the power p"; the power being thus confused with the index or logarithm.

(iii.) *Scales of Notation* lead, by considering, *e.g.*, how to express in the scale of 10 a number whose expression in the scale of 8 is 2222222, to

(iv.) *Geometrical Progressions.*—It should be observed that the *radix* of the scale is exactly the same thing as the *root* mentioned under (ii.) above; and it is better to use the term "root" throughout. Denoting the root by a, and the number 2222222 in this scale by N, we have

$$\mathrm{N}=2222222.$$
$$a\mathrm{N}=22222220.$$

Thus by adding 2 to aN we can subtract N from $a\mathrm{N}+2$, obtaining 20000000, which is $=2\,.\,a^7$; and from this we easily pass to the general formula for the sum of a geometrical progression having a given number of terms.

(v.) *Permutations* and *Combinations* may be regarded as arithmetical recreations; they become important algebraically in reference to the binomial theroem (§§ 41, 44).

(vi.) *Surds and Approximate Logarithms.*—From the arithmetical point of view, surds present a greater difficulty than negative quantities and fractional numbers. We cannot solve the equation 7s.+X=4s.; but we are accustomed to transactions of lending and borrowing, and we can therefore invent a negative quantity −3s. such that −3s.+3s.=0. We cannot solve the equation 7X=4s.; but we are accustomed to subdivision of units, and we can therefore give a meaning to X by inventing a unit $\frac{1}{7}$s. such that $7\times\frac{1}{7}$s=1s., and can thence pass to the idea of fractional numbers. When, however, we come to the equation $x^2=5$, where we are dealing with numbers, not with quantities, we have no concrete facts to assist us. We can, however, find a number whose square shall be as nearly equal to 5 as we please, and it is this number that we treat arithmetically as $\sqrt{5}$. We may take it to (say) 4 places of decimals; or we may suppose it to be taken to 1000 places. In actual practice, surds mainly arise out of mensuration; and we can then give an exact definition by graphical methods.

When, by practice with logarithms, we become familiar with the correspondence between additions of length on the logarithmic scale (on a slide-rule) and multiplication of numbers in the natural scale (including fractional numbers), $\sqrt{5}$ acquires a definite meaning as the number corresponding to the extremity of a length x, on the logarithmic scale, such that 5 corresponds to the extremity of $2x$. Thus the concrete fact required to enable us to pass arithmetically from the conception of a fractional number to the conception of a surd is the fact of performing calculations by means of logarithms.

In the same way we regard $\log_{10}2$, not as a new kind of number, but as an approximation.

(vii.) The use of *fractional indices* follows directly from this parallelism. We find that the product $a^m \times a^m \times a^m$ is equal to a^{3m}; and, by definition, the product $\sqrt[3]{a} \times \sqrt[3]{a} \times \sqrt[3]{a}$ is equal to a, which is a^1. This suggests that we should write $\sqrt[3]{a}$ as $a^{1/3}$; and we find that the use of fractional indices in this way satisfies the laws of integral indices. It should be observed that, by analogy with the definition of a fraction, $a^{p/q}$ mean $(a^{1/q})^p$, not $(a^p)^{1/q}$.

II. *Graphical Introduction to Algebra.*

29. The science of *graphics* is closely related to that of *mensuration*. While mensuration is concerned with the representation of geometrical magnitudes by numbers, graphics is concerned with the representation of numerical quantities by geometrical figures, and particularly by lengths. An important development, covering such diverse matters as the equilibrium of forces and the algebraic theory of complex numbers (§ 66), has relation to cases where the numerical quantity has direction as well as magnitude. There are also cases in which graphics and mensuration are used jointly; a variable numerical quantity is represented by a graph, and the principles of mensuration are then applied to determine related numerical quantities. General aspects of the subject are considered under MENSURATION; VECTOR ANALYSIS; INFINITESIMAL CALCULUS.

30. The elementary use of graphic methods is qualitative rather than quantitative; *i.e.* it is for purposes of illustration and suggestion rather than for purposes of deduction and exact calculation. We start with related facts, and adopt a particular method of visualizing the relation. One of the relations most commonly illustrated in this way is the time-relation; the passage of time being associated with the passage of a point along a straight line, so that equal intervals of time are represented by equal lengths.

31. It is important to begin the study of graphics with concrete cases rather than with tracing values of an algebraic function. Simple examples of the time-relation are—the number of scholars present in a class, the height of the barometer, and the reading of the thermometer, on successive days. Another useful set of graphs comprises those which give the relation between the expressions of a length, volume, &c., on different systems of measurement. Mechanical, commercial, economic and statistical facts (the latter usually involving the time-relation) afford numerous examples.

32. The ordinary method of representation is as follows. Let X and Y be the related quantities, their expressions in terms of selected units A and B being x and y, so that $X = x.A$, $Y = y.B$. For graphical representation we select units of length L and M, not necessarily identical. We take a fixed line OX, usually drawn horizontally; for each value of X we measure a length or *abscissa* ON equal to x.L, and draw an *ordinate* NP at right angles to OX and equal to the corresponding value of y . M. The assemblage of ordinates NP is then the *graph* of Y.

The series of values of X will in general be discontinuous, and the graph will then be made up of a succession of parallel and (usually) equidistant ordinates. When the series is theoretically continuous, the theoretical graph will be a continuous figure of which the lines actually drawn are ordinates. The upper boundary of this figure will be a line of some sort; it is this line, rather than the figure, that is sometimes called the "graph." It is better, however, to treat this as a secondary meaning. In particular, the equality or inequality of values of two functions is more readily grasped by comparison of the lengths of the ordinates of the graphs than by inspection of the relative positions of their bounding lines.

33. The importance of the bounding line of the graph lies in the fact that we can keep it unaltered while we alter the graph as a whole by moving OX up or down. We might, for instance, read temperature from 60° instead of from 0°. Thus we form the conception, not only of a zero, but also of the arbitrariness of position of this zero (cf. § 27 (i.)); and we are assisted to the conception of negative quantities. On the other hand, the alteration in the direction of the bounding line, due to alteration in the unit of measurement of Y, is useful in relation to geometrical projection.

This, however, applies mainly to the representation of values of Y. Y is represented by the length of the ordinate NP, so that the representation is cardinal; but this ordinate really corresponds to the point N, so that the representation of X is ordinal. It is therefore only in certain special cases, such as those of simple time-relations (*e.g.* "J is aged 40, and K is aged 26; when will J be twice as old as K?"), that the graphic method leads without arithmetical reasoning to the properties of negative values. In other cases the continuation of the graph may constitute a dangerous extrapolation.

34. Graphic representation thus rests on the principle that equal numerical quantities may be represented by equal lengths, and that a quantity mA may be represented by a length mL, where A and L are the respective units; and the science of graphics rests on the converse property that the quantity represented by pL is pA, *i.e.* that pA is determined by finding the number of times that L is contained in pL. The graphic method may therefore be used in arithmetic for comparing two particular magnitudes of the same kind by comparing the corresponding lengths P and Q measured along a single line OX from the same point O.

(i.) To divide P by Q, we cut off from P successive portions each equal to Q, till we have a piece R left which is less than Q. Thus $P = kQ + R$, where k is an integer.

(ii.) To continue the division we may take as our new unit a submultiple of Q, such as Q/r, where r is an integer, and repeat the process. We thus get $P = kQ + m.Q/r + S = (k + m/r)Q + S$, where S is less than Q/r. Proceeding in this way, we may be able to express $P \div Q$ as the sum of a finite number of terms $k + m/r + n/r^2 + \ldots$; or, if r is not suitably chosen, we may not. If, *e.g.* $r = 10$, we get the ordinary expression of P/Q as an integer and a decimal; but, if P/Q were equal to 1/3, we could not express it as a decimal with a finite number of figures.

(iii.) In the above method the choice of r is arbitrary. We can avoid this arbitrariness by a different procedure. Having obtained R, which is less than Q, we now repeat with Q and R the process that we adopted with P and Q; *i.e.* we cut off from Q successive portions each equal to R. Suppose we find $Q = sR + T$, then we repeat the process with R and T; and so on. We thus express $P \div Q$ in the form of a *continued fraction*, $k + \cfrac{1}{s + \cfrac{1}{t + \&c.}}$, which is usually written, for conciseness, $k + \frac{1}{s+}\,\frac{1}{t+}\,\&c.$, or $k + \frac{1}{s} + \frac{1}{t} + \&c.$

(iv.) If P and Q can be expressed in the forms pL and qL, where p and q are integers, R will be equal to $(p - kq)$L, which is both less than pL and less than qL. Hence the successive remainders are successively smaller multiples of L, but still integral multiples, so that the series of quotients $k, s, t, \ldots$ will ultimately come to an end. Moreover, if the last divisor is uL, then it follows from the theory of numbers (§ 26 (ii.)) that (a) u is a factor of p and of q, and (b) any number which is a factor of p and q is also a factor of u. Hence u is the greatest common measure of p and q.

35. In relation to algebra, the graphic method is mainly useful in connexion with the theory of limits (§§ 58, 61) and the functional treatment of equations (§ 60). As regards the latter, there are two classes of cases. In the first class come equations in a single unknown; here the function which is equated to zero is the Y whose values for different values of X are traced,

and the solution of the equation is the determination of the points where the ordinates of the graph are zero. The second class of cases comprises equations involving two unknowns; here we have to deal with two graphs, and the solution of the equation is the determination of their common ordinates.

Graphic methods also enter into the consideration of irrational numbers (§ 65).

III. *Elementary Algebra of Positive Numbers.*

36. *Monomials.*—(i.) An expression such as $a.2.a.a.b.c.3.a.a.c$, denoting that a series of multiplications is to be performed, is called a *monomial*; the numbers (arithmetical or algebraical) which are multiplied together being its *factors*. An expression denoting that two or more monomials are to be added or subtracted is a *multinomial* or *polynomial*, each of the monomials being a *term* of it. A multinomial consisting of two or of three terms is a *binomial* or a *trinomial*.

(ii.) By means of the commutative law we can collect like terms of a monomial, numbers being regarded as like terms. Thus the above expression is equal to $6a^5bc^2$, which is, of course, equal to other expressions, such as $6ba^5c^2$. The numerical factor 6 is called the *coefficient* of a^5bc^2 (§ 20); and, generally, the coefficient of any factor or of the product of any factors is the product of the remaining factors.

(iii.) The multiplication and division of monomials is effected by means of the law of indices. Thus $6a^5bc^2 \div 5a^2bc = \frac{6}{5}a^3c$, since $b^0 = 1$. It must, of course, be remembered (§ 23) that this is a statement of arithmetical equality; we call the statement an "identity," but we do not mean that the expressions are the same, but that, whatever the numerical values of a, b and c may be, the expressions give the same numerical result.

In order that a monomial containing a^m as a factor may be divisible by a monomial containing a^p as a factor, it is necessary that p should be not greater than m.

(iv.) In algebra we have a theory of *highest common factor* and *lowest common multiple*, but it is different from the arithmetical theory of greatest common divisor and least common multiple. We disregard numerical coefficients, so that by the H.C.F. or L.C.M. of $6a^5bc^2$ and $12a^4b^2cd$ we mean the H.C.F. or L.C.M. of a^5bc^2 and a^4b^2cd. The H.C.F. is then an expression of the form $a^pb^qc^rd^s$, where p, q, r, s have the greatest possible values consistent with the condition that each of the given expressions shall be divisible by $a^pb^qc^rd^s$. Similarly the L.C.M. is of the form $a^pb^qc^rd^s$, where p, q, r, s have the least possible values consistent with the condition that $a^pb^qc^rd^s$ shall be divisible by each of the given expressions. In the particular case it is clear that the H.C.F. is a^4bc and the L.C.M. is $a^5b^2c^2d$.

The extension to multinomials forms part of the theory of factors (§ 51).

37. *Products of Multinomials.*—(i.) Special arithmetical results may often be used to lead up to algebraical formulae. Thus a comparison of numbers occurring in a table of squares

$$\begin{array}{lcl} 1^2 = 1 & \qquad & 11^2 = 121 \\ 2^2 = 4 & & 12^2 = 144 \\ 3^2 = 9 & & 13^2 = 169 \\ \vdots & & \vdots \end{array}$$

suggests the formula $(A+a)^2 = A^2 + 2Aa + a^2$. Similarly the equalities

$$\begin{array}{l} 99 \times 101 = 9999 = 10000 - 1 \\ 98 \times 102 = 9996 = 10000 - 4 \\ 97 \times 103 = 9991 = 10000 - 9 \\ \quad\vdots \qquad\qquad\quad \vdots \end{array}$$

lead up to $(A-a)\ (A+a) = A^2 - a^2$. These, with $(A-a)^2 = A^2 - 2Aa + a^2$, are the most important in elementary work.

(ii.) These algebraical formulae involve not only the distributive law and the law of signs, but also the commutative law. Thus $(A+a)^2 = (A+a)(A+a) = A(A+a) + a(A+a) = AA + Aa + aA + aa$; and the grouping of the second and third terms as $2Aa$ involves treating Aa and aA as identical. This is important when we come to the binomial theorem (§ 41, and cf. § 54 (i.)).

(iii.) By writing $(A+a)^2 = A^2 + 2Aa + a^2$ in the form $(A+a)^2 = A^2 + (2A+a)a$, we obtain the rule for extracting the square root in arithmetic.

(iv.) When the terms of a multinomial contain various powers of x, and we are specially concerned with x, the terms are usually arranged in descending (or ascending) order of the indices; terms which contain the same power being grouped so as to give a single coefficient. Thus $2bx - 4x^2 + 6ab + 3ax$ would be written $-4x^2 + (3a+2b)x + 6ab$. It is not necessary to regard -4 here as a negative number; all that is meant is that $4x^2$ has to be subtracted.

(v.) When we have to multiply two multinomials arranged according to powers of x, the method of *detached coefficients* enables us to omit the powers of x during the multiplication. If any power is absent, we treat it as present, but with coefficient 0. Thus, to multiply $x^3 - 2x + 1$ by $2x^2 + 4$, we write the process

$$\begin{array}{rrrrrr} +1 & +0 & -2 & +1 & & \\ +2 & +0 & +4 & & & \\ \hline +2 & +0 & -4 & +2 & & \\ & +0 & +0 & -0 & +0 & \\ & & +4 & +0 & -8 & +4 \\ \hline +2 & +0 & +0 & +2 & -8 & +4 \end{array}$$

giving $2x^5 + 2x^2 - 8x + 4$ as the result.

38. *Construction and Transformation of Equations.*—(i.) The statement of problems in equational form should precede the solution of equations.

(ii.) The solution of equations is effected by transformation, which may be either arithmetical or algebraical. The principles of arithmetical transformation follow from those stated in §§ 15-18 by replacing X, A, B, m, M, x, n, a and p by any expressions involving or not involving the unknown quantity or number and representing positive numbers or (in the case of X, A, B and M) positive quantities. The principle of algebraic transformation has been stated in § 22; it is that, if $A = B$ is an equation (*i.e.* if either or both of the expressions A and B involves x, and A is arithmetically equal to B for the particular value of x which we require), and if $B = C$ is an identity (*i.e.* if B and C are expressions involving x which are different in form but are arithmetically equal for all values of x), then the statement $A = C$ is an equation which is true for the same value of x for which $A = B$ is true.

(iii.) A special rule of transformation is that any expression may be transposed from one side of an equation to the other, provided its sign is changed. This is the *rule of transposition.* Suppose, for instance, that $P+Q-R+S=T$. This may be written $(P+Q-R)+S=T$; and this statement, by definition of the sign $-$, is the same as the statement that $(P+Q-R) = T-S$. Similarly the statements $P+Q-R-S=T$ and $P+Q-R=T+S$ are the same. These transpositions are purely arithmetical. To transpose a term which is not the last term on either side we must first use the commutative law, which involves an algebraical transformation. Thus from the equation $P+Q-R+S=T$ and the identity $P+Q-R+S=P-R+S+Q$ we have the equation $P-R+S+Q=T$, which is the same statement as $P-R+S=T-Q$.

(iv.) The procedure is sometimes stated differently, the transposition being regarded as a corollary from a general theorem that the roots of an equation are not altered if the same expression is added to or subtracted from both members of the equation. The objection to this (cf. § 21 (ii.)) is that we do not need the general theorem, and that it is unwise to cultivate the habit of laying down a general law as a justification for an isolated action.

(v.) An alternative method of obtaining the rule of transposition is to change the zero from which we measure. Thus from $P+Q-R+S=T$ we deduce $P+(Q-R+S) = P+(T-P)$. If instead of measuring from zero we measure from P, we find $Q-R+S=T-P$. The difference between this and (iii.) is that we transpose the first term instead of the last; the two methods corresponding to the two cases under (i.) of § 15 (2).

(vi.) In the same way, we do not lay down a general rule that an equation is not altered by multiplying both members by the same number. Suppose, for instance, that $\frac{2}{5}(x+1)=\frac{4}{3}(x-2)$. Here each member is a number, and the equation may, by the commutative law for multiplication, be written $\frac{2(x+1)}{5}=\frac{4(x-2)}{3}$. This means that, whatever unit A we take, $\frac{2(x+1)}{5}$ A and $\frac{4(x-2)}{3}$ A are equal. We therefore take A to be 15, and find that $6(x+1)=20(x-2)$. Thus, if we have an equation $P=Q$, where P and Q are numbers involving fractions, we can clear of fractions, not by multiplying P and Q by a number m, but by applying the equal multiples P and Q to a number m as unit. If the P and Q of our equation were quantities expressed in terms of a unit A, we should restate the equation in terms of a unit A/m, as explained in §§ 18 and 21 (i.) (a).

(vii.) One result of the rule of transposition is that we can transpose all the terms in x to one side of equation, and all the terms not containing x to the other. An equation of the form $ax=b$, where a and b do not contain x, is the standard form of *simple equation*.

(viii.) The *quadratic equation* is the equation of two expressions, monomial or multinomial, none of the terms involving any power of x except x and x^2. The standard form is usually taken to be

$$ax^2+bx+c=0,$$

from which we find, by transformation,

$$(2ax+b)^2=b^2-4ac,$$

and thence

$$x=\frac{\sqrt{\{b^2-4ac\}}-b}{2a}.$$

This only gives one root. As to the other root, see § 47 (iii.).

39. *Fractional Expressions.*—An equation may involve a fraction of the form $\frac{P}{Q}$, where Q involves x.

(i.) If P and Q can (algebraically) be written in the forms RA and SA respectively, where A may or may not involve x, then $\frac{P}{Q}=\frac{RA}{SA}=\frac{R}{S}$, *provided A is not* $=0$.

(ii.) In an equation of the form $\frac{P}{Q}=\frac{U}{V}$, the expressions P, Q, U, V are usually numerical. We then have $\frac{P}{Q}.QV.=\frac{U}{V}.QV$, or $PV=UQ$, as in § 38 (vi.). This is the *rule of cross-multiplication.*

(iii.) The restriction in (i.) is important. Thus $\frac{x^2-1}{x^2+x-2}=\frac{(x-1)(x+1)}{(x-1)(x+2)}$ is equal to $\frac{x+1}{x+2}$, except when $x=1$. For this latter value it becomes $\frac{0}{0}$, which has no direct meaning, and requires interpretation (§ 61).

40. *Powers of a Binomial.*—We know that $(A+a)^2=A^2+2Aa+a^2$. Continuing to develop the successive powers of $A+a$ into multinomials, we find that $(A+a)^3=A^3+3A^2a+3Aa^2+a^3$, &c.; each power containing one more term than the preceding power, and the coefficients, when the terms are arranged in descending powers of A, being given by the following table:—

$$\begin{array}{lllllll}
1 \\
1 & 1 \\
1 & 2 & 1 \\
1 & 3 & 3 & 1 \\
1 & 4 & 6 & 4 & 1 \\
1 & 5 & 10 & 10 & 5 & 1 \\
1 & 6 & 15 & 20 & 15 & 6 & 1 \\
 & & \&c.,
\end{array}$$

where the first line stands for $(A+a)^0=1.A^0a^0$, and the successive numbers in the $(n+1)$th line are the coefficients of $A^na^0, A^{n-1}a^1, \ldots A^0a^n$ in the $n+1$ terms of the multinomial equivalent to $(A+a)^n$.

In the same way we have $(A-a)^2=A^2-2Aa+a^2$, $(A-a)^3=A^3-3A^2a+3Aa^2-a^3, \ldots$, so that the multinomial equivalent to $(A-a)^n$ has the same coefficients as the multinomial equivalent to $(A+a)^n$, but with signs alternately + and −.

The multinomial which is equivalent to $(A\pm a)^n$, and has its terms arranged in ascending powers of a, is called the *expansion* of $(A\pm a)^n$.

41. The *binomial theorem* gives a formula for writing down the coefficient of any stated term in the expansion of any stated power of a given binomial.

(i.) For the general formula, we need only consider $(A+a)^n$. It is clear that, since the numerical coefficients of A and of a are each 1, the coefficients in the expansions arise from the grouping and addition of like terms (§ 37 (ii.)). We therefore determine the coefficients by counting the grouped terms individually, instead of adding them. To individualize the terms, we replace $(A+a)(A+a)(A+a)\ldots$ by $(A+a)(B+b)(C+c)\ldots$, so that no two terms are the same; the "like"-ness which determines the placing of two terms in one group being the fact that they become equal (by the commutative law) when B, C, . . . and $b, c, \ldots$ are each replaced by A and a respectively.

Suppose, for instance, that $n=5$, so that we take five factors $(A+a)(B+b)(C+c)(D+d)(E+e)$ and find their product. The coefficient of A^2a^3 in the expansion of $(A+a)^5$ is then the number of terms such as ABcde, AbCde, AbCde, . . . , in each of which there are two large and three small letters. The first term is ABCDE, in which all the letters are large; and the coefficient of A^2a^3 is therefore the number of terms which can be obtained from ABCDE by changing three, and three only, of the large letters into small ones.

We can begin with any one of the 5 letters, so that the first change can be made in 5 ways. There are then 4 letters left, and we can change any one of these. Then 3 letters are left, and we can change any one of these. Hence the change can be made in 3.4.5 ways.

If, however, the 3.4.5 results of making changes like this are written down, it will be seen that any one term in the required product is written down several times. Consider, for instance, the term A$bc$D$e$, in which the small letters are bce. Any one of these 3 might have appeared first, any one of the remaining 2 second, and the remaining 1 last. The term therefore occurs 1.2.3 times. This applies to each of the terms in which there are two large and three small letters. The total number of such terms in the multinomial equivalent to $(A+a)(B+b)(C+c)(D+d)(E+e)$ is therefore $(3.4.5)\div(1.2.3)$; and this is therefore the coefficient of A^2a^3 in the expansion of $(A+a)^5$.

The reasoning is quite general; and, in the same way, the coefficient of $A^{n-r}a^r$ in the expansion of $(A+a)^n$ is $\{(n-r+1)(n-r+2)\ldots(n-1)n\}\div\{1.2.3\ldots r\}$. It is usual to write this as a fraction, inverting the order of the factors in the numerator. Then, if we denote it by $n_{(r)}$, so that

$$n_{(r)}\equiv\frac{n(n-1)\ldots(n-r+1)}{1.2.3\ldots r} \qquad (1),$$

we have

$$(A+a)^n=n_{(0)}A^n+n_{(1)}A^{n-1}a+\ldots+n_{(r)}A^{n-r}a^r+\ldots+n_{(n)}a^n \qquad (2),$$

where $n_{(0)}$, introduced for consistency of notation, is defined by

$$n_{(0)}\equiv1 \qquad (3).$$

This is the *binomial theorem* for a positive integral index.

(ii.) To verify this, let us denote the true coefficient of $A^{n-r}a^r$ by $\binom{n}{r}$, so that we have to prove that $\binom{n}{r}=n_{(r)}$, where $n_{(r)}$ is defined by (1); and let us inspect the actual process of multiplying the expansion of $(A+a)^{n-1}$ by $A+a$ in order to obtain that of $(A+a)^n$. Using detached coefficients (§ 37 (v.)), the multiplication is represented by the following:—

$$\begin{array}{lllllllllllll}
1 & + & \binom{n-1}{1} & + & \binom{n-1}{2} & +\ldots+ & \binom{n-1}{r} & +\ldots+ & 1 & & \\
 & & 1 & + & \binom{n-1}{1} & +\ldots+ & \binom{n-1}{r-1} & +\ldots+ & \binom{n-1}{n-2} & + & 1 \\
\hline
1 & + & \binom{n}{1} & + & \binom{n}{2} & +\ldots+ & \binom{n}{r} & +\ldots+ & \binom{n}{n-1} & + & 1,
\end{array}$$

so that

$$\binom{n}{r}=\binom{n-1}{r}+\binom{n-1}{r-1}.$$

Now suppose that the formula (2) has been established for every power of $A+a$ up to the $(n-1)$th inclusive, so that $\binom{n-1}{r}=(n-1)_{(r)}$, $\binom{n-1}{r-1}=(n-1)_{(r-1)}$. Then $\binom{n}{r}$, the coefficient of $A^{n-r}a^r$ in the expansion of $(A+a)^n$, is equal to $(n-1)_{(r)}+(n-1)_{(r-1)}$. But it may be shown that (r being >0)

$$n_{(r)}=(n-1)_{(r)}+(n-1)_{(r-1)} \qquad (4),$$

and therefore $\binom{n}{r}=n_{(r)}.$

Hence the formula (2) is also true for the nth power of $A+a$. But it is true for the 1st and the 2nd powers; therefore it is true for the 3rd; therefore for the 4th; and so on. Hence it is true for all positive integral powers of n.

(iii.) The product 1. 2. 3 . . . r is denoted by $\underline{|r}$ or $r!$, and is called *factorial* r. The form $r!$ is better for printing, but the form $\underline{|r}$ is more convenient for ordinary use. If we denote $n(n-1)\ .\ .\ .\ (n-r+1)$ (r factors) by $n^{(r)}$, then $n_{(r)}=n^{(r)}/r!$.

(iv.) We can write $n_{(r)}$ in the more symmetrical form

$$n_{(r)}=\frac{n!}{(n-r)!\ r!} \qquad (5),$$

which shows that

$$n_{(r)}=n_{(n-r)} \qquad (6).$$

We should have arrived at this form in (i.) by considering the selection of terms in which there are to be two large and three small letters, the large letters being written down first. The terms can be built up in 5! ways; but each will appear 2! 3! times.

(v.) Since $n_{(r)}$ is an integer, $n^{(r)}$ is divisible by $r!$; *i.e.* the *product of any r consecutive integers is divisible by r!* (see § 42 (ii.)).

(vi.) The product $r!$ arose in (i.) by the successive multiplication of $r, r-1, r-2, \dots 1$. In practice the successive factorials 1!, 2!, 3! . . . are supposed to be obtained successively by introduction of new factors, so that

$$r!=r.\ (r-1)! \qquad (7).$$

Thus in defining $r!$ as 1. 2. 3 . . . r we regard the multiplications as taking place from left to right; and similarly in $n^{(r)}$. A product in which multiplications are taken in this order is called a *continued product*.

(vii.) In order to make the formula (5) hold for the extreme values $n_{(0)}$ and $n_{(n)}$ we must adopt the convention that

$$0!=1 \qquad (8).$$

This is consistent with (7), which gives $1!=1.0!$. It should be observed that, for $r=0$, (4) is replaced by

$$n_{(0)}=(n-1)_{(0)} \qquad (9),$$

and similarly, for the final terms, we should note that

$$p_{(q)}=0 \text{ if } q>p \qquad (10).$$

(viii.) If u_r denotes the term involving a^r in the expansion of $(A+a)^n$, then $u_r/u_{r-1}=\{(n-r+1)/r\}.a/A$. This decreases as r increases; its value ranging from na/A to $a/(nA)$. If $na<A$, the terms will decrease from the beginning; if $n\,A<a$, the terms will increase up to the end; if $na>A$ and $nA>a$, the terms will first increase up to a greatest term (or two consecutive equal greatest terms) and then decrease.

(ix.) The position of the greatest term will depend on the relative values of A and a; if a/A is small, it will be near the beginning. Advantage can be taken of this, when n is large, to make approximate calculations, by omitting terms that are negligible.

(*a*) Let S_r denote the sum $u_0+u_1+\ .\ .\ .\ +u_r$, this sum being taken so as to include the greatest term (or terms); and let $u_{r+1}/u_r=\theta$, so that $\theta<1$. Then the sum of the remaining terms $u_{r+1}+u_{r+2}+\ .\ .\ .+u_n$ is less than $(1+\theta+\theta^2+\ .\ .\ .\ +\theta^{n-r-1})u_{r+1}$, which is less than $u_{r+1}/(1-\theta)$; and therefore $(A+a)^n$ lies between S_r and $S_r+u_{r+1}/(1-\theta)$. We can therefore stop as soon as $u_{r+1}/\ (1-\theta)$ becomes negligible.

(*b*) In the same way, for the expansion of $(A-a)^n$, let σ_r denote $u_0-u_1+\ .\ .\ .\ \pm u_r$. Then, provided σ_r includes the greatest term, it will be found that $(A-a)^n$ lies between σ_r and σ_{r+1}.

For actual calculation it is most convenient to write the theorem in the form

$$(A\pm a)^n=A^n(1\pm x)^n=A^n\pm\frac{n}{1}x.A^n+\frac{n-1}{2}x.\frac{n}{1}x.A^n\pm\dots$$

where $x\equiv a/A$; thus the successive terms are obtained by successive multiplication. To apply the method to the calculation of N^n, it is necessary that we should be able to express N in the form $A+a$ or $A-a$, where a is small in comparison with A, A^n is easy to calculate and a/A is convenient as a multiplier.

42. The reasoning adopted in § 41 (ii.) illustrates two general methods of procedure. We know that $(A+a)^n$ is equal to a multinomial of $n+1$ terms with unknown coefficients, and we require to find these coefficients. We therefore represent them by separate symbols, in the same way that we represent the unknown quantity in an equation by a symbol. This is the method of *undetermined coefficients*. We then obtain a set of equations, and by means of these equations we establish the required result by a process known as *mathematical induction*. This process consists in proving that a property involving p is true when p is any positive integer by proving (1) that it is true when $p=1$, and (2) that if it is true when $p=n$, where n is any positive integer, then it is true when $p=n+1$. The following are some further examples of mathematical induction.

(i.) By adding successively 1, 3, 5 . . . we obtain 1, 4, 9, . . . This suggests that, if u_n is the sum of the first n odd numbers, then $u_n=n^2$. Assume this true for $u_1, u_2, \dots, u_n$. Then $u_{n+1}=u_n+(2n+1)=n^2+(2n+1)=(n+1)^2$, so that it is true for u_{n+1}. But it is true for u_1. Therefore it is true generally.

(ii.) We can prove the theorem of § 41 (v.) by a double application of the method.

(*a*) It is clear that every integer is divisible by 1!.

(*b*) Let us assume that the product of every set of p consecutive integers is divisible by $p!$, and let us try to prove that the product of every set of $p+1$ consecutive integers is divisible by $(p+1)!$. Denote the product $n(n+1)\ .\ .\ .\ (n+r-1)$ by $n^{[r]}$. Then the assumption is that, whatever positive integral value n may have, $n^{[p]}$ is divisible by $p!$.

(1) $n^{[p+1]}-(n-1)^{[p+1]}=n(n+1)\dots(n+p-1)(n+p)-(n-1)n\ .\ .\ .\ (n+p-1)=(p+1).\ n^{[p]}$. But, by hypothesis, $n^{[p]}$ is divisible by p!. Therefore $n^{[p+1]}-(n-1)^{[p+1]}$ is divisible by $p!$. Therefore, if $(n-1)^{[p+1]}$ is divisible by $(p+1)!$, $n^{[p+1]}$ is divisible by $(p+1)!$.

(2) But $1^{[p+1]}=(p+1)!$, which is divisible by $(p+1)!$.

(3) Therefore $n^{[p+1]}$ is divisible by $(p+1)!$, whatever positive integral value n may have.

(*c*) Thus, if the theorem of § 41 (v.) is true for $r=p$, it is true for $r=p+1$. But it is true for $r=1$. Therefore it is true generally.

(iii.) Another application of the method is to proving the law of formation of consecutive convergents to a continued fraction (see CONTINUED FRACTIONS).

43. *Binomial Coefficients.*—The numbers denoted by $n_{(r)}$ in § 41 are the *binomial coefficients* shown in the table in § 40; $n_{(r)}$ being the $(r+1)$th number in the $(n+1)$th row. They have arisen as the coefficients in the expansion of $(A+a)^n$; but they may be considered independently as a system of numbers defined by (1) of § 41. The individual numbers are connected by various relations, some of which are considered in this section.

(i.) From (4) of § 41 we have

$$n_{(r)}-(n-1)_{(r)}=(n-1)_{(r-1)} \qquad (11).$$

Changing n into $n-1$, $n-2$, . . ., and adding the results,

$$n_{(r)}-(n-s)_{(r)}=(n-1)_{(r-1)}+(n-2)_{(r-1)}+\dots+(n-s)_{(r-1)} \qquad (12).$$

In particular,

$$n_{(r)}=(n-1)_{(r-1)}+(n-2)_{(r-1)}+\dots+(r-1)_{(r-1)} \qquad (13).$$

Similarly, by writing (4) in the form

$$n_{(r)}-(n-1)_{(r-1)}=(n-1)_{(r)} \qquad (14),$$

changing n and r into $n-1$ and $r-1$, repeating the process, and adding, we find, taking account of (9),

$$n_{(r)}=(n-1)_{(r)}+(n-2(_{(r-1)}+\dots+(n-r-1)_0 \qquad (15).$$

(ii.) It is therefore more convenient to rearrange the table of § 40 as shown below, on the left; the table on the right giving the key to the arrangement.

$$\begin{array}{ccccccccc}
1 &&&&&&&& \\
& 1 &&&&&&& \\
1 && 1 &&&&&& \\
& 2 && 1 &&&&& \\
1 && 3 && 1 &&&& \\
& 3 && 4 && 1 &&& \\
1 && 6 && 5 && 1 && \\
& 4 && 10 && 6 && 1 & \\
1 && 10 && 15 && 7 && 1 \\
&& \&c. &&&&&&
\end{array}
\qquad
\begin{array}{ccccccccc}
0_{(0)} &&&&&&&& \\
& 1_{(1)} &&&&&&& \\
1_{(0)} && 2_{(2)} &&&&&& \\
& 2_{(1)} && 3_{(3)} &&&&& \\
2_{(0)} && 3_{(2)} && 4_{(4)} &&&& \\
& 3_{(1)} && 4_{(3)} && 5_{(5)} &&& \\
3_{(0)} && 4_{(2)} && 5_{(4)} && 6_{(6)} && \\
& 4_{(1)} && 5_{(3)} && 6_{(5)} && 7_{(7)} & \\
4_{(0)} && 5_{(2)} && 6_{(4)} && 7_{(6)} && 8_{(8)} \\
&&&& \&c. &&&&
\end{array}$$

Here we have introduced a number $0_{(0)}$ given by

$$0_{(0)}=1 \qquad (16),$$

which is consistent with the relations in (i.). In this table any number is equal to the sum of the numbers which lie horizontally above it in the preceding column, and the difference of any two numbers in a column is equal to the sum of the numbers horizontally between them in the preceding column.

The coefficients in the expansion of $(A+a)^n$ for any particular value of n are obtained by reading diagonally upwards from left to right from the $(n+1)$th number in the first column.

(iii.) The table might be regarded as constructed by successive applications of (9) and (4); the initial data being (16) and (10). Alternatively, we might consider that we start with the first diagonal row (downwards from the left) and construct the remaining diagonal rows by successive applications of (15). Constructed in this way, the successive diagonal rows, commencing with the first, give the *figurate* numbers of the first, second, third, . . . order. The $(r+1)$th figurate number of the nth order, *i.e.* the $(r+1)$th number in the nth diagonal row, is $n(n+1)\ \ldots\ (n+r-1)/r!=n^{[r]}/r!$; this may, by analogy with the notation of §41, be denoted by $n_{[r]}$. We then have

$$(n+1)_{[r]}=(r+1)_{[n]}=(n+r)!/(n!\,r!)=(n+r)_{(r)}=(n+r)_{(n)} \quad (17).$$

(iv.) By means of (17) the relations between the binomial coefficients in the form $p_{(q)}$ may be replaced by others with the coefficients expressed in the form $p_{[q]}$. The table in (ii.) may be written

$$\begin{array}{ccccccccc}
1_{[0]} & & & & & & & & \\
 & 1_{[1]} & & & & & & & \\
2_{[0]} & & 1_{[2]} & & & & & & \\
 & 2_{[1]} & & 1_{[3]} & & & & & \\
3_{[0]} & & 2_{[2]} & & 1_{[4]} & & & & \\
 & 3_{[1]} & & 2_{[3]} & & 1_{[5]} & & & \\
4_{[0]} & & 3_{[2]} & & 2_{[4]} & & 1_{[6]} & & \\
 & 4_{[1]} & & 3_{[3]} & & 2_{[5]} & & 1_{[7]} & \\
5_{[0]} & & 4_{[2]} & & 3_{[4]} & & 2_{[6]} & & 1_{[8]} \\
 & & & \text{\&c.} & & & & &
\end{array}$$

The most important relations are

$$n_{[r]}=n_{[r-1]}+(n-1)_{[r]} \qquad (18);$$

$$0_{[r]}=0 \qquad (19);$$

$$n_{[r]}-(n-s)_{[r]}=n_{[r-1]}+(n-1)_{[r-1]}+\ldots+(n-s+1)_{[r-1]} \quad (20);$$

$$n_{[r]}=n_{[r-1]}+(n-1)_{[r-1]}+\ldots+1_{[r-1]} \qquad (21).$$

(v.) It should be mentioned that the notation of the binomial coefficients, and of the continued products such as $n(n-1)\ \ldots\ (n-r+1)$, is not settled. Some writers, for instance, use the symbol n_r in place, in some cases, of $n_{(r)}$, and, in other cases, of $n^{(r)}$. It is convenient to retain x_r to denote $x^r/r!$, so that we have the consistent notation

$$x_r=x^r/r!,\ n_{(r)}=n^{(r)}/r!,\ n_{[r]}=n^{[r]}/r!.$$

The binomial theorem for positive integral index may then be written

$$(x+y)_n=x_ny_0+x_{n-1}y_1+\ldots+x_{n-r}y_r+\ldots+x_0y_n.$$

This must not be confused with the use of suffixes to denote particular terms of a series or a progression (as in § 41 (viii.) and (ix.)).

44. *Permutations and Combinations.*—The discussion, in § 41 (i.), of the number of terms of a particular kind in a particular product, forms part of the theory of *combinatorial analysis* (*q.v.*), which deals with the grouping and arrangement of individuals taken from a defined stock. The following are some particular cases; the proof usually follows the lines already indicated. Certain of the individuals may be distinguishable from the remainder of the stock, but not from each other; these may be called a *type*.

(i.) A *permutation* is a linear arrangement, read in a definite direction of the line. The number $({}_nP_r)$ of permutations of r individuals out of a stock of n, all being distinguishable, is $n^{(r)}$. In particular, the number of permutations of the whole stock is $n!$.

If a of the stock are of one type, b of another, c of another, . . . the number of distinguishable permutations of the whole stock is $n!\div(a!b!c!\ \ldots)$.

(ii.) A *combination* is a group of individuals without regard to arrangement. The number $({}_nC_r)$ of combinations of r individuals out of a stock of n has in effect been proved in § 41 (i.) to be $n_{(r)}$. This property enables us to establish, by simple reasoning, certain relations between binomial coefficients. Thus (4) of § 41 (ii.) follows from the fact that, if A is any one of the n individuals, the ${}_nC_r$ groups of r consist of ${}_{n-1}C_{r-1}$ which contain A and ${}_{n-1}C_r$ which do not contain A. Similarly, considering the various ways in which a group of r may be obtained from two stocks, one containing m and the other containing n, we find that

$${}_{m+n}C_r={}_mC_r\cdot{}_nC_0+{}_mC_{r-1}\cdot{}_nC_1+\ldots+{}_mC_0\cdot{}_nC_r,$$

which gives

$$(m+n)_{(r)}=m_{(r)}.n_{(0)}+m_{(r-1)}.n_{(1)}+\ldots+m_{(0)}.n_{(r)} \qquad (22).$$

This may also be written

$$(m+n)^{(r)}=m^{(r)}.n^{(0)}+r_{(1)}.m^{(r-1)}.n^{(1)}+\ldots+r_{(r)}.m^{(0)}.n^{(r)} \quad (23).$$

If r is greater than m or n (though of course not greater than $m+n$), some of the terms in (22) and (23) will be zero.

(iii.) If there are n types, the number of individuals in each type being unlimited (or at any rate not less than r), the number $({}_nH_r)$ of distinguishable groups of r individuals out of the total stock is $n_{[r]}$. This is sometimes called the number of *homogeneous products of r dimensions* formed out of n letters; *i.e.* the number of products such as x^r, $x^{r-3}y^3$, $x^{r-2}z^2$, . . . that can be formed with positive integral indices out of n letters $x, y, z,\ \ldots$, the sum of the indices in each product being r.

(iv.) Other developments of the theory deal with *distributions*, *partitions*, &c. (see COMBINATORIAL ANALYSIS).

(v.) The theory of *probability* (*q.v.*) also comes under this head. Suppose that there are a number of arrangements of r terms or elements, the first of which a is always either A or not-A, the second b is B or not-B, the third c is C or not-C, and so on. If, out of every N cases, where N may be a very large number, a is A in pN cases and not-A in $(1-p)$N cases, where p is a fraction such that pN is an integer, then p is the *probability* or *frequency* of occurrence of A. We may consider that we are dealing always with a single arrangement $abc\ \ldots$, and that the number of times that a is made A bears to the number of times that a is made not-A the ratio of p to $1-p$; or we may consider that there are N individuals, for pN of which the *attribute* a is A, while for $(1-p)$N it is not-A. If, in this latter case, the proportion of cases in which b is B to cases in which b is not-B is the same for the group of pN individuals in which a is A as for the group of $(1-p)$N in which a is not-A, then the frequencies of A and of B are said to be *independent*; if this is not the case they are said to be *correlated*. The possibilities of a, instead of being A and not-A, may be $A_1, A_2,\ \ldots$, each of these having its own frequency; and similarly for $b, c,\ \ldots$ If the frequency of each A is independent of the frequency of each B, then the attributes a and b are independent; otherwise they are correlated.

45. *Application of Binomial Theorem to Rational Integral Functions.*—An expression of the form $c_0x^n+c_1x^{n-1}+\ \ldots\ +c_n$, where $c_0, c_1,\ \ldots$ do not involve x, and the indices of the powers of x are all positive integers, is called a *rational integral function* of x of *degree n*.

If we represent this expression by $f(x)$, the expression obtained by changing x into $x+h$ is $f(x+h)$; and each term of this may be expanded by the binomial theorem. Thus we have

$$\begin{aligned}
f(x+)h &= c_0x^n+nc_0x^{n-1}\frac{h}{1!}+n(n-1)c_0x^{n-2}\frac{h^2}{2!}+\ldots \\
&\quad +c_1x^{n-1}+(n-1)c_1x^{n-2}\frac{h}{1!}+(n-1)(n-2)c_1x^{n-3}\frac{h^2}{2!}+\ldots \\
&\quad +c_2x^{n-2}+(n-2)c_2x^{n-3}\frac{h}{1!}+(n-2)(n-3)c_2x^{n-4}\frac{h^2}{2!}+\ldots \\
&\quad +\ \text{\&c.} \\
&= \{c_0x^n+c_1x^{n-1}+c_2x^{n-2}+\ldots\} \\
&\quad +\left\{nc_0x^{n-1}+(n-1)c_1x^{n-2}+(n-2)c_2x^{n-3}+\ldots\right\}\frac{h}{1!} \\
&\quad +\left\{n(n-1)c_0x^{n-2}+(n-1)(n-2)c_1x^{n-3}+\ldots\right\}\frac{h^2}{2!} \\
&\quad +\ \text{\&c.}
\end{aligned}$$

It will be seen that the expression in curled brackets in each line after the first is obtained from the corresponding expression in the preceding line by a definite process; viz. x_r is replaced by

$r.x^{r-1}$, except for $r=0$, when x^0 is replaced by 0. The expressions obtained in this way are called the *first*, *second*, . . . *derived functions* of $f(x)$. If we denote these by $f_1(x)$, $f_2(x)$, . . ., so that $f_s(x)$ is obtained from $f_{s-1}(x)$ by the above process, we have

$$f(x+h)=f(x)+f_1(x).h+f_2(x)h^2/2!+\dots+f_r(x)h^r/r!+\dots$$

This is a particular case of *Taylor's theorem* (see INFINITESIMAL CALCULUS).

46. *Relation of Binomial Coefficients to Summation of Series.*—(i.) The sum of the first n terms of an ordinary arithmetical progression $(a+b)$, $(a+2b)$, . . . $(a+nb)$ is (§ 28 (i.)) $\frac{1}{2}n\,\{(a+b)+(a+nb)\} = na+\frac{1}{2}n(n+1)b = n_{[1]}.a+n_{[2]}.b$. Comparing this with the table in §43 (iv.), and with formula (21), we see that the series expressing the sum may be regarded as consisting of two, viz. $a+a+$ . . . and $b+2b+3b+$ . . . ; for the first series we multiply the table (*i.e.* each number in the table) by a, and for the second series we multiply it by b, and the terms and their successive sums are given for the first series by the first and the second columns, and for the second series by the second and the third columns.

(ii.) In the same way, if we multiply the table by c, the sum of the first n numbers in any column is equal to the nth number in the next following column. Thus we get a formula for the sum of n terms of a series such as

$$2.4.6+4.6.8+\dots,\ \text{or}\ 6.8.10.12+8.10.12.14+\dots$$

(iii.) Suppose we have such a series as $2.5+5.8+8.11+$ . . . This cannot be summed directly by the above method. But the nth term is $(3n-1)(3n+2)=18n_{[2]}-6n_{[1]}-2$. The sum of n terms is therefore (§ 43 (iv.))

$$18n_{[3]}-6n_{[2]}-2n_{[1]}=3n^3+6n^2+n.$$

(iv.) Generally, let N be any rational integral function of n of degree r. Then, since $n_{[r]}$ is also a rational integral function of n of degree r, we can find a coefficient c_r, not containing n, and such as to make $\mathrm{N}-c_r n_{[r]}$ contain no power of n higher than n^{r-1}. Proceeding in this way, we can express N in the form $c_r.n_{[r]}+c_{r-1}.n_{[r-1]}+$ . . ., where c_r, c_{r-1}, c_{r-2}, . . . do not contain n; and thence we can obtain the sum of the numbers found by putting $n=1, 2, 3,$ . . . n successively in N. These numbers constitute an *arithmetical progression of the rth order*.

(v.) A particular case is that of the sum $1^r+2^r+3^r+\dots+n^r$, where r is a positive integer. It can be shown by the above reasoning that this can be expressed as a series of terms containing descending powers of n, the first term being $n^{r+1}/(r+1)$. The most important cases are

$$1+2+3+\dots+n=\tfrac{1}{2}n(n+1).$$
$$1^2+2^2+3^2+\dots+n^2=\tfrac{1}{6}n(n+1)(2n+1).$$
$$1^3+2^3+3^3+\dots+n^3=\tfrac{1}{4}n^2(n+1)^2=(1+2+\dots+n)^2.$$

The general formula (which is established by more advanced methods) is

$$\tfrac{1}{2}.0^r+1^r+2^r+\dots+(n-1)^r+\tfrac{1}{2}n^r$$
$$=\frac{1}{r+1}\left\{n^{r+1}+\mathrm{B}_1(r+1)_{(2)}n^{r-1}-\mathrm{B}_2(r+1)_{(4)}n^{r-3}+\ \dots\right\},$$

where B_1, B_2, . . . are certain numbers known as *Bernoulli's numbers*, and the terms within the bracket, after the first, have signs alternately + and −. The values of the first ten of Bernoulli's numbers are

$\mathrm{B}_1=\frac{1}{6}$, $\mathrm{B}_2=\frac{1}{30}$, $\mathrm{B}_3=\frac{1}{42}$, $\mathrm{B}_4=\frac{1}{30}$, $\mathrm{B}_5=\frac{5}{66}$, $\mathrm{B}_6=\frac{691}{2730}$, $\mathrm{B}_7=\frac{7}{6}$,
$\mathrm{B}_8=\frac{3617}{510}$, $\mathrm{B}_9=\frac{43867}{798}$, $\mathrm{B}_{10}=\frac{174611}{330}$.

IV. *Negative Numbers and Formal Algebra.*

47. Negative quantities will have arisen in various ways, *e.g.*

(i.) The logical result of the commutative law, applied to a succession of additions and subtractions, is to produce a negative quantity −3s. such that −3s.+3s.= 0(§ 28 (vi.)).

(ii.) Simple equations, especially equations in which the unknown quantity is an interval of time, can often only be satisfied by a negative solution (§ 33).

(iii.) In solving a quadratic equation by the method of § 38 (viii.) we may be led to a result which is apparently absurd. If, for instance, we inquire as to the time taken to reach a given height by a body thrown upwards with a given velocity, we find that the time increases as the height decreases. Graphical representation shows that there are two solutions, and that an equation $\mathrm{X}^2=9a^2$ may be taken to be satisfied not only by $\mathrm{X}=3a$ but also by $\mathrm{X}=-3a$.

48. The occurrence of negative quantities does not, however, involve the conception of negative numbers. In (iii.) of § 47, for instance, "$-3a$" does not mean that a is to be taken (−3·) times, but that a is to be taken 3 times, and the result treated as subtractive; *i.e.* $-3a$ means $-(3a)$, not $(-3)a$ (cf. § 27 (i.)).

In the graphic method of representation the sign − may be taken as denoting a reversal of direction, so that, if + 3 represents a length of 3 units measured in one direction, −3 represents a length of 3 units measured in the other direction. But even so there are two distinct operations concerned in the −3, viz. the multiplication by 3 and the reversal of direction. The graphic method, therefore, does not give any direct assistance towards the conception of negative numbers as operators, though it is useful for interpreting negative quantities as results.

49. In algebraical transformations, however, such as $(x-a)^2=x^2-2ax+a^2$, the arithmetical rule of signs enables us to combine the sign − with a number and to treat the result as a whole, subject to its own laws of operation. We see first that any operation with $4a-3b$ can be regarded as an operation with $(+)4a+(-)3b$, subject to the conditions (1) that the signs (+) and (−) obey the laws $(+)(+)=(+)$, $(+)(-)=(-)(+)=(-)$, $(-)(-)=(+)$, and (2) that, when processes of multiplication are completed, a quantity is to be added or subtracted according as it has the sign (+) or (−) prefixed. We are then able to combine any number with the + or the − sign inside the bracket, and to deal with this constructed symbol according to special laws; *i.e.* we can replace pr or $-pr$ by $(+p)r$ or $(-p)r$, subject to the conditions that $(+p)(+q)=(-p)(-q)=(+pq)$, $(+p)(-q)=(-p)(+q)=(-pq)$, and that $+(-s)$ means that s is to be subtracted.

These constructed symbols may be called *positive* and *negative coefficients*; or a symbol such as $(-p)$ may be called a *negative number*, in the same way that we call $\frac{2}{3}$ a fractional number.

This increases the extent of the numbers with which we have to deal; but it enables us to reduce the number of formulae. The binomial theorem may, for instance, be stated for $(x+a)^n$ alone; the formula for $(x-a)^n$ being obtained by writing it as $\{x+(-)a\}^n$ or $\{x+(-a)\}^n$, so that

$$(x-a)^n=x^n-n_{(1)}x^{n-1}a+\dots+(-)^r n_{(r)}x^{n-r}a^r+\dots,$$

where $+(-)^r$ means − or + according as r is odd or even.

The result of the extension is that the number or quantity represented by any symbol, such as P, may be either positive or negative. The numerical value is then represented by $|\mathrm{P}|$; thus "$|x|<1$" means that x is between -1 and $+1$.]

50. The use of negative coefficients leads to a difference between arithmetical division and *algebraical division* (by a multinomial), in that the latter may give rise to a quotient containing subtractive terms. The most important case is division by a binomial, as illustrated by the following examples:—

$$\begin{array}{rr}
 & (1) \\
2.10+1) & 6.100+5.10+1\,(3.10+1 \\
 & \underline{6.100+3.10} \\
 & 2.10+1 \\
 & \underline{\underline{2.10+1}}
\end{array}
\qquad
\begin{array}{rr}
 & (2) \\
2.10+1) & 6.100+1.10-1\,(3.10-1 \\
 & \underline{6.100+3.10} \\
 & -2.10-1 \\
 & \underline{\underline{-2.10-1}}
\end{array}$$

In (1) the division is both arithmetical and algebraical, while in (2) it is algebraical, the quotient for arithmetical division being 2.10+9.

It may be necessary to introduce terms with zero coefficients. Thus, to divide 1 by $1+x$ algebraically, we may write it in the form $1+0.x+0.x^2+0.x^3+0.x^4$, and we then obtain

$$\frac{1}{1+x}=\frac{1+0.x+0.x^2+0.x^3+0.x^4}{1+x}=1-x+x^2-x^3+\frac{x^4}{1+x},$$

where the successive terms of the quotient are obtained by a process which is purely formal.

51. If we divide the sum of x^2 and a^2 by the sum of x and a, we get a quotient $x-a$ and remainder $2a^2$, or a quotient $a-x$ and remainder $2x^2$, according to the order in which we work. Algebraical division therefore has no definite meaning unless

dividend and divisor are rational integral functions of some expression such as x which we regard as the root of the notation (§ 28 (iv.)), and are arranged in descending or ascending powers of x. If P and M are rational integral functions of x, arranged in descending powers of x, the division of P by M is complete when we obtain a remainder R whose degree (§ 45) is less than that of M. If $R=0$, then M is said to be a *factor* of P.

The ***highest common factor*** (or common factor of highest degree) of two rational integral functions of x is therefore found in the same way as the G.C.M. in arithmetic; numerical coefficients of the factor as a whole being ignored (cf. § 36 (iv.)).

52. ***Relation between Roots and Factors.***—(i.) If we divide the multinomial

$$P \equiv p_0x^n + p_1x^{n-1} + \dots + p_n$$

by $x-a$, according to algebraical division, the remainder is

$$R \equiv p_0a^n + p_1a^{n-1} + \dots + p_n.$$

This is the *remainder-theorem*; it may be proved by induction.

(ii.) If $x=a$ satisfies the equation $P=0$, then $p_0a^n+p_1a^{n-1}+\dots+p_n=0$; and therefore the remainder when P is divided by $x-a$ is 0, *i.e.* $x-a$ is a factor of P.

(iii.) Conversely, if $x-a$ is a factor of P, then $p_0a^n+p_1a^{n-1}+\dots+p_n=0$; *i.e.* $x=a$ satisfies the equation $P=0$.

(iv.) Thus the problems of determining the roots of an equation $P=0$ and of finding the factors of P, when P is a rational integral function of x, are the same.

(v.) In particular, the equation $P=0$, where P has the value in (i.), cannot have more than n different roots.

The consideration of cases where two roots are equal belongs to the theory of equations (see EQUATION).

(vi.) It follows that, if two multinomials of the nth degree in x have equal values for more than n values of x, the corresponding coefficients are equal, so that the multinomials are equal for all values of x.

53. *Negative Indices and Logarithms.*—(i.) Applying the general principles of §§ 47-49 to indices, we find that we can interpret X^{-m} as being such that

$$X^m.X^{-m} = X^0 = 1; \text{ i.e. } X^{-m} = 1/X^m.$$

In the same way we interpret $X^{-p/q}$ as meaning $1/X^{p/q}$.

(ii.) This leads to negative logarithms (see LOGARITHM).

54. *Laws of Algebraic Form.*—(i.) The results of the addition, subtraction and multiplication of multinomials (including monomials as a particular case) are subject to certain laws which correspond with the laws of arithmetic (§ 26 (i.)) but differ from them in relating, not to arithmetical value, but to algebraic form. The commutative law in arithmetic, for instance, states that $a+b$ and $b+a$, or ab and ba, are equal. The corresponding law of form regards $a+b$ and $b+a$, or ab and ba, as being not only equal but identical (cf. § 37 (ii.)), and then says that A+B and B+A, or AB and BA, are identical, where A and B are any multinomials. Thus $a(b+c)$ and $(b+c)a$ give the same result, though it may be written in various ways, such as $ab+ac$, $ca+ab$, &c. In the same way the associative law is that A(BC) and (AB)C give the same formal result.

These laws can be established either by tracing the individual terms in a sum or a product or by means of the general theorem in § 52 (vi.).

(ii.) One result of these laws is that, when we have obtained any formula involving a letter a, we can replace a by a multinomial. For instance, having found that $(x+a)^2 = x^2+2ax+a^2$, we can deduce that $(x+b+c)^2 = \{x+(b+c)\}^2 = x^2+2(b+c)x+(b+c)^2$.

(iii.) Another result is that we can *equate* coefficients of like powers of x in two multinomials obtained from the same expression by different methods of expansion. For instance, by equating coefficients of x^r in the expansions of $(1+x)^{m+n}$ and of $(1+x)^m.(1+x)^n$ we obtain (22) of § 44 (ii.).

(iv.) On the other hand, the method of equating coefficients often applies without the assumption of these laws. In § 41 (ii.), for instance, the coefficient of $A^{n-r}a^r$ in the expansion of $(A+a)(A+a)^{n-1}$ has been called $\binom{n}{r}$; and it has then been shown that $\binom{n}{r} = \binom{n-1}{r} + \binom{n-1}{r-1}$. This does not involve any assumption of the identity of results obtained in different ways; for the expansions of $(A+a)^2$, $(A+a)^3$, ... are there supposed to be obtained in one way only, viz. by successive multiplications by $A+a$.

55. *Algebraical Division.*—In order to extend these laws so as to include division, we need a definition of algebraical division. The divisions in §§ 50-52 have been supposed to be performed by a process similar to the process of arithmetical division, viz. by a series of subtractions. This latter process, however, is itself based on a definition of division in terms of multiplication (§§ 15, 16). If, moreover, we examine the process of algebraical division as illustrated in § 50, we shall find that, just as arithmetical division is really the solution of an equation (§ 14), and involves the tacit use of a symbol to denote an unknown quantity or number, so algebraical division by a multinomial really implies the use of undetermined coefficients (§ 42). When, for instance, we find that the quotient, when $6+5x+7x^2+13x^3+5x^4$ is divided by $2+3x+x^2$, is made up of three terms $+3$, $-2x$, and $+5x^2$, we are really obtaining successively the values of c_0, c_1, and c_2 which satisfy the identity $6+5x+7x^2+13x^3+5x^4 = (c_0+c_1x+c_2x^2)(2+3x+x^2)$; and we could equally obtain the result by expanding the right-hand side of this identity and equating coefficients in the first three terms, the coefficients in the remaining terms being then compared to see that there is no remainder. We therefore define algebraical division by means of algebraical multiplication, and say that, if P and M are multinomials, the statement "$P/M=Q$" means that Q is a multinomial such that MQ (or QM) and P are identical. In this sense, the laws mentioned in § 54 apply also to algebraical division.

56. ***Extensions of the Binomial Theorem.***—It has been mentioned in § 41 (ix.) that the binomial theorem can be used for obtaining an approximate value for a power of a number; the most important terms only being taken into account. There are extensions of the binomial theorem, by means of which approximate calculations can be made of fractions, surds, and powers of fractions and of surds; the main difference being that the number of terms which can be taken into account is unlimited, so that, although we may approach nearer and nearer to the true value, we never attain it exactly. The argument involves the theorem that, if θ is a positive quantity less than 1, θ^t can be made as small as we please by taking t large enough; this follows from the fact that $t\log\theta$ can be made as large (numerically) as we please.

(i.) By algebraical division,

$$\frac{1}{1+x} = \frac{1+0.x+0.x^2+\dots+0.x^{r+1}}{1+x}$$
$$= 1-x+x^2-\dots+(-)^rx^r+(-)^{r+1}\frac{x^{r+1}}{1+x} \quad (24).$$

If, therefore, we take $1/(1+x)$ as equal to $1-x+x^2-\dots+(-)^rx^r$, there is an error whose numerical magnitude is $|x^{r+1}/(1+x)|$; and, if $|x|<1$, this can be made as small as we please.

This is the foundation of the use of recurring decimals; thus we can replace $\frac{4}{11}\{=\frac{36}{99}=\frac{36}{100}/(1-\frac{1}{100})\}$ by $\cdot363636(=36/10^2+36/10^4+36/10^6)$, with an error (in defect) of only $36/(10^6 . 99)$.

(ii.) Repeated divisions of (24) by $1+x$, r being replaced by $r+1$ before each division, will give

$$(1+x)^{-2} = 1-2x+3x^2-4x^3+\dots+(-)^r(r+1)x^r$$
$$+(-)^{r+1}x^{r+1}\{(r+1)(1+x)^{-1}+(1+x)^{-2}\}.$$
$$(1+x)^{-3} = 1-3x+6x^2-10x^3+\dots+(-)^r.\tfrac{1}{2}(r+1)(r+2)x^r$$
$$+(-)^{r+1}x^{r+1}\{\tfrac{1}{2}(r+1)(r+2)(1+x)^{-1}+(r+1)(1+x)^{-2}+(1+x)^{-3}\}, \text{\&c.}$$

Comparison with the table of binomial coefficients in § 43 suggests that, if m is any positive integer,

$$(1+x)^{-m} = S_r + R_r \quad (25),$$

where

$$S_r \equiv 1-m_{[1]}x+m_{[2]}x^2\dots+(-)^rm_{[r]}x^r \quad (26),$$
$$R_r \equiv (-)^{r+1}x^{r+1}\{m_{[r]}(1+x)^{-1}+(m-1)_{[r]}(1+x)^{-2}+\dots+1_{[r]}(1+x)^{-m}\} \quad (27).$$

This can be verified by induction. The same result would (§ 55) be obtained if we divided $1+0.x+0.x^2+\dots$ at once by the expansion of $(1+x)^m$.

(iii.) From (21) of § 43 (iv.) we see that $|R_r|$ is less than $m_{[r+1]}x^{r+1}$ if x is positive, or than $|m_{[r+1]}x^{r+1}(1+x)^{-m}|$ if x is negative; and it can hence be shown that, if $|x|<1$, $|R_r|$ can be made as small as we please by taking r large enough, so that we can make S_r approximate as closely as we please to $(1+x)^{-m}$.

(iv.) To assimilate this to the binomial theorem, we extend the definition of $n_{(r)}$ in (1) of § 41 (i.) so as to cover negative integral values of n; and we then have

$$(-m)_{(r)}=\frac{(-m)(-m-1)\dots(-m-r+1)}{r!}=(-)^r m_{[r]} \quad (28),$$

so that, if $n\equiv -m$,

$$S_r\equiv 1+n_{(1)}x+n_{(2)}x^2+\dots+n_{(r)}x^r \quad (29).$$

(v.) The further extension to fractional values (positive or negative) of n depends in the first instance on the establishment of a method of algebraical evolution which bears the same relation to arithmetical evolution (calculation of a surd) that algebraical division bears to arithmetical division. In calculating $\sqrt{2}$, for instance, we proceed as if 2·0000 . . . were the exact square of some number of the form $c_0+c_1/10+c_2/10^2+\dots$

In the same way, to find $X^{1/q}$, where $X\equiv 1+a_1x+a_2x^2+\dots$ and q is a positive integer, we assume that $X^{1/q}=1+b_1x+b_2x^2\dots$, and we then (cf. § 55) determine $b_1, b_2, \dots$ in succession so that $(1+b_1x+b_2x^2+\dots)^q$ shall be identical with X.

The application of the method to the calculation of $(1+x)^n$, when $n=p/q$, q being a positive integer and p a positive or negative integer, involves, as in the case where n is a negative integer, the separate consideration of the form of the coefficients $b_1, b_2, \dots$ and of the numerical value of $1+b_1x+b_2x^2+\dots+b_1x^r$.

(vi.) The definition of $n_{(r)}$, which has already been extended in (iv.) above, has to be further extended so as to cover fractional values of n, positive or negative. Certain relations still hold, the most important being (22) of § 44 (ii.), which holds whatever the values of m and of n may be, r, of course, being a positive integer. This may be proved either by induction or by the method of § 52 (vi.). The relation, when written in the form (23), is known as *Vandermonde's theorem*. By means of this theorem it can be shown that, whatever the value of n may be,

$$\{1+(p/q)_{(1)}x+(p/q)_{(2)}x^2+\dots+(p/q)_{(r)}x^r\}^q=1+p_{(1)}x+p_{(2)}x^2+\dots+p_{(r)}x^r$$
$$+\text{terms in } x^{r+1}, x^{r+2},\dots x^{qr}.$$

(vii.) The comparison of the numerical value of $1+n_{(1)}x+n_{(2)}x^2+\dots+n_{(r)}x^r$, when n is fractional, with that of $(1+x)^n$, involves advanced methods (§ 64). It is found that this expression can be used for approximating to the value of $(1+x)^n$, provided that $|x|<1$; the results are as follows, where u_r denotes $n_{(r)}x^r$ and S_r denotes $u_0+u_1+u_2+\dots+u_r$.

(*a*) If $n>-1$, then, provided $r>n$,

(1) If $1>x>0$, $(1+x)^n$ lies between S_r and S_{r+1};
(2) If $0>x>-1$, $(1+x)^n$ lies between S_r and $S_r+u_{r+1}/(1+x)$.

(*b*) If $n<-1$, the successive terms will either constantly decrease (numerically) from the beginning or else increase up to a greatest term (or two equal consecutive greatest terms) and then constantly decrease. If S_r is taken so as to include the greatest term (or terms), then,

(1) If $1>x>0$, $(1+x)^n$ lies between S_r and S_{r+1};
(2) If $0>x>-1$, $(1+x)^n$ lies between S_r and $S_r+u_{r+1}/(1-u_{r+1}/u_r)$.

The results in (*b*) apply also if n is a negative integer.

(viii.) In applying the theorem to concrete cases, conversion of a number into a continued fraction is often useful. Suppose, for instance, that we require to calculate $(23/13)^{\frac{3}{2}}$. We want to express $(23/13)^3$ in the form a^2b, where b is nearly equal to 1. We find that $\frac{3}{2}\log_{10}(23/13)=\cdot 3716767=\log_{10}(2\cdot 3533)=\log_{10}(40/17)$ nearly; and thence that $(23/13)^{\frac{3}{2}}=(40/17)\,(1+1063/3515200)^{\frac{1}{2}}$, which can be calculated without difficulty to a large number of significant figures.

(ix.) The extension of $n_{(r)}$, and therefore of $n_{[r]}$, to negative and fractional values of n, enables us to extend the applicability of the binomial coefficients to the summation of series (§ 46 (ii.)). Thus the nth term of the series $2.5+5.8+8.11+\dots$ in § 46 (iii.) is $18(n-\frac{1}{3})_{[2]}$; formula (20) of § 43 (iv.) holds for the extended coefficients, and therefore the sum of n terms of this series is $18.(n-\frac{1}{3})_{[3]}-18.(-\frac{1}{3})_{[3]}=3n^3+6n^2+n$. In this way we get the general rule that, to find the sum of n terms of a series, the rth term of which is $(a+rb)(a+\overline{r+1}\cdot b)\,..\,(a+\overline{r+p-1}\cdot b)$, we divide the product of the $p+1$ factors which occur either in the nth or in the $(n+1)$th term by $p+1$, and by the common difference of the factors, and add to a constant, whose value is found by putting $n=0$.

57. *Generating Functions.*—The series $1-m_{(1)}x+m_{(2)}x^2-\dots$ obtained by dividing $1+0.\,x+0.x^2+\dots$ by $(1+x)^n$, or the series $1+(p/q)_{(1)}x+(p/q)_{(2)}x^2+\dots$ obtained by taking the qth root of $1+p_{(1)}x+p_{(2)}x^2+\dots$, is an *infinite series*, *i.e.* a series whose successive terms correspond to the numbers 1, 2, 3, . . . It is often convenient, as in § 56 (ii.) and (vi.), to consider the mode of development of such a series, without regard to arithmetical calculation; *i.e.* to consider the relations between the coefficients of powers of x, rather than the values of the terms themselves. From this point of view, the function which, by algebraical operations on $1+0.x+0.x^2+\dots$, produces the series, is called its *generating function*. The generating functions of the two series, mentioned above, for example, are $(1+x)^{-m}$ and $(1+x)^{p/q}$. In the same way, the generating function of the series $1+2x+x^2+0.x^3+0.x^4+\dots$ is $(1+x)^2$.

Considered in this way, the relations between the coefficients of the powers of x in a series may sometimes be expressed by a formal equality involving the series as a whole. Thus (4) of § 41 (ii.) may be written in the form

$$1+n_{(1)}x+n_{(2)}x^2+\dots+n_{(r)}x^r+\dots\underset{f}{=}(1+x)\{1+(n-1)_{(1)}x+(n-1)_{(2)}x^2+\dots$$
$$+(n-1)_{(r)}x^r+\dots\};$$

the symbol "$\underset{f}{=}$" being used to indicate that the equality is only formal, not arithmetical.

This accounts for the fact that the same table of binomial coefficients serves for the expansions of positive powers of $1+x$ and of negative powers of $1-x$. For (4) may (§ 43 (iv.)) be written

$$(n-1)_{[r]}=n_{[r]}-n_{[r-1]},$$

and this leads to relations of the form

$$1+2x+3x^2+\dots\underset{f}{=}(1-x)(1+3x+6x^2+10x^3+\dots) \quad (30),$$

each set of coefficients being the numbers in a downward diagonal of the table. In the same way (21) of § 43 (iv.) leads to such relations as

$$1+3x+6x^2+\dots\underset{f}{=}(1+x+x^2+\dots)(1+2x+3x^2+\dots) \quad (31),$$

the relation of which to (30) is obvious.

An application of the method is to the summation of a *recurring series*, *i.e.* a series $c_0+c_1x+c_2x^2+\dots$ whose coefficients are connected by a relation of the form $p_0c_r+p_1c_{r-1}+\dots+p_kc_{r-k}=0$, where $p_0, p_1, \dots p_k$ are independent of x and of r.

58. *Approach to a Limit.*—There are two kinds of approach to a limit, which may be illustrated by the series forming the expansion of $(x+h)^n$, where n is a negative integer and $1>h/x>0$.

(i.) Denote $n_{(r)}x^{n-r}h^r$ by u_r, and $u_0+u_1+\dots+u_r$ by S_r. Then (§ 56 (iii.)) $(x+h)^n$ lies between S_r and S_{r+1}; and provided S_r includes the numerically greatest term, $|S_{r+1}-S_r|$ constantly decreases as r increases, and can be made as small as we please by taking r large enough. Thus by taking $r=0, 1, 2, \dots$ we have a *sequence* $S_0, S_1, S_2, \dots$ (*i.e.* a succession of numbers corresponding to the numbers 1, 2, 3, . . .) which possesses the property that, by starting far enough in the sequence, the range of variation of all subsequent terms can be made as small as we please, but $(x+h)^n$ always lies between the two values determining the range. This is expressed by saying that the sequence *converges* to $(x+h)^n$ as its *limit*; it may be stated concisely in any of the three ways,

$$(x+h)^n=\lim(x^n+n_{(1)}x^{n-1}h+\dots+n_{(r)}x^{n-r}h^r+\dots),\ (x+h)^n=\lim S_r,$$
$$S_r \doteq (x+h)^n.$$

It will be noticed that, although the differences between successive terms of the sequence will ultimately become indefinitely small, there will always be intermediate numbers that do not occur in the sequence. The approach to the limit will therefore be by a series of jumps, each of which, however small, will be finite; *i.e.* the approach will be discontinuous.

(ii.) Instead of examining what happens as r increases, let us examine what happens as h/x decreases, r remaining unaltered. Denote h/x by θ, where $1>\theta>0$; and suppose further that $\theta<|1/n|$, so that the first term of the series $u_0+u_1+u_2+\dots$ is the greatest (numerically). Then $\{(x+h)^n-\mathrm{S}_r\}/h^{r+1}$ lies between $n_{(r+1)}x^{n-r-1}$ and $n_{(r+1)}x^{n-r-1}(1+\theta)^n$; and the difference between these can be made as small as we please by taking h small enough. Thus we can say that the limit of $\{(x+h)^n-\mathrm{S}_r\}/h^{r+1}$ is $n_{(r+1)}x^{n-r-1}$; but the approach to this limit is of a different kind from that considered in (i.), and its investigation involves the idea of continuity.

V. *Continuity.*

59. The idea of continuity must in the first instance be introduced from the graphical point of view; arithmetical continuity being impossible without a considerable extension of the idea of number (§ 65). The idea is utilized in the elementary consideration of a differential coefficient; and its importation into the treatment of certain functions as continuous is therefore properly associated with the infinitesimal calculus.

60. The first step consists in the functional treatment of equations. Thus, to solve the equation $ax^2+bx+c=0$, we consider, not merely the value of x for which ax^2+bx+c is 0, but the value of ax^2+bx+c for every possible value of x. By graphical treatment we are able, not merely to see why the equation has usually two roots, and also to understand why there is in certain cases only one root (*i.e.* two equal roots) and in other cases no root, but also to see why there cannot be more than two roots.

Simultaneous equations in two unknowns x and y may be treated in the same way, except that each equation gives a functional relation between x and y. ("Indeterminate equations" belong properly to the theory of numbers.)

61. From treating an expression involving x as a function of x which may change continuously when x changes continuously, we are led to regard two functions x and y as changing together, so that (subject to certain qualifications) to any succession of values of x or of y there corresponds a succession of values of y or of x; and thence, if (x, y) and $(x+h, y+k)$ are pairs of corresponding values, we are led to consider the limit (§ 58 (ii.)) of the ratio k/h when h and k are made indefinitely small. Thus we arrive at the differential coefficient of $f(x)$ as the limit of the ratio of $f(x+\theta)-f(x)$ to θ when θ is made indefinitely small; and this gives an interpretation of nx^{n-1} as the derived function of x^n (§ 45).

This conception of a limit enables us to deal with algebraical expressions which assume such forms as $\frac{0}{0}$ for particular values of the variable (§ 39 (iii.)). We cannot, for instance, say that the fraction $\frac{x^2-1}{x-1}$ is arithmetically equal to $x+1$ when $x=1$, as well as for other values of x; but we can say that the limit of the ratio of x^2-1 to $x-1$ when x becomes indefinitely nearly equal to 1 is the same as the limit of $x+1$.

On the other hand, if $f(y)$ has a definite and finite value for $y=x$, it must not be supposed that this is necessarily the same as the limit which $f(y)$ approaches when y approaches the value x, though this is the case with the functions with which we are usually concerned.

62. The elementary idea of a differential coefficient is useful in reference to the *logarithmic* and *exponential* series. We know that $\log_{10}\mathrm{N}(1+\theta)=\log_{10}\mathrm{N}+\log_{10}(1+\theta)$, and inspection of a table of logarithms shows that, when θ is small, $\log_{10}(1+\theta)$ is approximately equal to $\lambda\theta$, where λ is a certain constant, whose value is ·434. . . If we took logarithms to base a, we should have

$$\log_a(1+\theta)=\log_a 10\times\lambda\theta,$$

approximately. If therefore we choose a quantity e such that

$$\log_e 10\times\lambda=1,\ \log_{10}e=\lambda,$$

which gives (by more accurate calculation)

$$e=2{\cdot}71828\ldots,$$

we shall have $\qquad \lim\{\log_e(1+\theta)\}/\theta=1,$

and conversely $\qquad \lim\{e^{x+\phi}-e^x\}/\phi=e^x.$

The deduction of the expansions

$$\log_e(1+x)=x-\tfrac{1}{2}x^2+\tfrac{1}{3}x^3-\ldots,$$
$$e^x=1+x+x^2/2!+x^3/3!+\ldots,$$

is then more simply obtained by the differential calculus than by ordinary algebraic methods.

63. The theory of *inequalities* is closely connected with that of maxima and minima, and therefore seems to come properly under this head. The more simple properties, however, only require the use of elementary methods. Thus to show that the arithmetic mean of n positive numbers is greater than their geometric mean (*i.e.* than the nth root of their product) we show that if any two are unequal their product may be increased, without altering their sum, by making them equal, and that if all the numbers are equal their arithmetic mean is equal to their geometric mean.

VI. *Special Developments.*

64. One case of convergence of a sequence has already been considered in § 58 (i.). The successive terms of the sequence in that case were formed by successive additions of terms of a series; the series is then also said to converge to the limit which is the limit of the sequence.

Another example of a sequence is afforded by the successive convergents to a continued fraction of the form $a_0+\frac{1}{a_1+}\,\frac{1}{a_2+}\ldots$, where $a_0, a_1, a_2, \ldots$ are integers. Denoting these convergents by $\mathrm{P}_0/\mathrm{Q}_0$, $\mathrm{P}_1/\mathrm{Q}_1$, $\mathrm{P}_2/\mathrm{Q}_2, \ldots$ they may be regarded as obtained from a series $\frac{\mathrm{P}_0}{\mathrm{Q}_0}+\left(\frac{\mathrm{P}_1}{\mathrm{Q}_1}-\frac{\mathrm{P}_0}{\mathrm{Q}_0}\right)+\left(\frac{\mathrm{P}_2}{\mathrm{Q}_2}-\frac{\mathrm{P}_1}{\mathrm{Q}_1}\right)+\ldots$; the successive terms of this series, after the first, are alternately positive and negative, and consist of fractions with numerators 1 and denominators continually increasing.

Another kind of sequence is that which is formed by introducing the successive factors of a continued product; *e.g.* the successive factors on the right hand side of *Wallis's theorem*

$$\frac{\pi}{2}=\frac{2.2}{1.3}\cdot\frac{4.4}{3.5}\cdot\frac{6.6}{5.7}\ldots$$

A continued product of this kind can, by taking logarithms, be replaced by an infinite series.

In the particular case considered in § 58 (i.) we were able to examine the approach of the sequence $\mathrm{S}_0, \mathrm{S}_1, \mathrm{S}_2, \ldots$ to its limit X by direct examination of the value of $\mathrm{X}-\mathrm{S}_r$. In most cases this is not possible; and we have first to consider the convergence of the sequence or of the series which it represents, and then to determine its limit by indirect methods. This constitutes the general theory of *convergence of series* (see SERIES).

The word "sequence," as defined in § 58 (i.), includes progressions such as the arithmetical and geometrical progressions, and, generally, the succession of terms of a series. It is usual, however, to confine it to those sequences (*e.g.* the sequence formed by taking successive sums of a series) which have to be considered in respect of their convergence or non-convergence.

In order that numerical results obtained by summing the first few terms of a series may be of any value, it is usually necessary that the series should converge to a limit; but there are exceptions to this rule. For instance, when n is large, $n!$ is approximately equal to $\sqrt{(2\pi n)}.(n/e)^n$; the approximation may be improved by *Stirling's theorem*

$$\log_e 2+\log_e 3+\ldots+\log_e(n-)+\tfrac{1}{2}\log_e n=\tfrac{1}{2}\log_e(2\pi)+n\log_e n-n$$
$$+\frac{\mathrm{B}_1}{1.2.n}-\frac{\mathrm{B}_2}{3.4.n^3}+\ldots+\frac{(-)^{r-1}\mathrm{B}_r}{(2r-1).2r.n^{2r-1}}+\ldots,$$

where $\mathrm{B}_1, \mathrm{B}_2, \ldots$ are Bernoulli's numbers (§ 46 (v.)), although the series is not convergent.

65. Consideration of the binomial theorem for fractional index, or of the continued fraction representing a surd, or of theorems such as Wallis's theorem (§ 64), shows that a sequence, every term of which is rational, may have as its limit an *irrational number*, *i.e.* a number which cannot be expressed as the ratio of two integers.

These are isolated cases of irrational numbers. Other cases arise when we consider the continuity of a function. Suppose, for instance, that $y=x^2$; then to every rational value of x there corresponds a rational value of y, but the converse does not hold. Thus there appear to be discontinuities in the values of y. The difficulty is due to the fact that number is naturally not continuous, so that continuity can only be achieved by an artificial development. The development is based on the necessity of being able to represent geometrical magnitude by arithmetical magnitude; and it may be regarded as consisting of three stages. Taking any number n to be represented by a point on a line at distance nL from a fixed point O, where L is a unit of length, we start with a series of points representing the integers 1, 2, 3, . . . This series is of course discontinuous. The next step is to suppose that fractional numbers are represented in the same way. This extension produces a change of character in the series of numbers. In the original integral series each number had a definite number next to it, on each side, except 1, which began the series. But in the new series there is no first number, and no number can be said to be next to any other number, since, whatever two numbers we take, others can be inserted between them. On the other hand, this new series is not continuous; for we know that there are some points on the line which represent surds and other irrational numbers, and these numbers are not contained in our series. We therefore take a third step, and obtain theoretical continuity by considering that every point on the line, if it does not represent a rational number, represents something which may be called an *irrational number*.

This insertion of irrational numbers (with corresponding negative numbers) requires for its exact treatment certain special methods, which form part of the *algebraic theory of number*, and are dealt with under NUMBER.

66. The development of the theory of equations leads to the amplification of real numbers, rational and irrational, positive and negative, by *imaginary* and *complex numbers*. The quadratic equation $x^2+b^2=0$, for instance, has no real root; but we may treat the roots as being $+b\sqrt{-1}$, and $-b\sqrt{-1}$, if $\sqrt{-1}$ is treated as something which obeys the laws of arithmetic and emerges into reality under the condition $\sqrt{-1}.\sqrt{-1}=-1$. Expressions of the form $b\sqrt{-1}$ and $a+b\sqrt{-1}$, where a and b are real numbers, are then described as *imaginary* and *complex* numbers respectively; the former being a particular case of the latter.

Complex numbers are conveniently treated in connexion not only with the theory of equations but also with analytical trigonometry, which suggests the graphic representation of $a+b\sqrt{-1}$ by a line of length $(a^2+b^2)^{\frac{1}{2}}$ drawn in a direction different from that of the line along which real numbers are represented.

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(W. F. SH.)

B. SPECIAL KINDS OF ALGEBRA

1. A *special* algebra is one which differs from ordinary algebra in the laws of equivalence which its symbols obey. Theoretically, no limit can be assigned to the number of possible algebras; the varieties actually known use, for the most part, the same signs of operation, and differ among themselves principally by their rules of multiplication.

2. Ordinary algebra developed very gradually as a kind of shorthand, devised to abbreviate the discussion of arithmetical problems and the statement of arithmetical facts. Although the distinction is one which cannot be ultimately maintained, it is convenient to classify the signs of algebra into symbols of quantity (usually figures or letters), symbols of operation, such as $+$, $\sqrt{}$, and symbols of distinction, such as brackets. Even when the formal evolution of the science was fairly complete, it was taken for granted that its symbols of quantity invariably stood for numbers, and that its symbols of operation were restricted to their ordinary arithmetical meanings. It could not escape notice that one and the same symbol, such as $\sqrt{(a-b)}$, or even $(a-b)$, sometimes did and sometimes did not admit of arithmetical interpretation, according to the values attributed to the letters involved. This led to a prolonged controversy on the nature of negative and imaginary quantities, which was ultimately settled in a very curious way. The progress of analytical geometry led to a geometrical interpretation both of negative and also of imaginary quantities; and when a "meaning" or, more properly, an interpretation, had thus been found for the symbols in question, a reconsideration of the old algebraic problem became inevitable, and the true solution, now so obvious, was eventually obtained. It was at last realized that the laws of algebra do not depend for their validity upon any particular interpretation, whether arithmetical, geometrical or other; the only question is whether these laws do or do not involve any logical contradiction. When this fundamental truth had been fully grasped, mathematicians began to inquire whether algebras might not be discovered which obeyed laws different from those obtained by the generalization of arithmetic. The answer to this question has been so manifold as to be almost embarrassing. All that can be done here is to give a sketch of the more important and independent special algebras at present known to exist.

3. Although the results of ordinary algebra will be taken for granted, it is convenient to give the principal rules upon which it is based. They are

$$\begin{array}{llll} (a+b)+c=a+(b+c) & (\text{A}) & (a\times b)\times c=a\times(b\times c) & (\text{A}') \\ a+b=b+a & (\text{C}) & a\times b=b\times a & (\text{C}') \\ & a(b+c)=ab+ac & (\text{D}) & \\ (a-b)+b=a & (\text{I}) & (a\div b)\times b=a & (\text{I}') \end{array}$$

These formulae express the *associative* and *commutative* laws of the operations $+$ and $\times$, the *distributive* law of $\times$, and the definitions of the *inverse* symbols $-$ and $\div$, which are assumed to be unambiguous. The special symbols 0 and 1 are used to denote $a-a$ and $a\div a$. They behave exactly like the corresponding symbols in arithmetic; and it follows from this that whatever "meaning" is attached to the symbols of quantity, ordinary algebra includes arithmetic, or at least an image of it. Every ordinary algebraic quantity may be regarded as of the form $\alpha+\beta\sqrt{-1}$, where α, β are "real"; that is to say, every algebraic equivalence remains valid when its symbols of quantity are interpreted as complex numbers of the type $\alpha+\beta\sqrt{-1}$ (cf. NUMBER). But the symbols of ordinary algebra do not necessarily denote numbers; they may, for instance, be interpreted as coplanar points or vectors. Evolution and involution are usually regarded as operations of ordinary algebra; this leads to a notation for powers and roots, and a theory of irrational algebraic quantities analogous to that of irrational numbers.

Non-numerical algebra.

4. The only known type of algebra which does not contain arithmetical elements is substantially due to George Boole. Although originally suggested by formal logic, it is most simply interpreted as an algebra of regions in space. Let i denote a definite region of space; and let a, b, &c., stand for definite parts of i. Let $a+b$ denote the region made up of a and b together (the common part, if any, being reckoned only once), and let $a\times b$ or ab mean the region common to a and b. Then $a+a=aa=a$; hence numerical coefficients and indices are not required. The inverse symbols $-$, $\div$ are ambiguous, and in fact are rarely used. Each symbol a is associated with its *supplement* $\bar{a}$ which satisfies the equivalences $a+\bar{a}=i$, $a\bar{a}=0$, the latter of which means that a and $\bar{a}$ have no region in common. Finally, there is a *law of absorption* expressed by $a+ab=a$. From every proposition in this algebra a reciprocal one may be deduced by interchanging + and ×, and also the symbols 0 and i. For instance, $x+y=x+\bar{x}y$ and $xy=x(\bar{x}+y)$ are reciprocal. The operations + and × obey all the ordinary laws A, C, D (§ 3).

Möbius's barycentric calculus.

5. A point A in space may be associated with a (real, positive, or negative) numerical quantity α, called its *weight*, and denoted by the symbol αA. The sum of two weighted points αA, βB is, by definition, the point $(\alpha+\beta)$G, where G divides AB so that AG: GB $=\beta:\alpha$. It can be proved by geometry that

$$(\alpha A+\beta B)+\gamma C=\alpha A+(\beta B+\gamma C)=(\alpha+\beta+\gamma)P,$$

where P is in fact the centroid of masses α, β, γ placed at A, B, C respectively. So, in general, if we put

$$\alpha A+\beta B+\gamma C+\dots+\lambda L=(\alpha+\beta+\gamma+\dots+\lambda)X.$$

X is, in general, a determinate point, the *barycentre* of αA, βB, &c. (or of A, B, &c. for the weights α, β, &c.). If $(\alpha+\beta+\dots+\lambda)$ happens to be zero, X lies at infinity in a determinate direction; unless $-\alpha$A is the barycentre of βB, γC, ... λL, in which case $\alpha A+\beta B+\dots+\lambda L$ vanishes identically, and X is indeterminate. If ABCD is a tetrahedron of reference, any point P in space is determined by an equation of the form

$$(\alpha+\beta+\gamma+\delta)P=\alpha A+\beta B+\gamma C+\delta D:$$

α, β, γ, δ are, in fact, equivalent to a set of homogeneous co-ordinates of P. For constructions in a fixed plane three points of reference are sufficient. It is remarkable that Möbius employs the symbols AB, ABC, ABCD in their ordinary geometrical sense as lengths, areas and volumes, except that he distinguishes their sign; thus AB = −BA, ABC = −ACB, and so on. If he had happened to think of them as "products," he might have anticipated Grassmann's discovery of the extensive calculus. From a merely formal point of view, we have in the barycentric calculus a set of "special symbols of quantity" or "extraordinaries" A, B, C, &c., which combine with each other by means of operations + and − which obey the ordinary rules, and with ordinary algebraic quantities by operations × and ÷, also according to the ordinary rules, except that division by an extraordinary is not used.

Hamilton's quaternions.

6. A quaternion is best defined as a symbol of the type

$$q=\Sigma\alpha_s e_s=\alpha_0e_0+\alpha_1e_1+\alpha_2e_2+\alpha_3e_3,$$

where $e_0, \dots e_3$ are independent extraordinaries and $\alpha_0, \dots \alpha_3$ ordinary algebraic quantities, which may be called the co-ordinates of q. The sum and product of two quaternions are defined by the formulae

$$\Sigma\alpha_s e_s+\Sigma\beta_s e_s=\Sigma(\alpha_s+\beta_s)e_s$$
$$\Sigma\alpha_r e_r\times\Sigma\beta_s e_s=\Sigma\alpha_r\beta_s e_r e_s,$$

where the products e_re_s are further reduced according to the following multiplication table, in which, for example, the

	e_0	e_1	e_2	e_3
e_0	e_0	e_1	e_2	e_3
e_1	e_1	$-e_0$	e_3	$-e_2$
e_2	e_2	$-e_3$	$-e_0$	e_1
e_3	e_3	e_2	$-e_1$	$-e_0$

second line is to be read $e_1e_0=e_1$, $e_1^2=-e_0$, $e_1e_2=e_3$, $e_1e_3=-e_2$. The effect of these definitions is that the sum and the product of two quaternions are also quaternions; that addition is associative and commutative; and that multiplication is associative and distributive, but not commutative. Thus $e_1e_2=-e_2e_1$, and if q, q' are any two quaternions, qq' is generally different from $q'q$. The symbol e_0 behaves exactly like 1 in ordinary algebra; Hamilton writes 1, i, j, k instead of e_0, e_1, e_2, e_3, and in this notation all the special rules of operation may be summed up by the equalities

$$i^2=j^2=k^2=ijk=-1.$$

Putting $q=\alpha+\beta i+\gamma j+\delta k$, Hamilton calls α the *scalar part* of q, and denotes it by Sq; he also writes Vq for $\beta i+\gamma j+\delta k$, which is called the *vector part* of q. Thus every quaternion may be written in the form $q=\mathrm{S}q+\mathrm{V}q$, where either S$q$ or Vq may separately vanish; so that ordinary algebraic quantities (or *scalars*, as we shall call them) and pure vectors may each be regarded as special cases of quaternions.

The equations $q'+x=q$ and $y+q'=q$ are satisfied by the same quaternion, which is denoted by $q-q'$. On the other hand, the equations $q'x=q$ and $yq'=q$ have, in general, different solutions. It is the value of y which is generally denoted by $q\div q'$; a special symbol for x is desirable, but has not been established. If we put $q'_0=\mathrm{S}q'-\mathrm{V}q'$, then q'_0 is called the *conjugate* of q', and the scalar $q'q'_0=q'_0q'$ is called the *norm* of q' and written Nq'. With this notation the values of x and y may be expressed in the forms

$$x=q'_0q/\mathrm{N}q', \qquad y=qq'_0/\mathrm{N}q',$$

which are free from ambiguity, since scalars are commutative with quaternions. The values of x and y are different, unless $\mathrm{V}(qq'_0)=0$.

In the applications of the calculus the co-ordinates of a quaternion are usually assumed to be numerical; when they are complex, the quaternion is further distinguished by Hamilton as a *biquaternion*. Clifford's biquaternions are quantities $\xi q+\eta r$, where q, r are quaternions, and ξ, η are symbols (commutative with quaternions) obeying the laws $\xi^2=\xi$, $\eta^2=\eta$, $\xi\eta=\eta\xi=0$ (cf. QUATERNIONS).

Grassmann's extensive calculus.

7. In the extensive calculus of the nth category, we have, first of all, n independent "units," $e_1, e_2, \dots e_n$. From these are derived symbols of the type

$$A_1=\alpha_1e_1+\alpha_2e_2+\dots+\alpha_ne_n=\Sigma\alpha e,$$

which we shall call *extensive quantities of the first species* (and, when necessary, of the nth category). The *co-ordinates* $\alpha_1, \dots \alpha_n$ are scalars, and in particular applications may be restricted to real or complex numerical values.

If $B_1=\Sigma\beta e$, there is a law of addition expressed by

$$A_1+B_1=\Sigma(\alpha_i+\beta_i)e_i=B_1+A_1;$$

this law of addition is associative as well as commutative. The inverse operation is free from ambiguity, and, in fact,

$$A_1-B_1=\Sigma(\alpha_i-\beta_i)e_i.$$

To multiply A_1 by a scalar, we apply the rule

$$\xi A_1=A_1\xi=\Sigma(\xi\alpha_i)e_i,$$

and similarly for division by a scalar.

All this is analogous to the corresponding formulae in the barycentric calculus and in quaternions; it remains to consider the multiplication of two or more extensive quantities. The binary products of the units e_i are taken to satisfy the equalities

$$e_i^2=0, \quad e_ie_j=-e_je_i;$$

this reduces them to $\frac{1}{2}n(n-1)$ distinct values, exclusive of zero. These values are assumed to be independent, so we have $\frac{1}{2}n(n-1)$ *derived units of the second species or order*. Associated with these new units there is a system of extensive quantities of the second species, represented by symbols of the type

$$A_2=\Sigma\alpha_iE_i^{(2)} \qquad [i=1, 2, \dots \tfrac{1}{2}n(n-1)],$$

where $E_1^{(2)}, E_2^{(2)}$, &c. are the derived units of the second species. If $A_1=\Sigma\alpha_ie_i$, $B_1=\Sigma\beta_ie_i$, the distributive law of multiplication is preserved by assuming

$$A_1B_1=\Sigma(\alpha_i\beta_j)e_ie_j;$$

it follows that $A_1B_1=-B_1A_1$, and that $A_1^2=0$.

By assuming the truth of the associative law of multiplication, and taking account of the reducing formulae for binary products, we may construct derived units of the third, fourth ... nth species. Every unit of the rth species which does not vanish is the product of r different units of the first species; two such units are independent unless they are permutations of the same set of primary units e_i, in which case they are equal or opposite according to the usual rule employed in determinants. Thus, for instance—

$$e_1.e_2e_3 = e_1e_2.e_3 = e_1e_2e_3 = -e_2e_1e_3 = e_2e_3e_1;$$

and, in general, the number of distinct units of the rth species in the nth category ($r \nless n$) is $C_{n,r}$. Finally, it is assumed that (in the nth category) $e_1e_2e_3 \ldots e_n = 1$, the suffixes being in their natural order.

Let $A_r = \Sigma\alpha E^{(r)}$ and $B_s = \Sigma\beta E^{(s)}$ be two extensive quantities of species r and s; then if $r+s \nless n$, they may be multiplied by the rule

$$A_rB_s = \Sigma(\alpha\beta)E^{(r)}E^{(s)}$$

where the products $E^{(r)}E^{(s)}$ may be expressed as derived units of species $(r+s)$. The product B_sA_r is equal or opposite to A_rB_s, according as rs is even or odd. This process may be extended to the product of three or more factors such as $A_rB_sC_t \ldots$ provided that $r+s+t+ \ldots$ does not exceed n. The law is associative; thus, for instance, $(AB)C = A(BC)$. But the commutative law does not always hold; thus, indicating species, as before, by suffixes, $A_rB_sC_t = (-1)^{rs+st+tr}C_tB_sA_r$, with analogous rules for other cases.

If $r+s>n$, a product such as E_rE_s, worked out by the previous rules, comes out to be zero. A characteristic feature of the calculus is that a meaning can be attached to a symbol of this kind by adopting a new rule, called that of *regressive* multiplication, as distinguished from the foregoing, which is *progressive.* The new rule requires some preliminary explanation. If E is any extensive unit, there is one other unit E′, and only one, such that the (progressive) product EE′ = 1. This unit is called the supplement of E, and denoted by |E. For example, when $n=4$,

$$|e_1 = e_2e_3e_4, \quad |e_1e_3 = e_4e_2, \quad |e_2e_3e_4 = -e_1,$$

and so on. Now when $r+s>n$, the product E_rE_s is defined to be that unit of which the supplement is the progressive product $|E_r|E_s$. For instance, if $n=4$, $E_r = e_1e_3$, $E_s = e_2e_3e_4$, we have

$$|E_r|E_s = (-e_2e_4)(-e_1) = e_1e_2e_4 = |e_3,$$

consequently, by the rule of regressive multiplication,

$$e_1e_3.e_2e_3e_4 = e_3.$$

Applying the distributive law, we obtain, when $r+s>n$,

$$A_rB_s = \Sigma\alpha E_r\Sigma\beta E_s = \Sigma(\alpha\beta)E_rE_s,$$

where the regressive products E_rE_s are to be reduced to units of species $(r+s-n)$ by the foregoing rule.

If $A = \Sigma\alpha E$, then, by definition, $|A = \Sigma\alpha|E$, and hence

$$A|(B+C) = A|B + A|C.$$

Now this is formally analogous to the distributive law of multiplication; and in fact we may look upon A|B as a particular way of multiplying A and B (not A and B). The symbol AB, from this point of view, is called the *inner* product of A and B, as distinguished from the *outer* product |AB. An inner product may be either progressive or regressive. In the course of reducing such expressions as (AB)C, (AB)|C(DE)| and the like, where a chain of multiplications has to be performed in a certain order, the multiplications may be all progressive, or all regressive, or partly, one, partly the other. In the first two cases the product is said to be *pure,* in the third case *mixed.* A pure product is associative; a mixed product, speaking generally, is not.

The outer and inner products of two extensive quantities A, B, are in many ways analogous to the quaternion symbols Vab and Sab respectively. As in quaternions, so in the extensive calculus, there are numerous formulae of transformation which enable us to deal with extensive quantities without expressing them in terms of the primary units. Only a few illustrations can be given here, Let a, b, c, d, e, f be quantities of the first species in the fourth category; A, B, C ... quantities of the third species in the same category. Then

$$\begin{aligned}(de)(abc) &= (abde)c + (cade)b + (bcde)a \\ &= (abce)d - (abcd)e.\end{aligned}$$

$$(ab)(AB) = (aA)(bB) - (aB)(bA)$$

$$ab|c = (a|c)b - (b|c)a, \quad (ab|cd) = (a|c)(b|d) - (a|d)(b|c).$$

These may be compared and contrasted with such quaternion formulae as

$$\begin{gathered}S(VabVcd) = SadSbc - SacSbd \\ dSabc = aSbcd - bScda + cSadb\end{gathered}$$

where a, b, c, d denote arbitrary vectors.

Linear algebras.

8. An n-tuple linear algebra (also called a complex number system) deals with quantities of the type $A = \Sigma\alpha_ie_i$ derived from n special units $e_1, e_2 \ldots e_n$. The sum and product of two quantities are defined in the first instance by the formulae

$$\Sigma\alpha e + \Sigma\beta e = \Sigma(\alpha+\beta)e, \quad \Sigma\alpha_ie_i \times \Sigma\beta_je_j = \Sigma(\alpha_i\beta_j)e_ie_j,$$

so that the laws A, C, D of § 3 are satisfied. The binary products e_ie_j, however, are expressible as linear functions of the units e_i by means of a "multiplication table" which defines the special characteristics of the algebra in question. Multiplication may or may not be commutative, and in the same way it may or may not be associative. The types of linear associative algebras, not assumed to be commutative, have been enumerated (with some omissions) up to sextuple algebras inclusive by B. Pierce. Quaternions afford an example of a quadruple algebra of this kind; ordinary algebra is a special case of a duplex linear algebra. If, in the extensive calculus of the nth category, all the units (including 1 and the derived units E) are taken to be homologous instead of being distributed into species, we may regard it as a (2^n-1)-tuple linear algebra, which, however, is not wholly associative. It should be observed that while the use of special units, or extraordinaries, in a linear algebra is convenient, especially in applications, it is not indispensable. Any linear quantity may be denoted by a symbol $(\alpha_1, \alpha_2, \ldots \alpha_n)$ in which only its scalar coefficients occur; in fact, the special units only serve, in the algebra proper, as *umbrae* or regulators of certain operations on scalars (see NUMBER). This idea finds fuller expression in the algebra of matrices, as to which it must suffice to say that a matrix is a symbol consisting of a rectangular array of scalars, and that matrices may be combined by a rule of addition which obeys the usual laws, and a rule of multiplication which is distributive and associative, but not, in general, commutative. Various special algebras (for example, quaternions) may be expressed in the notation of the algebra of matrices.

9. In ordinary algebra we have the disjunctive law that if $ab=0$, then either $a=0$ or $b=0$. This applies also to quaternions, but not to extensive quantities, nor is it true for linear algebras in general. One of the most important questions in investigating a linear algebra is to decide the necessary relations between a and b in order that this product may be zero.

Subsidiary algebras.

10. The algebras discussed up to this point may be considered as independent in the sense that each of them deals with a class of symbols of quantity more or less homogeneous, and a set of operations applying to them all. But when an algebra is used with a particular interpretation, or even in the course of its formal development, it frequently happens that new symbols of operation are, so to speak, superposed upon the algebra, and are found to obey certain formal laws of combination of their own. For instance, there are the symbols Δ, D, E used in the calculus of finite differences; Aronhold's symbolical method in the calculus of invariants; and the like. In most cases these subsidiary algebras, as they may be called, are inseparable from the applications in which they are used; but in any attempt at a natural classification of algebra (at present a hopeless task), they would have to be taken into account. Even in ordinary algebra the notation for powers and roots disturbs the symmetry of the rational theory; and when a schoolboy illegitimately extends the distributive law by writing $\sqrt{(a+b)} = \sqrt{a} + \sqrt{b}$, he is unconsciously emphasizing this want of complete harmony.

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C. HISTORY

Etymology.

Various derivations of the word "algebra," which is of Arabian origin, have been given by different writers. The first mention of the word is to be found in the title of a work by Mahommed ben Musa al-Khwarizmi (Hovarezmi), who flourished about the beginning of the 9th century. The full title is *ilm al-jebr wa'l-muqâbala*, which contains the ideas of restitution and comparison, or opposition and comparison, or resolution and equation, *jebr* being derived from the verb *jabara*, to reunite, and *muqābala*, from *gabala*, to make equal. (The root *jabara* is also met with in the word *algebrista*, which means a "bone-setter," and is still in common use in Spain.) The same derivation is given by Lucas Paciolus (Luca Pacioli), who reproduces the phrase in the transliterated form *alghebra e almucabala*, and ascribes the invention of the art to the Arabians.

Other writers have derived the word from the Arabic particle *al* (the definite article), and *geber*, meaning "man." Since, however, Geber happened to be the name of a celebrated Moorish philosopher who flourished in about the 11th or 12th century, it has been supposed that he was the founder of algebra, which has since perpetuated his name. The evidence of Peter Ramus (1515–1572) on this point is interesting, but he gives no authority for his singular statements. In the preface to his *Arithmeticae libri duo et totidem Algebrae* (1560) he says: "The name *Algebra* is Syriac, signifying the art or doctrine of an excellent man. For *Geber*, in Syriac, is a name applied to men, and is sometimes a term of honour, as master or doctor among us. There was a certain learned mathematician who sent his algebra, written in the Syriac language, to Alexander the Great, and he named it *almucabala*, that is, the book of dark or mysterious things, which others would rather call the doctrine of algebra. To this day the same book is in great estimation among the learned in the oriental nations, and by the Indians, who cultivate this art, it is called *aljabra* and *alboret*; though the name of the author himself is not known." The uncertain authority of these statements, and the plausibility of the preceding explanation, have caused philologists to accept the derivation from *al* and *jabara*. Robert Recorde in his *Whetstone of Witte* (1557) uses the variant *algeber*, while John Dee (1527–1608) affirms that *algiebar*, and not algebra, is the correct form, and appeals to the authority of the Arabian Avicenna.

Although the term "algebra" is now in universal use, various other appellations were used by the Italian mathematicians during the Renaissance. Thus we find Paciolus calling it *l'Arte Magiore; ditta dal vulgo la Regula de la Cosa over Alghebra e Almucabala*. The name *l'arte magiore*, the greater art, is designed to distinguish it from *l'arte minore*, the lesser art, a term which he applied to the modern arithmetic. His second variant, *la regula de la cosa*, the rule of the thing or unknown quantity, appears to have been in common use in Italy, and the word *cosa* was preserved for several centuries in the forms *coss* or algebra, *cossic* or algebraic, *cossist* or algebraist, &c. Other Italian writers termed it the *Regula rei et census*, the rule of the thing and the product, or the root and the square. The principle underlying this expression is probably to be found in the fact that it measured the limits of their attainments in algebra, for they were unable to solve equations of a higher degree than the quadratic or square.

Franciscus Vieta (François Viète) named it *Specious Arithmetic*, on account of the species of the quantities involved, which he represented symbolically by the various letters of the alphabet. Sir Isaac Newton introduced the term *Universal Arithmetic*, since it is concerned with the doctrine of operations, not affected on numbers, but on general symbols.

Notwithstanding these and other idiosyncratic appellations, European mathematicians have adhered to the older name, by which the subject is now universally known.

It is difficult to assign the invention of any art or science definitely to any particular age or race. The few fragmentary records, which have come down to us from past civilizations, must not be regarded as representing the totality of their knowledge, and the omission of a science or art does not necessarily imply that the science or art was unknown. It was formerly the custom to assign the invention of algebra to the Greeks, but since the decipherment of the *Rhind papyrus* by Eisenlohr this view has changed, for in this work there are distinct signs of an algebraic analysis. The particular problem—a heap (*hau*) and its seventh makes 19—is solved as we should now solve a simple equation; but Ahmes varies his methods in other similar problems. This discovery carries the invention of algebra back to about 1700 B.C., if not earlier.

Greek algebra.

It is probable that the algebra of the Egyptians was of a most rudimentary nature, for otherwise we should expect to find traces of it in the works of the Greek geometers, of whom Thales of Miletus (640–546 B.C.) was the first. Notwithstanding the prolixity of writers and the number of the writings, all attempts at extracting an algebraic analysis from their geometrical theorems and problems have been fruitless, and it is generally conceded that their analysis was geometrical and had little or no affinity to algebra. The first extant work which approaches to a treatise on algebra is by Diophantus (*q.v.*), an Alexandrian mathematician, who flourished about A.D. 350. The original, which consisted of a preface and thirteen books, is not lost, but we have a Latin translation of the first six books and a fragment of another on polygonal numbers by Xylander of Augsburg (1575), and Latin and Greek translations by Gaspar Bachet de Merizac (1621–1670). Other editions have been published, of which we may mention Pierre Fermat's (1670), T. L. Heath's (1885) and P. Tannery's (1893–1895). In the preface to this work, which is dedicated to one Dionysius, Diophantus explains his notation, naming the square, cube and fourth powers, *dynamis*, *cubus*, *dynamodinimus*, and so on, according to the sum in the indices. The unknown he terms *arithmos*, the number, and in solutions he marks it by the final *s*; he explains the generation of powers, the rules for multiplication and division of simple quantities, but he does not treat of the addition, subtraction, multiplication and division of compound quantities. He then proceeds to discuss various artifices for the simplification of equations, giving methods which are still in common use. In the body of the work he displays considerable ingenuity in reducing his problems to simple equations, which admit either of direct solution, or fall into the class known as indeterminate equations. This latter class he discussed so assiduously that they are often known as *Diophantine problems*, and the methods of resolving them as the *Diophantine analysis* (see EQUATION, *Indeterminate*). It is

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difficult to believe that this work of Diophantus arose spontaneously in a period of general stagnation. It is more than likely that he was indebted to earlier writers, whom he omits to mention, and whose works are now lost; nevertheless, but for this work, we should be led to assume that algebra was almost, if not entirely, unknown to the Greeks.

The Romans, who succeeded the Greeks as the chief civilized power in Europe, failed to set store on their literary and scientific treasures; mathematics was all but neglected; and beyond a few improvements in arithmetical computations, there are no material advances to be recorded.

Indian algebra.

In the chronological development of our subject we have now to turn to the Orient. Investigation of the writings of Indian mathematicians has exhibited a fundamental distinction between the Greek and Indian mind, the former being pre-eminently geometrical and speculative, the latter arithmetical and mainly practical. We find that geometry was neglected except in so far as it was of service to astronomy; trigonometry was advanced, and algebra improved far beyond the attainments of Diophantus.

The earliest Indian mathematician of whom we have certain knowledge is Aryabhatta, who flourished about the beginning of the 6th century of our era. The fame of this astronomer and mathematician rests on his work, the *Aryabhattiyam*, the third chapter of which is devoted to mathematics. Ganessa, an eminent astronomer, mathematician and scholiast of Bhaskara, quotes this work and makes separate mention of the *cuttaca* ("pulveriser"), a device for effecting the solution of indeterminate equations. Henry Thomas Colebrooke, one of the earliest modern investigators of Hindu science, presumes that the treatise of Aryabhatta extended to determinate quadratic equations, indeterminate equations of the first degree, and probably of the second. An astronomical work, called the *Surya-siddhanta* ("knowledge of the Sun"), of uncertain authorship and probably belonging to the 4th or 5th century, was considered of great merit by the Hindus, who ranked it only second to the work of Brahmagupta, who flourished about a century later. It is of great interest to the historical student, for it exhibits the influence of Greek science upon Indian mathematics at a period prior to Aryabhatta. After an interval of about a century, during which mathematics attained its highest level, there flourished Brahmagupta (b. A.D. 598), whose work entitled *Brahma-sphuta-siddhanta* ("The revised system of Brahma") contains several chapters devoted to mathematics. Of other Indian writers mention may be made of Cridhara, the author of a *Ganita-sara* ("Quintessence of Calculation"), and Padmanabha, the author of an algebra.

A period of mathematical stagnation then appears to have possessed the Indian mind for an interval of several centuries, for the works of the next author of any moment stand but little in advance of Brahmagupta. We refer to Bhaskara Acarya, whose work the *Siddhanta-ciromani* ("Diadem of an Astronomical System"), written in 1150, contains two important chapters, the *Lilavati* ("the beautiful [science or art]") and *Viga-ganita* ("root-extraction"), which are given up to arithmetic and algebra.

English translations of the mathematical chapters of the *Brahma-siddhanta* and *Siddhanta-ciromani* by H. T. Colebrooke (1817), and of the *Surya-siddhanta* by E. Burgess, with annotations by W. D. Whitney (1860), may be consulted for details.

The question as to whether the Greeks borrowed their algebra from the Hindus or *vice versa* has been the subject of much discussion. There is no doubt that there was a constant traffic between Greece and India, and it is more than probable that an exchange of produce would be accompanied by a transference of ideas. Moritz Cantor suspects the influence of Diophantine methods, more particularly in the Hindu solutions of indeterminate equations, where certain technical terms are, in all probability, of Greek origin. However this may be, it is certain that the Hindu algebraists were far in advance of Diophantus. The deficiencies of the Greek symbolism were partially remedied; subtraction was denoted by placing a dot over the subtrahend; multiplication, by placing *bha* (an abbreviation of *bhavita*, the "product") after the factors; division, by placing the divisor under the dividend; and square root, by inserting *ka* (an abbreviation of *karana*, irrational) before the quantity. The unknown was called *yâvattâvat*, and if there were several, the first took this appellation, and the others were designated by the names of colours; for instance, x was denoted by *yâ* and y by *kâ* (from *kâlaka*, black).

A notable improvement on the ideas of Diophantus is to be found in the fact that the Hindus recognized the existence of two roots of a quadratic equation, but the negative roots were considered to be inadequate, since no interpretation could be found for them. It is also supposed that they anticipated discoveries of the solutions of higher equations. Great advances were made in the study of indeterminate equations, a branch of analysis in which Diophantus excelled. But whereas Diophantus aimed at obtaining a single solution, the Hindus strove for a general method by which any indeterminate problem could be resolved. In this they were completely successful, for they obtained general solutions for the equations $ax \pm by = c$, $xy = ax + by + c$ (since rediscovered by Leonhard Euler) and $cy^2 = ax^2 + b$. A particular case of the last equation, namely, $y^2 = ax^2 + 1$, sorely taxed the resources of modern algebraists. It was proposed by Pierre de Fermat to Bernhard Frenicle de Bessy, and in 1657 to all mathematicians. John Wallis and Lord Brounker jointly obtained a tedious solution which was published in 1658, and afterwards in 1668 by John Pell in his *Algebra*. A solution was also given by Fermat in his *Relation*. Although Pell had nothing to do with the solution, posterity has termed the equation *Pell's Equation, or Problem*, when more rightly it should be the *Hindu Problem*, in recognition of the mathematical attainments of the Brahmans.

Hermann Hankel has pointed out the readiness with which the Hindus passed from number to magnitude and *vice versa*. Although this transition from the discontinuous to continuous is not truly scientific, yet it materially augmented the development of algebra, and Hankel affirms that if we define algebra as the application of arithmetical operations to both rational and irrational numbers or magnitudes, then the Brahmans are the real inventors of algebra.

Arabian algebra.

The integration of the scattered tribes of Arabia in the 7th century by the stirring religious propaganda of Mahomet was accompanied by a meteoric rise in the intellectual powers of a hitherto obscure race. The Arabs became the custodians of Indian and Greek science, whilst Europe was rent by internal dissensions. Under the rule of the Abbasids, Bagdad became the centre of scientific thought; physicians and astronomers from India and Syria flocked to their court; Greek and Indian manuscripts were translated (a work commenced by the Caliph Mamun (813–833) and ably continued by his successors); and in about a century the Arabs were placed in possession of the vast stores of Greek and Indian learning. Euclid's *Elements* were first translated in the reign of Harun-al-Rashid (786–809), and revised by the order of Mamun. But these translations were regarded as imperfect, and it remained for Tobit ben Korra (836–901) to produce a satisfactory edition. Ptolemy's *Almagest*, the works of Apollonius, Archimedes, Diophantus and portions of the Brahmasiddhanta, were also translated. The first notable Arabian mathematician was Mahommed ben Musa al-Khwarizmi, who flourished in the reign of Mamun. His treatise on algebra and arithmetic (the latter part of which is only extant in the form of a Latin translation, discovered in 1857) contains nothing that was unknown to the Greeks and Hindus; it exhibits methods allied to those of both races, with the Greek element predominating. The part devoted to algebra has the title *al-jebr wa'l-muqâbala*, and the arithmetic begins with "Spoken has Algoritmi," the name Khwarizmi or Hovarezmi having passed into the word *Algoritmi*, which has been further transformed into the more modern words *algorism* and *algorithm*, signifying a method of computing.

Tobit ben Korra (836–901), born at Harran in Mesopotamia, an accomplished linguist, mathematician and astronomer, rendered conspicuous service by his translations of various Greek authors. His investigation of the properties of *amicable numbers* (*q.v.*) and of the problem of trisecting an angle, are of importance. The Arabians more closely resembled the Hindus than the Greeks in the choice of studies; their philosophers blended speculative dissertations with the more progressive study of medicine; their mathematicians neglected the subtleties of the conic sections and Diophantine analysis, and applied themselves more particularly to perfect the system of numerals (see NUMERAL), arithmetic and astronomy (*q.v.*). It thus came about that while some progress was made in algebra, the talents of the race were bestowed on astronomy and trigonometry (*q.v.*). Fahri des al Karhi, who flourished about the beginning of the 11th century, is the author of the most important Arabian work on algebra. He follows the methods of Diophantus; his work on indeterminate equations has no resemblance to the Indian methods, and contains nothing that cannot be gathered from Diophantus. He solved quadratic equations both geometrically and algebraically, and also equations of the form $x^{2n}+ax^n+b=0$; he also proved certain relations between the sum of the first n natural numbers, and the sums of their squares and cubes.

Cubic equations were solved geometrically by determining the intersections of conic sections. Archimedes' problem of dividing a sphere by a plane into two segments having a prescribed ratio, was first expressed as a cubic equation by Al Mahani, and the first solution was given by Abu Gafar al Hazin. The determination of the side of a regular heptagon which can be inscribed or circumscribed to a given circle was reduced to a more complicated equation which was first successfully resolved by Abul Gud. The method of solving equations geometrically was considerably developed by Omar Khayyam of Khorassan, who flourished in the 11th century. This author questioned the possibility of solving cubics by pure algebra, and biquadratics by geometry. His first contention was not disproved until the 15th century, but his second was disposed of by Abul Wefa (940–998), who succeeded in solving the forms $x^4=a$ and $x^4+ax^3=b$.

Although the foundations of the geometrical resolution of cubic equations are to be ascribed to the Greeks (for Eutocius assigns to Menaechmus two methods of solving the equation $x^3=a$ and $x^3=2a^3$), yet the subsequent development by the Arabs must be regarded as one of their most important achievements. The Greeks had succeeded in solving an isolated example; the Arabs accomplished the general solution of numerical equations.

Considerable attention has been directed to the different styles in which the Arabian authors have treated their subject. Moritz Cantor has suggested that at one time there existed two schools, one in sympathy with the Greeks, the other with the Hindus; and that, although the writings of the latter were first studied, they were rapidly discarded for the more perspicuous Grecian methods, so that, among the later Arabian writers, the Indian methods were practically forgotten and their mathematics became essentially Greek in character.

Turning to the Arabs in the West we find the same enlightened spirit; Cordova, the capital of the Moorish empire in Spain, was as much a centre of learning as Bagdad. The earliest known Spanish mathematician is Al Madshritti (d. 1007), whose fame rests on a dissertation on amicable numbers, and on the schools which were founded by his pupils at Cordova, Dania and Granada. Gabir ben Aflah of Sevilla, commonly called Geber, was a celebrated astronomer and apparently skilled in algebra, for it has been supposed that the word "algebra" is compounded from his name.

When the Moorish empire began to wane the brilliant intellectual gifts which they had so abundantly nourished during three or four centuries became enfeebled, and after that period they failed to produce an author comparable with those of the 7th to the 11th centuries.

Algebra in Europe.

In Europe the decline of Rome was succeeded by a period, lasting several centuries, during which the sciences and arts were all but neglected. Political and ecclesiastical dissensions occupied the greatest intellects, and the only progress to be recorded is in the art of computing or arithmetic, and the translation of Arabic manuscripts. The first successful attempt to revive the study of algebra in Christendom was due to Leonardo of Pisa, an Italian merchant trading in the Mediterranean. His travels and mercantile experience had led him to conclude that the Hindu methods of computing were in advance of those then in general use, and in 1202 he published his *Liber Abaci*, which treats of both algebra and arithmetic. In this work, which is of great historical interest, since it was published about two centuries before the art of printing was discovered, he adopts the Arabic notation for numbers, and solves many problems, both arithmetical and algebraical. But it contains little that is original, and although the work created a great sensation when it was first published, the effect soon passed away, and the book was practically forgotten. Mathematics was more or less ousted from the academic curricula by the philosophical inquiries of the schoolmen, and it was only after an interval of nearly three centuries that a worthy successor to Leonardo appeared. This was Lucas Paciolus (Lucas de Burgo), a Minorite friar, who, having previously written works on algebra, arithmetic and geometry, published, in 1494, his principal work, entitled *Summa de Arithmetica, Geometria, Proportioni et Proportionalita*. In it he mentions many earlier writers from whom he had learnt the science, and although it contains very little that cannot be found in Leonardo's work, yet it is especially noteworthy for the systematic employment of symbols, and the manner in which it reflects the state of mathematics in Europe during this period. These works are the earliest printed books on mathematics. The renaissance of mathematics was thus effected in Italy, and it is to that country that the leading developments of the following century were due. The first difficulty to be overcome was the algebraical solution of cubic equations, the *pons asinorum* of the earlier mathematicians. The first step in this direction was made by Scipio Ferro (d. 1526), who solved the equation $x^3+ax=b$. Of his discovery we know nothing except that he declared it to his pupil Antonio Marie Floridas. An imperfect solution of the equation $x^3+px^2=q$ was discovered by Nicholas Tartalea (Tartaglia) in 1530, and his pride in this achievement led him into conflict with Floridas, who proclaimed his own knowledge of the form resolved by Ferro. Mutual recriminations led to a public discussion in 1535, when Tartalea completely vindicated the general applicability of his methods and exhibited the inefficiencies of that of Floridas. This contest over, Tartalea redoubled his attempts to generalize his methods, and by 1541 he possessed the means for solving any form of cubic equation. His discoveries had made him famous all over Italy, and he was earnestly solicited to publish his methods; but he abstained from doing so, saying that he intended to embody them in a treatise on algebra which he was preparing. At last he succumbed to the repeated requests of Girolamo or Geronimo Cardano, who swore that he would regard them as an inviolable secret. Cardan or Cardano, who was at that time writing his great work, the *Ars Magna*, could not restrain the temptation of crowning his treatise with such important discoveries, and in 1545 he broke his oath and gave to the world Tartalea's rules for solving cubic equations. Tartalea, thus robbed of his most cherished possession, was in despair. Recriminations ensued until his death in 1557, and although he sustained his claim for priority, posterity has not conceded to him the honour of his discovery, for his solution is now known as *Cardan's Rule*.

Cubic equations.

Biquadratic equations.

Cubic equations having been solved, biquadratics soon followed suit. As early as 1539 Cardan had solved certain particular cases, but it remained for his pupil, Lewis (Ludovici) Ferrari, to devise a general method. His solution, which is sometimes erroneously ascribed to Rafael Bombelli, was published in the *Ars Magna*. In this work, which is one of the most valuable contributions to the literature of algebra, Cardan shows that he was familiar with both real positive and negative roots of equations whether rational or irrational, but of imaginary roots he was quite ignorant, and he admits his inability to resolve the so-called "irreducible case" (see EQUATION). Fundamental theorems in the theory of equations are to be found in the same work. Clearer ideas of imaginary quantities and the "irreducible case" were subsequently published by Bombelli, in a work of which the dedication is dated 1572, though the book was not published until 1579.

Contemporaneously with the remarkable discoveries of the Italian mathematicians, algebra was increasing in popularity in Germany, France and England. Michael Stifel and Johann Scheubelius (Scheybl) (1494–1570) flourished in Germany, and although unacquainted with the work of Cardan and Tartalea, their writings are noteworthy for their perspicuity and the introduction of a more complete symbolism for quantities and operations. Stifel introduced the sign (+) for addition or a positive quantity, which was previously denoted by *plus*, *più*, or the letter *p*. Subtraction, previously written as *minus*, *mene* or the letter *m*, was symbolized by the sign (−) which is still in use. The square root he denoted by (√), whereas Paciolus, Cardan and others used the letter R.

The first treatise on algebra written in English was by Robert Recorde, who published his arithmetic in 1552, and his algebra entitled *The Whetstone of Witte, which is the second part of Arithmetik*, in 1557. This work, which is written in the form of a dialogue, closely resembles the works of Stifel and Scheubelius, the latter of whom he often quotes. It includes the properties of numbers; extraction of roots of arithmetical and algebraical quantities, solutions of simple and quadratic equations, and a fairly complete account of surds. He introduced the sign (=) for equality, and the terms *binomial* and *residual*. Of other writers who published works about the end of the 16th century, we may mention Jacques Peletier, or Jacobus Peletarius (*De occulta parte Numerorum, quam Algebram vocant*, 1558); Petrus Ramus (*Arithmeticae Libri duo et totidem Algebrae*, 1560), and Christoph Clavius, who wrote on algebra in 1580, though it was not published until 1608. At this time also flourished Simon Stevinus (Stevin) of Bruges, who published an arithmetic in 1585 and an algebra shortly afterwards. These works possess considerable originality, and contain many new improvements in algebraic notation; the unknown (*res*) is denoted by a small circle, in which he places an integer corresponding to the power. He introduced the terms *multinomial*, *trinomial*, *quadrinomial*, &c., and considerably simplified the notation for decimals.

About the beginning of the 17th century various mathematical works by Franciscus Vieta were published, which were afterwards collected by Franz van Schooten and republished in 1646 at Leiden. These works exhibit great originality and mark an important epoch in the history of algebra. Vieta, who does not avail himself of the discoveries of his predecessors—the negative roots of Cardan, the revised notation of Stifel and Stevin, &c.—introduced or popularized many new terms and symbols, some of which are still in use. He denotes quantities by the letters of the alphabet, retaining the vowels for the unknown and the consonants for the knowns; he introduced the *vinculum* and among others the terms *coefficient*, *affirmative*, *negative*, *pure* and *adfected* equations. He improved the methods for solving equations, and devised geometrical constructions with the aid of the conic sections. His method for determining approximate values of the roots of equations is far in advance of the Hindu method as applied by Cardan, and is identical in principle with the methods of Sir Isaac Newton and W. G. Horner.

We have next to consider the works of Albert Girard, a Flemish mathematician. This writer, after having published an edition of Stevin's works in 1625, published in 1629 at Amsterdam a small tract on algebra which shows a considerable advance on the work of Vieta. Girard is inconsistent in his notation, sometimes following Vieta, sometimes Stevin; he introduced the new symbols *ff* for *greater than* and § for *less than*; he follows Vieta in using the *plus* (+) for addition, he denotes subtraction by Recorde's symbol for equality (=), and he had no sign for equality but wrote the word out. He possessed clear ideas of indices and the generation of powers, of the negative roots of equations and their geometrical interpretation, and was the first to use the term *imaginary roots*. He also discovered how to sum the powers of the roots of an equation.

Passing over the invention of logarithms (*q.v.*) by John Napier, and their development by Henry Briggs and others, the next author of moment was an Englishman, Thomas Harriot, whose algebra (*Artis analyticae praxis*) was published posthumously by Walter Warner in 1631. Its great merit consists in the complete notation and symbolism, which avoided the cumbersome expressions of the earlier algebraists, and reduced the art to a form closely resembling that of to-day. He follows Vieta in assigning the vowels to the unknown quantities and the consonants to the knowns, but instead of using capitals, as with Vieta, he employed the small letters; equality he denoted by Recorde's symbol, and he introduced the signs > and < for *greater than* and *less than*. His principal discovery is concerned with equations, which he showed to be derived from the continued multiplication of as many simple factors as the highest power of the unknown, and he was thus enabled to deduce relations between the coefficients and various functions of the roots. Mention may also be made of his chapter on inequalities, in which he proves that the arithmetic mean is always greater than the geometric mean.

William Oughtred, a contemporary of Harriot, published an algebra, *Clavis mathematicae*, simultaneously with Harriot's treatise. His notation is based on that of Vieta, but he introduced the sign × for multiplication, ∺ for continued proportion, : : for proportion, and denoted ratio by one dot. This last character has since been entirely restricted to multiplication, and ratio is now denoted by two dots (:). His symbols for *greater than* and *less than* (⊐ and ⊐) have been completely superseded by Harriot's signs.

So far the development of algebra and geometry had been mutually independent, except for a few isolated applications of geometrical constructions to the solution of algebraical problems. Certain minds had long suspected the advantages which would accrue from the unrestricted application of algebra to geometry, but it was not until the advent of the philosopher Réné Descartes that the co-ordination was effected. In his famous *Geometria* (1637), which is really a treatise on the algebraic representation of geometric theorems, he founded the modern theory of analytical geometry (see GEOMETRY), and at the same time he rendered signal service to algebra, more especially in the theory of equations. His notation is based primarily on that of Harriot; but he differs from that writer in retaining the first letters of the alphabet for the known quantities and the final letters for the unknowns.

The 17th century is a famous epoch in the progress of science, and the mathematics in no way lagged behind. The discoveries of Johann Kepler and Bonaventura Cavalieri were the foundation upon which Sir Isaac Newton and Gottfried Wilhelm Leibnitz erected that wonderful edifice, the Infinitesimal Calculus (*q.v.*). Many new fields were opened up, but there was still continual progress in pure algebra. Continued fractions, one of the earliest examples of which is Lord Brouncker's expression for the ratio of the circumference to the diameter of a circle (see CIRCLE), were elaborately discussed by John Wallis and Leonhard Euler; the convergency of series treated by Newton, Euler and the Bernoullis; the binomial theorem, due originally to Newton and subsequently expanded by Euler and others, was used by Joseph Louis Lagrange as the basis of his *Calcul des Fonctions*. Diophantine problems were revived by Gaspar Bachet, Pierre Fermat and Euler; the modern theory of numbers was founded by Fermat and developed by Euler, Lagrange and others; and the theory of probability was attacked by Blaise Pascal and Fermat, their work being subsequently expanded by James Bernoulli, Abraham de Moivre, Pierre Simon Laplace and others. The germs of the theory of determinants are to be found in the works of Leibnitz; Étienne Bézout utilized them in 1764 for expressing the result obtained by the process of elimination known by his name, and since restated by Arthur Cayley.

In recent times many mathematicians have formulated other kinds of algebras, in which the operators do not obey the laws of ordinary algebra. This study was inaugurated by George Peacock, who was one of the earliest mathematicians to recognize the symbolic character of the fundamental principles of algebra. About the same time, D. F. Gregory, published a paper "on the real nature of symbolical algebra." In Germany the work of Martin Ohm (*System der Mathematik*, 1822) marks a step forward. Notable service was also rendered by Augustus de Morgan, who applied logical analysis to the laws of mathematics.

The geometrical interpretation of imaginary quantities had a far-reaching influence on the development of symbolic algebras. The attempts to elucidate this question by H. Kühn (1750–1751) and Jean Robert Argand (1806) were completed by Karl Friedrich Gauss, and the formulation of various systems of vector analysis by Sir William Rowan Hamilton, Hermann Grassmann and others, followed. These algebras were essentially geometrical, and it remained, more or less, for the American mathematician Benjamin Peirce to devise systems of pure symbolic algebras; in this work he was ably seconded by his son Charles S. Peirce. In England, multiple algebra was developed by James Joseph Sylvester, who, in company with Arthur Cayley, expanded the theory of matrices, the germs of which are to be found in the writings of Hamilton (see above, under (B); and QUATERNIONS).

The preceding summary shows the specialized nature which algebra has assumed since the 17th century. To attempt a history of the development of the various topics in this article is inappropriate, and we refer the reader to the separate articles.

REFERENCES.—The history of algebra is treated in all historical works on mathematics in general (see MATHEMATICS: *References*). Greek algebra can be specially studied in T. L. Heath's *Diophantus*. See also John Wallis, *Opera Mathematica* (1693–1699), and Charles Hutton, *Mathematical and Philosophical Dictionary* (1815), article "Algebra." (C. E.*)

ALGEBRAIC FORMS. The subject-matter of algebraic forms is to a large extent connected with the linear transformation of algebraical polynomials which involve two or more variables. The theories of determinants and of symmetric functions and of the algebra of differential operations have an important bearing upon this comparatively new branch of mathematics. They are the chief instruments of research, and have themselves much benefited by being so employed. When a homogeneous polynomial is transformed by general linear substitutions as hereafter explained, and is then expressed in the original form with new coefficients affecting the new variables, certain functions of the new coefficients and variables are numerical multiples of the same functions of the original coefficients and variables. The investigation of the properties of these functions, as well for a single form as for a simultaneous set of forms, and as well for one as for many series of variables, is included in the theory of invariants. As far back as 1773 Joseph Louis Lagrange, and later Carl Friedrich Gauss, had met with simple cases of such functions, George Boole, in 1841 (*Camb. Math. Journ.* iii. pp. 1-20), made important steps, but it was not till 1845 that Arthur Cayley (*Coll. Math. Papers*, i. pp. 80-94, 95-112) showed by his calculus of hyper-determinants that an infinite series of such functions might be obtained systematically. The subject was carried on over a long series of years by himself, J. J. Sylvester, G. Salmon, L. O. Hesse, S. H. Aronhold, C. Hermite, Francesco Brioschi, R.F.A. Clebsch, P. Gordon, &c. The year 1868 saw a considerable enlargement of the field of operations. This arose from the study by Felix Klein and Sophus Lie of a new theory of groups of substitutions; it was shown that there exists an invariant theory connected with every group of linear substitutions. The invariant theory then existing was classified by them as appertaining to "finite continuous groups." Other "Galois" groups were defined whose substitution coefficients have fixed numerical values, and are particularly associated with the theory of equations. Arithmetical groups, connected with the theory of quadratic forms and other branches of the theory of numbers, which are termed "discontinuous," and infinite groups connected with differential forms and equations, came into existence, and also particular linear and higher transformations connected with analysis and geometry. The effect of this was to co-ordinate many branches of mathematics and greatly to increase the number of workers. The subject of transformation in general has been treated by Sophus Lie in the classical work *Theorie der Transformationsgruppen*. The present article is merely concerned with algebraical linear transformation. Two methods of treatment have been carried on in parallel lines, the unsymbolic and the symbolic; both of these originated with Cayley, but he with Sylvester and the English school have in the main confined themselves to the former, whilst Aronhold, Clebsch, Gordan, and the continental schools have principally restricted themselves to the latter. The two methods have been conducted so as to be in constant touch, though the nature of the results obtained by the one differs much from those which flow naturally from the other. Each has been singularly successful in discovering new lines of advance and in encouraging the other to renewed efforts. P. Gordan first proved that for any system of forms there exists a finite number of covariants, in terms of which all others are expressible as rational and integral functions. This enabled David Hilbert to produce a very simple unsymbolic proof of the same theorem. So the theory of the forms appertaining to a binary form of unrestricted order was first worked out by Cayley and P. A. MacMahon by unsymbolic methods, and later G. E. Stroh, from a knowledge of the results, was able to verify and extend the results by the symbolic method. The partition method of treating symmetrical algebra is one which has been singularly successful in indicating new paths of advance in the theory of invariants; the important theorem of expressibility is, directly we exclude unity from the partitions, a theorem concerning the expressibility of covariants, and involves the theory of the reducible forms and of the syzygies. The theory brought forward has not yet found a place in any systematic treatise in any language, so that it has been judged proper to give a fairly complete account of it.[1]

I. THE THEORY OF DETERMINANTS.[1]

Let there be given n^2 quantities

$$\begin{array}{ccccc} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \dots & a_{3n} \\ \cdot & \cdot & \cdot & \dots & \cdot \\ a_{n1} & a_{n2} & a_{n3} & \dots & a_{nn} \end{array}$$

and form from them a product of n quantities

$$a_{1\alpha}\, a_{2\beta}\, a_{3\gamma} \dots a_{n\nu},$$

where the first suffixes are the natural numbers 1, 2, 3, ... n taken in order, and $\alpha, \beta, \gamma, \dots \nu$ is some permutation of these n numbers. This permutation by a transposition of two numbers, say α, β, becomes $\beta, \alpha, \gamma, \dots \nu$, and by successively transposing pairs of letters the permutation can be reduced to the form 1, 2, 3, ... n. Let k such transpositions be necessary; then the expression

$$\Sigma(-)^k a_{1\alpha} a_{2\beta} a_{3\gamma} \dots a_{n\nu},$$

the summation being for all permutations of the n numbers, is called the determinant of the n^2 quantities. The quantities $a_{1\alpha}, a_{2\beta} \dots$ are called the elements of the determinant; the term $(-)^k a_{1\alpha} a_{2\beta} a_{3\gamma} \dots a_{n\nu}$ is called a member of the determinant, and there are evidently $n!$ members corresponding to the $n!$ permutations of the n numbers 1, 2, 3, ... n. The determinant is usually written

$$\Delta = \begin{vmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \dots & a_{3n} \\ \cdot & \cdot & \cdot & \dots & \cdot \\ a_{n1} & a_{n2} & a_{n3} & \dots & a_{nn} \end{vmatrix}$$

the square array being termed the *matrix* of the determinant. A matrix has in many parts of mathematics a signification apart from its evaluation as a determinant. A theory of matrices has been constructed by Cayley in connexion particularly with the theory of linear transformation. The matrix consists of n rows and n columns. Each row as well as each column supplies one and only one element to each member of the determinant. Consideration of the definition of the determinant shows that the value is unaltered when the suffixes in each element are transposed.

Theorem.—If the determinant is transformed so as to read by columns as it formerly did by rows its value is unchanged. The *leading member* of the determinant is $a_{11}a_{22}a_{33} \dots a_{nn}$, and corresponds to the *principal diagonal* of the matrix.

We write frequently

$$\Delta = \Sigma \pm a_{11}a_{22}a_{33} \dots a_{nn} = (a_{11}a_{22}a_{33} \dots a_{nn}).$$

If the first two columns of the determinant be transposed the expression for the determinant becomes $\Sigma(-)^h a_{1\beta}a_{2\alpha}a_{3\gamma}\ldots a_{n\nu}$, viz. α and β are transposed, and it is clear that the number of transpositions necessary to convert the permutation $\beta\alpha\gamma\ldots\nu$ of the second suffixes to the natural order is changed by unity. Hence the transposition of columns merely changes the sign of the determinant. Similarly it is shown that the transposition of any two columns or of any two rows merely changes the sign of the determinant.

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[1] The elementary theory is given in the article DETERMINANT.

Theorem.—Interchange of any two rows or of any two columns merely changes the sign of the determinant.

Corollary.—If any two rows or any two columns of a determinant be identical the value of the determinant is zero.

Minors of a Determinant.—From the value of Δ we may separate those members which contain a particular element a_{ik} as a factor, and write the portion $a_{ik}A_{ik}$; A_{ik}, the cofactor of a_{ik}, is called a minor of order $n-1$ of the determinant.

Now $a_{11}A_{11}=\Sigma\pm a_{11}a_{22}a_{33}\ldots a_{nn}$, wherein a_{11} is not to be changed, but the second suffixes in the product $a_{22}a_{33}\ldots a_{nn}$ assume all permutations, the number of transpositions necessary determining the sign to be affixed to the member.

Hence $a_{11}A_{11}=a_{11}\Sigma\pm a_{22}a_{33}\ldots a_{nn}$, where the cofactor of a_{11} is clearly the determinant obtained by erasing the first row and the first column.

$$\text{Hence } A_{11}=\begin{vmatrix} a_{22} & a_{23} & \ldots & a_{2n}\\ a_{32} & a_{33} & \ldots & a_{3n}\\ \cdot & \cdot & \ldots & \cdot\\ a_{n2} & a_{n3} & \ldots & a_{nn}\end{vmatrix}.$$

Similarly A_{ik}, the cofactor of a_{ik}, is shown to be the product of $(-)^{i+k}$ and the determinant obtained by erasing from Δ the ith row and k^{th} column. No member of a determinant can involve more than one element from the first row. Hence we have the development

$$\Delta=a_{11}A_{11}+a_{12}A_{12}+a_{13}A_{13}+\ldots+a_{1n}A_{1n},$$

proceeding according to the elements of the first row and the corresponding minors.

Similarly we have a development proceeding according to the elements contained in any row or in any column, viz.

$$\left.\begin{aligned}\Delta&=a_{i1}A_{i1}+a_{i2}A_{i2}+a_{i3}A_{i3}+\ldots+a_{in}A_{in}\\ \Delta&=a_{1k}A_{1k}+a_{2k}A_{2k}+a_{3k}A_{3k}+\ldots+a_{nk}A_{nk}\end{aligned}\right\}(A).$$

This theory enables the evaluation of a determinant by successive reduction of the orders of the determinants involved.

Ex. gr.
$$\begin{vmatrix}1 & 0 & 3\\ 2 & 1 & 6\\ 0 & -5 & 3\end{vmatrix}=1\begin{vmatrix}1 & 6\\ -5 & 3\end{vmatrix}-0\begin{vmatrix}2 & 6\\ 0 & 3\end{vmatrix}+3\begin{vmatrix}2 & 1\\ 0 & -5\end{vmatrix}$$
$$=1\,|3|-6\,|-5|+3.2\,|-5|-3.1\,|0|$$
$$=3+30-30-0=3.$$

Since the determinant

$$\begin{vmatrix} a_{21} & a_{22} & a_{23} & \ldots & a_{2n}\\ a_{21} & a_{22} & a_{23} & \ldots & a_{2n}\\ a_{31} & a_{32} & a_{33} & \ldots & a_{3n}\\ \cdot & \cdot & \cdot & \ldots & \cdot\\ a_{n1} & a_{n2} & a_{n3} & \ldots & a_{nn}\end{vmatrix},\ \text{having two identical rows,}$$

vanishes identically; we have by development according to the elements of the first row

$$a_{21}A_{11}+a_{22}A_{12}+a_{23}A_{13}+\ldots+a_{2n}A_{1n}=0;$$

and, in general, since

$$a_{i1}A_{i1}+a_{i2}A_{i2}+a_{i3}A_{i3}+\ldots+a_{in}A_{in}=\Delta,$$

if we suppose the ith and k^{th} rows identical

$$a_{k1}A_{i1}+a_{k2}A_{i2}+a_{k3}A_{i3}+\ldots+a_{kn}A_{in}=0\quad(k\gtrless i);$$

and proceeding by columns instead of rows,

$$a_{1k}A_{1i}+a_{2k}A_{2i}+a_{3k}A_{3i}+\ldots+a_{nk}A_{ni}=0\quad(k\gtrless i)$$

identical relations always satisfied by these minors.

If in the first relation of (A) we write $a_{is}=b_{is}+c_{is}+d_{is}+\ldots$ we find that $\Sigma a_{is}A_{is}=\Sigma b_{is}A_{is}+\Sigma c_{is}A_{is}+\Sigma d_{is}A_{is}+\ldots$ so that Δ breaks up into a sum of determinants, and we also obtain a theorem for the addition of determinants which have $n-1$ rows in common. If we multiply the elements of the second row by an arbitrary magnitude λ, and add to the corresponding elements of the first row, Δ becomes $\Sigma a_{1s}A_{1s}+\lambda\Sigma a_{2s}A_{1s}=\Sigma a_{1s}A_{1s}=\Delta$, showing that the value of the determinant is unchanged. In general we can prove in the same way the—

Theorem.—The value of a determinant is unchanged if we add to the elements of any row or column the corresponding elements of the other rows or other columns respectively each multiplied by an arbitrary magnitude, such magnitude remaining constant in respect of the elements in a particular row or a particular column.

Observation.—Every factor common to all the elements of a row or of a column is obviously a factor of the determinant, and may be taken outside the determinant brackets.

Ex. gr.
$$\begin{vmatrix}\alpha^2 & \beta^2 & \gamma^2\\ \alpha & \beta & \gamma\\ 1 & 1 & 1\end{vmatrix}=\begin{vmatrix}\alpha^2 & \beta^2-\alpha^2 & \gamma^2-\alpha^2\\ \alpha & \beta-\alpha & \gamma-\alpha\\ 1 & 0 & 0\end{vmatrix}=\begin{vmatrix}\beta^2-\alpha^2 & \gamma^2-\alpha^2\\ \beta-\alpha & \gamma-\alpha\end{vmatrix}$$
$$=(\beta-\alpha)(\gamma-\alpha)\begin{vmatrix}\beta+\alpha & \gamma+\alpha\\ 1 & 1\end{vmatrix}=(\beta-\gamma)(\gamma-\alpha)\begin{vmatrix}\beta-\gamma & \gamma+\alpha\\ 0 & 1\end{vmatrix}$$
$$=(\beta-\alpha)(\gamma-\alpha)(\beta-\gamma).$$

The minor A_{ik} is $\frac{\partial\Delta}{\partial a_{ik}}$, and is itself a determinant of order $n-1$. We may therefore differentiate again in regard to any element a_{rs} where $r\gtrless i$, $s\gtrless k$; we will thus obtain a minor of A_{ik}, which is a minor also of Δ of order $n-2$. It will be $A_{\substack{ik\\rs}}=\frac{\partial A_{ik}}{\partial a_{rs}}=\frac{\partial^2\Delta}{\partial a_{ik}\partial a_{rs}}$ and will be obtained by erasing from the determinant A_{ik} the row and column containing the element a_{rs}; this was originally the rth row and s^{th} column of Δ; the rth row of Δ is the rth or $(r-1)^{th}$ row of A_{ik} according as $r\lessgtr i$ and the sth column of Δ is the sth or $(s-1)^{th}$ column of A_{ik} according as $s\gtrless k$. Hence, if T_{ri} denote the number of transpositions necessary to bring the succession ri into ascending order of magnitude, the sign to be attached to the determinant arrived at by erasing the ith and r^{th} rows and the kth and s^{th} columns from Δ in order produce $A_{\substack{ik\\rs}}$ will be -1 raised to the power of $T_{ri}+T_{ks}+i+k+r+s$.

Similarly proceeding to the minors of order $n-3$, we find that $A_{\substack{ik\\rs\\tu}}=\frac{\partial}{\partial a_{tu}}A_{\substack{ik\\rs}}=\frac{\partial^2}{\partial a_{rs}\partial a_{tu}}A_{ik}=\frac{\partial^3}{\partial a_{ik}\partial a_{rs}\partial a_{tu}}\Delta$ is obtained from Δ by erasing the ith, r^{th}, t^{th} rows, the kth, s^{th}, u^{th} columns, and multiplying the resulting determinant by -1 raised to the power $T_{irt}+T_{ksu}+i+k+r+s+t+u$ and the general law is clear.

Corresponding Minors.—In obtaining the minor $A_{\substack{ik\\rs}}$ in the form of a determinant we erased certain rows and columns, and we would have erased in an exactly similar manner had we been forming the determinant associated with $A_{\substack{is\\rk}}$, since the deleting lines intersect in two pairs of points. In the latter case the sign is determined by -1 raised to the same power as before, with the exception that T_{sk} replaces T_{ks}; but if one of these numbers be even the other must be uneven; hence

$$A_{\substack{ik\\rs}}=-A_{\substack{is\\rk}}.$$

Moreover

$$a_{ik}a_{rs}A_{\substack{ik\\rs}}+a_{is}a_{rk}A_{\substack{is\\rk}}=\begin{vmatrix}a_{ik} & a_{is}\\ a_{rk} & a_{rs}\end{vmatrix}A_{\substack{ik\\rs}},$$

where the determinant factor is given by the four points in which the deleting lines intersect. This determinant and that associated with $A_{\substack{ik\\rs}}$ are termed corresponding determinants. Similarly p lines of deletion intersecting in p^2 points yield corresponding determinants of orders p and $n-p$ respectively. Recalling the formula

$$\Delta=a_{11}A_{11}+a_{12}A_{12}+a_{13}A_{13}+\ldots+a_{1n}A_{1n},$$

it will be seen that a_{1k} and A_{1k} involve corresponding determinants. Since A_{1k} is a determinant we similarly obtain

$$A_{1k}=a_{21}A_{\substack{1k\\21}}+\ldots+a_{2,k-1}A_{\substack{1,k\\2,k-1}}+a_{2,k+1}A_{\substack{1,k\\2,k+1}}+\ldots+a_{2,n}A_{\substack{1,k\\2,n}},$$

and thence

$$\Delta=\Sigma_{i,k}a_{1i}a_{2k}A_{\substack{1i\\2k}}\quad\text{where } i\gtrless k;$$

and as before

$$\Delta=\Sigma_{i,k}\begin{vmatrix}a_{1i} & a_{2i}\\ a_{1k} & a_{2k}\end{vmatrix}A_{\substack{1i\\2k}}\quad i>k,$$

an important expansion of Δ.

Similarly

$$\Delta=\Sigma_{i,k,r}\begin{vmatrix}a_{1i} & a_{2i} & a_{3i}\\ a_{1k} & a_{2k} & a_{3k}\\ a_{1r} & a_{2r} & a_{3r}\end{vmatrix}A_{\substack{1i\\2k\\3r}}\quad i>k>r,$$

and the general theorem is manifest, and yields a development in a sum of products of corresponding determinants. If the jth column be identical with the ith the determinant Δ vanishes identically; hence if j be not equal to i, k, or r,

$$0=\Sigma\begin{vmatrix}a_{1j} & a_{2j} & a_{3j}\\ a_{1k} & a_{2k} & a_{3k}\\ a_{1r} & a_{2r} & a_{3r}\end{vmatrix}A_{\substack{1i\\2k\\3r}}.$$

Similarly, by putting one or more of the deleted rows or columns equal to rows or columns which are not deleted, we obtain, with Laplace, a number of identities between products of determinants of complementary orders.

Multiplication.—From the theorem given above for the expansion of a determinant as a sum of products of pairs of corresponding determinants it will be plain that the product of $\Delta=(a_{11}, a_{22}, \ldots a_{nn})$ and $D=(b_{11}, b_{22}, b_{nn})$ may be written as a determinant of order $2n$, viz.

$$\begin{vmatrix}
a_{11} & a_{21} & a_{31} & \ldots & a_{n1} & -1 & 0 & 0 & \ldots & 0\\
a_{12} & a_{22} & a_{32} & \ldots & a_{n2} & 0 & -1 & 0 & \ldots & 0\\
a_{13} & a_{23} & a_{33} & \ldots & a_{n3} & 0 & 0 & -1 & \ldots & 0\\
\cdot & \cdot & \cdot & \ldots & \cdot & \cdot & \cdot & \cdot & \ldots & \cdot\\
a_{1n} & a_{2n} & a_{3n} & \ldots & a_{nn} & 0 & 0 & 0 & \ldots & -1\\
0 & 0 & 0 & \ldots & 0 & b_{11} & b_{12} & b_{13} & \ldots & b_{1n}\\
0 & 0 & 0 & \ldots & 0 & b_{21} & b_{22} & b_{23} & \ldots & b_{2n}\\
0 & 0 & 0 & \ldots & 0 & b_{31} & b_{32} & b_{33} & \ldots & b_{3n}\\
\cdot & \cdot & \cdot & \ldots & \cdot & \cdot & \cdot & \cdot & \ldots & \cdot\\
0 & 0 & 0 & \ldots & 0 & b_{n1} & b_{n2} & b_{n3} & \ldots & b_{nn}
\end{vmatrix}=\begin{vmatrix}A & B\\ C & D\end{vmatrix}\ \text{for brevity.}$$

Multiply the 1st, 2nd, … n^{th} rows by $b_{11}, b_{12}, \ldots b_{1n}$ respectively, and add to the $(n+1)^{th}$ row; by $b_{21}, b_{22} \dots b_{2n}$, and add to the $(n+2)^{th}$ row; by $b_{31}, b_{32}, \dots b_{3n}$ and add to the $(n+3)^{rd}$ row, &c. C then becomes

$$\begin{vmatrix} a_{11}b_{11}+a_{12}b_{12}+\dots+a_{1n}b_{1n}, & a_{21}b_{11}+a_{22}b_{12}+\dots+a_{2n}b_{1n}, & \dots a_{n1}b_{11}+a_{n2}b_{12}+\dots+a_{nn}b_{1n} \\ a_{11}b_{21}+a_{12}b_{22}+\dots+a_{1n}b_{2n}, & a_{21}b_{21}+a_{22}b_{22}+\dots+a_{2n}b_{2n}, & \dots a_{n1}b_{21}+a_{n2}b_{22}+\dots+a_{nn}b_{2n} \\ a_{11}b_{31}+a_{12}b_{32}+\dots+a_{1n}b_{3n}, & a_{21}b_{31}+a_{22}b_{32}+\dots+a_{2n}b_{3n}, & \dots a_{n1}b_{31}+a_{n2}b_{32}+\dots+a_{nn}b_{3n} \\ \cdot & \cdot & \cdot \\ a_{11}b_{n1}+a_{12}b_{n2}+\dots+a_{1n}b_{nn}, & a_{21}b_{n1}+a_{22}b_{n2}+\dots+a_{2n}b_{nn}, & \dots a_{n1}b_{n1}+a_{n2}b_{n2}+\dots+a_{nn}b_{nn} \end{vmatrix}$$

and all the elements of D become zero. Now by the expansion theorem the determinant becomes

$$(-)^{1+2+3+\dots+2n}B.C=(-1)^{n(2n+1)+n}C=C.$$

We thus obtain for the product a determinant of order n. We may say that, in the resulting determinant, the element in the ith row and k^{th} column is obtained by multiplying the elements in the kth row of the first determinant severally by the elements in the ith row of the second, and has the expression

$$a_{k1}b_{i1}+a_{k2}b_{i2}+a_{k3}b_{i3}\dots+a_{kn}b_{in},$$

and we obtain other expressions by transforming either or both determinants so as to read by columns as they formerly did by rows.

Remark.—In particular the square of a determinant is a determinant of the same order $(b_{11}b_{22}b_{33}\dots b_{nn})$ such that $b_{ik}=b_{ki}$; it is for this reason termed symmetrical.

The Adjoint or Reciprocal Determinant arises from $\Delta=(a_{11}a_{22}a_{33}\dots a_{nn})$ by substituting for each element A_{ik} the corresponding minor A_{ik} so as to form $D=(A_{11}A_{22}A_{33}\dots A_{nn})$. If we form the product $\Delta.D$ by the theorem for the multiplication of determinants we find that the element in the ith row and k^{th} column of the product is

$$a_{k1}A_{i1}+a_{k2}A_{i2}+\dots+a_{kn}A_{in},$$

the value of which is zero when k is different from i, whilst it has the value Δ when $k=i$. Hence the product determinant has the principal diagonal elements each equal to Δ and the remaining elements zero. Its value is therefore Δ^n and we have the identity

$$D.\Delta=\Delta^n \text{ or } D=\Delta^{n-1}.$$

It can now be proved that the first minor of the adjoint determinant, say B_{rs} is equal to $\Delta^{n-2}a_{rs}$.

From the equations

$$\begin{aligned} a_{11}x_1+a_{12}x_2+a_{13}x_3+\dots &=\xi_1, \\ a_{21}x_1+a_{22}x_2+a_{23}x_3+\dots &=\xi_2, \\ a_{31}x_1+a_{32}x_2+a_{33}x_3+\dots &=\xi_3, \\ \cdot \quad \cdot \quad \cdot \quad \dots & \quad \cdot \end{aligned}$$

we derive

$$\begin{aligned} \Delta x_1 &= A_{11}\xi_1+A_{21}\xi_2+A_{31}\xi_3+\dots, \\ \Delta x_2 &= A_{12}\xi_1+A_{22}\xi_2+A_{32}\xi_3+\dots, \\ \Delta x_3 &= A_{13}\xi_1+A_{23}\xi_2+A_{33}\xi_3+\dots, \\ \cdot \quad & \cdot \quad \cdot \quad \cdot \quad \dots, \end{aligned}$$

and thence

$$\begin{aligned} \Delta^{n-1}\xi_1 &= B_{11}\Delta x_1+B_{12}\Delta x_2+B_{13}\Delta x_3+\dots, \\ \Delta^{n-1}\xi_2 &= B_{21}\Delta x_1+B_{22}\Delta x_2+B_{23}\Delta x_3+\dots, \\ \Delta^{n-1}\xi_3 &= B_{31}\Delta x_1+B_{32}\Delta x_2+B_{33}\Delta x_3+\dots, \\ \cdot \quad & \cdot \quad \cdot \quad \cdot \quad \dots, \end{aligned}$$

and comparison of the first and third systems yields

$$B_{rs}=\Delta^{n-2}a_{rs}.$$

In general it can be proved that any minor of order p of the adjoint is equal to the complementary of the corresponding minor of the original multiplied by the $(p-1)^{th}$ power of the original determinant.

Theorem.—The adjoint determinant is the $(n-1)^{th}$ power of the original determinant. The adjoint determinant will be seen subsequently to present itself in the theory of linear equations and in the theory of linear transformation.

Determinants of Special Forms.—It was observed above that the square of a determinant when expressed as a determinant of the same order is such that its elements have the property expressed by $a_{ik}=a_{ki}$. Such determinants are called *symmetrical*. It is easy to see that the adjoint determinant is also symmetrical, viz. such that $A_{ik}=A_{ki}$, for the determinant got by suppressing the ith row and k^{th} column differs only by an interchange of rows and columns from that got by suppressing the kth row and i^{th} column. If any symmetrical determinant vanish and be *bordered* as shown below

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} & \lambda_1 \\ a_{12} & a_{22} & a_{23} & \lambda_2 \\ a_{13} & a_{23} & a_{33} & \lambda_3 \\ \lambda_1 & \lambda_2 & \lambda_3 & . \end{vmatrix}$$

it is a perfect square when considered as a function of $\lambda_1, \lambda_2, \lambda_3$. For since $A_{11}A_{22}-A_{12}^2=\Delta a_{33}$, with similar relations, we have a number of relations similar to $A_{11}A_{22}=A_{12}^2$, and either $A_{rs}=+\sqrt{(A_{rr}A_{ss})}$ or $-\sqrt{(A_{rr}A_{ss})}$ for all different values of r and s. Now the determinant has the value

$$-\{\lambda_1^2A_{11}+\lambda_2^2A_{22}+\lambda_3^2A_{33}+2\lambda_2\lambda_3A_{23}+2\lambda_3\lambda_1A_{31}+2\lambda_1\lambda_2A_{12}\}$$
$$=-\Sigma\lambda_r^2A_{rr}-2\Sigma\lambda_r\lambda_sA_{rs} \text{ in general, and hence by substitution}$$
$$=\{\lambda_1\sqrt{A_{11}}+\lambda_2\sqrt{A_{22}}+\dots+\lambda_n\sqrt{A_{nn}}\}^2.$$

A *skew symmetric determinant* has $a_{rr}=0$ and $a_{rs}=-a_{sr}$ for all values of r and s. Such a determinant when of uneven degree vanishes, for if we multiply each row by -1 we multiply the determinant by $(-1)^n=-1$, and the effect of this is otherwise merely to transpose the determinant so that it reads by rows as it formerly did by columns, an operation which we know leaves the determinant unaltered. Hence $\Delta=-\Delta$ or $\Delta=0$. When a skew symmetric determinant is of even degree it is a perfect square. This theorem is due to Cayley, and reference may be made to Salmon's *Higher Algebra*, 4th ed. Art. 39. In the case of the determinant of order 4 the square root is

$$A_{12}A_{34}-A_{13}A_{24}+A_{14}A_{23}.$$

A *skew determinant* is one which is skew symmetric in all respects, except that the elements of the leading diagonal are not all zero. Such a determinant is of importance in the theory of orthogonal substitution. In the theory of surfaces we transform from one set of three rectangular axes to another by the substitutions

$$\begin{aligned} X &= ax+by+cz, \\ Y &= a'x+b'y+c'z, \\ Z &= a''x+b''y+c''z, \end{aligned}$$

where $X^2+Y^2+Z^2=x^2+y^2+z^2$. This relation implies six equations between the coefficients, so that only three of them are independent. Further we find

$$\begin{aligned} x &= aX+a'Y+a''Z, \\ y &= bX+b'Y+b''Z, \\ z &= cX+c'Y+c''Z, \end{aligned}$$

and the problem is to express the nine coefficients in terms of three independent quantities.

In general in space of n dimensions we have n substitutions similar to

$$X_1=a_{11}x_1+a_{12}x_2+\dots+a_{1n}x_n,$$

and we have to express the n^2 coefficients in terms of $\tfrac{1}{2}n(n-1)$ independent quantities; which must be possible, because

$$X_1^2+X_2^2+\dots+X_n^2=x_1^2+x_2^2+x_3^2+\dots+x_n^2.$$

Let there be $2n$ equations

$$\begin{aligned} x_1 &= b_{11}\xi_1+b_{12}\xi_2+b_{13}\xi_3+\dots, \\ x_2 &= b_{21}\xi_1+b_{22}\xi_2+b_{23}\xi_3+\dots, \\ \cdot \quad & \cdot \quad \cdot \quad \cdot \quad \cdot \\ X_1 &= b_{11}\xi_1+b_{21}\xi_2+b_{31}\xi_3+\dots, \\ X_2 &= b_{12}\xi_1+b_{22}\xi_2+b_{32}\xi_3+\dots, \\ \cdot \quad & \cdot \quad \cdot \quad \cdot \quad \cdot \end{aligned}$$

where $b_{rr}=1$ and $b_{rs}=-b_{sr}$ for all values of r and s. There are then $\tfrac{1}{2}n(n-1)$ quantities b_{rs}. Let the determinant of the b's be Δ_b and B_{rs}, the minor corresponding to b_{rs}. We can eliminate the quantities $\xi_1, \xi_2, \dots \xi_n$ and obtain n relations

$$\begin{aligned} \Delta_bX_1 &= (2B_{11}-\Delta_b)x_1+2B_{21}x_2+2B_{31}x_3+\dots, \\ \Delta_bX_2 &= 2B_{12}x_1+(2B_{22}-\Delta_b)x_2+2B_{32}x_3+\dots, \\ \cdot \quad & \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \end{aligned}$$

and from these another equivalent set

$$\begin{aligned} \Delta_bx_1 &= (2B_{11}-\Delta_b)X_1+2B_{12}X_2+2B_{13}X_3+\dots, \\ \Delta_bx_2 &= 2B_{21}X_1+(2B_{22}-\Delta_b)X_2+2B_{23}X_3+\dots, \\ \cdot \quad & \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \end{aligned}$$

and now writing

$$\frac{2B_{ii}-\Delta_b}{\Delta_b}=a_{ii}, \frac{2B_{ik}}{\Delta_b}=a_{ik},$$

we have a transformation which is orthogonal, because $\Sigma X^2=\Sigma x^2$ and the elements a_{ii}, a_{ik} are functions of the $\tfrac{1}{2}n(n-1)$ independent quantities b. We may therefore form an orthogonal transformation in association with every skew determinant which has its leading diagonal elements unity, for the $\tfrac{1}{2}n(n-1)$ quantities b are clearly arbitrary.

For the second order we may take

$$\Delta_b=\begin{vmatrix} 1, & \lambda \\ -\lambda, & 1 \end{vmatrix}=1+\lambda^2,$$

and the adjoint determinant is the same; hence

$$\begin{aligned} (1+\lambda^2)x_1 &= (1-\lambda^2)X_1+2\lambda X_2, \\ (1+\lambda^2)x_2 &= -2\lambda X_1+(1-\lambda^2)X_2. \end{aligned}$$

Similarly, for the order 3, we take

$$\Delta_b=\begin{vmatrix} 1 & \nu & -\mu \\ -\nu & 1 & \lambda \\ \mu & -\lambda & 1 \end{vmatrix}=1+\lambda^2+\mu^2+\nu^2,$$

and the adjoint is

$$\begin{vmatrix} 1+\lambda^2 & \nu+\lambda\mu & -\mu+\lambda\nu \\ -\nu+\lambda\mu & 1+\mu^2 & \lambda+\mu\nu \\ \mu+\lambda\nu & -\lambda+\mu\nu & 1+\nu^2 \end{vmatrix},$$

leading to the orthogonal substitution

$$\begin{aligned} \Delta_bx_1 &= (1+\lambda^2-\mu^2-\nu^2)X_1+2(\nu+\lambda\mu)X_2+2(-\mu+\lambda\nu)X_3 \\ \Delta_bx_2 &= 2(\lambda\mu-\nu)X_1+(1+\mu^2-\lambda^2-\nu^2)X_2+2(\mu\nu+\lambda)X_3 \\ \Delta_bx_3 &= 2(\lambda\nu+\mu)X_1+2(\mu\nu-\lambda)X_2+(1+\nu^2-\lambda^2-\mu^2)X_3. \end{aligned}$$

Functional determinants were first investigated by Jacobi in a work *De Determinantibus Functionalibus*. Suppose n dependent variables $y_1, y_2, \dots y_n$, each of which is a function of n independent variables $x_1, x_2, \dots x_n$, so that $y_s=f_s(x_1, x_2, \dots x_n)$. From the differential coefficients of the y's with regard to the x's we form the functional determinant

$$R=\begin{vmatrix}\frac{\partial y_1}{\partial x_1} & \frac{\partial y_1}{\partial x_2} & \dots & \frac{\partial y_1}{\partial x_n}\\ \frac{\partial y_2}{\partial x_1} & \frac{\partial y_2}{\partial x_2} & \dots & \frac{\partial y_2}{\partial x_n}\\ \cdot & \cdot & \dots & \cdot\\ \frac{\partial y_n}{\partial x_1} & \frac{\partial y_n}{\partial x_2} & \dots & \frac{\partial y_n}{\partial x_n}\end{vmatrix}=\begin{pmatrix}y_1, y_2, \dots y_n\\ x_1, x_2, \dots x_n\end{pmatrix} \text{ for brevity.}$$

If we have new variables z such that $z_s=\phi_s(y_1, y_2, \dots y_n)$, we have also $z_s=\psi_s(x_1, x_2, \dots x_n)$, and we may consider the three determinants

$$\begin{pmatrix}y_1, y_2, \dots y_n\\ x_1, x_2, \dots x_n\end{pmatrix}, \begin{pmatrix}z_1, z_2, \dots z_n\\ y_1, y_2, \dots y_n\end{pmatrix}, \begin{pmatrix}z_1, z_2, \dots z_n\\ x_1, x_2, \dots x_n\end{pmatrix}.$$

Forming the product of the first two by the product theorem, we obtain for the element in the ith row and k^{th} column

$$\frac{\partial z_i}{\partial y_1}\frac{\partial y_1}{\partial x_k}+\frac{\partial z_i}{\partial y_2}\frac{\partial y_2}{\partial x_k}+\dots+\frac{\partial z_i}{\partial y_n}\frac{\partial y_n}{\partial x_k},$$

which is $\frac{\partial z_i}{\partial x_k}$, the partial differential coefficient of z_i with regard to x_k. Hence the product theorem

$$\begin{pmatrix}z_1, z_2, \dots z_n\\ y_1, y_2, \dots y_n\end{pmatrix}\begin{pmatrix}y_1, y_2, \dots y_n\\ x_1, x_2, \dots x_n\end{pmatrix}=\begin{pmatrix}z_1, z_2, \dots z_n\\ x_1, x_2, \dots x_n\end{pmatrix};$$

and as a particular case

$$\begin{pmatrix}y_1, y_2, \dots y_n\\ x_1, x_2, \dots x_n\end{pmatrix}\begin{pmatrix}x_1, x_2, \dots x_n\\ y_1, y_2, \dots y_n\end{pmatrix}=1.$$

Theorem.—If the functions $y_1, y_2, \dots y_n$ be not independent of one another the functional determinant vanishes, and conversely if the determinant vanishes, $y_1, y_2, \dots y_n$ are not independent functions of $x_1, x_2, \dots x_n$.

Linear Equations.—It is of importance to study the application of the theory of determinants to the solution of a system of linear equations. Suppose given the n equations

$$\begin{gathered}f_1=a_{11}x_1+a_{12}x_2+\dots+a_{1n}x_n=0,\\ f_2=a_{21}x_1+a_{22}x_2+\dots+a_{2n}x_n=0,\\ \cdot \quad \cdot \quad \cdot \quad \dots \quad \cdot\\ f_n=a_{n1}x_1+a_{n2}x_2+\dots+a_{nn}x_n=0.\end{gathered}$$

Denote by Δ the determinant $(a_{11}a_{22}\dots a_{nn})$.

Multiplying the equations by the minors $A_{1\mu}, A_{2\mu}, \dots A_{n\mu}$ respectively, and adding, we obtain

$$x_\mu(a_{1\mu}A_{1\mu}+a_{2\mu}A_{2\mu}+\dots+a_{n\mu}A_{n\mu})=x_\mu\Delta=0,$$

since from results already given the remaining coefficients of $x_1, x_2, \dots x_{\mu-1}, x_{\mu+1}, \dots x_n$ vanish identically.

Hence if Δ does not vanish $x_1=x_2=\dots=x_n=0$ is the only solution; but if Δ vanishes the equations can be satisfied by a system of values other than zeros. For in this case the n equations are not independent since identically

$$A_{1\mu}f_1+A_{2\mu}f_2+\dots+A_{n\mu}f_n=0,$$

and assuming that the minors do not all vanish the satisfaction of $n-1$ of the equations implies the satisfaction of the nth.

Consider then the system of $n-1$ equations

$$\begin{gathered}a_{21}x_1+a_{22}x_2+\dots+a_{2n}x_n=0\\ a_{31}x_1+a_{32}x_2+\dots+a_{3n}x_n=0\\ \cdot \quad \cdot \quad \dots \quad \cdot\\ a_{n1}x_1+a_{n2}x_2+\dots+a_{nn}x_n=0,\end{gathered}$$

which becomes on writing $\frac{x_s}{x_n}=y_s$,

$$\begin{gathered}a_{21}y_1+a_{22}y_2+\dots+a_{2,n-1}y_{n-1}+a_{2n}=0\\ a_{31}y_1+a_{32}y_2+\dots+a_{3,n-1}y_{n-1}+a_{3n}=0\\ \cdot \quad \cdot \quad \dots \quad \cdot \quad \cdot\\ a_{n1}y_1+a_{n2}y_2+\dots+a_{n,n-1}y_{n-1}+a_{nn}=0.\end{gathered}$$

We can solve these, assuming them independent, for the $n-1$ ratios $y_1, y_2, \dots y_{n-1}$.

Now

$$\begin{gathered}a_{21}A_{11}+a_{22}A_{12}+\dots+a_{2n}A_{1n}=0\\ a_{31}A_{11}+a_{32}A_{12}+\dots+a_{3n}A_{1n}=0\\ \cdot \quad \cdot \quad \dots \quad \cdot\\ a_{n1}A_{11}+a_{n2}A_{12}+\dots+a_{nn}A_{1n}=0,\end{gathered}$$

and therefore, by comparison with the given equations, $x_i=\rho A_{1i}$, where ρ is an arbitrary factor which remains constant as i varies.

Hence $y_i=\frac{A_{1i}}{A_{1n}}$ where A_{1i} and A_{1n} are minors of the complete determinant $(a_{11}a_{22}\dots a_{nn})$.

$$\therefore y_i=(-)^{i+n}\frac{\begin{vmatrix}a_{21} & a_{22} & \dots a_{2,i-1} & a_{2,i+1} & \dots a_{2n}\\ a_{31} & a_{32} & \dots a_{3,i-1} & a_{3,i+1} & \dots a_{3n}\\ \cdot & \cdot & \dots \quad \cdot & \cdot & \dots \quad \cdot\\ a_{n1} & a_{n2} & \dots a_{n,i-1} & a_{n,i+1} & \dots a_{nn}\end{vmatrix}}{\begin{vmatrix}a_{21} & a_{22} & \dots a_{2,n-1}\\ a_{31} & a_{32} & \dots a_{3,n-1}\\ \cdot & \cdot & \dots \quad \cdot\\ a_{n1} & a_{n2} & \dots a_{n,n-1}\end{vmatrix}},$$

or, in words, y_i is the quotient of the determinant obtained by erasing the ith column by that obtained by erasing the nth column, multiplied by $(-1)^{i+n}$. For further information concerning the compatibility and independence of a system of linear equations, see Gordon, *Vorlesungen über Invariantentheorie*, Bd. 1, § 8.

Resultants.—When we are given k homogeneous equations in k variables or k non-homogeneous equations in $k-1$ variables, the equations being independent, it is always possible to derive from them a single equation $R=0$, where in R the variables do not appear. R is a function of the coefficients which is called the "resultant" or "eliminant" of the k equations, and the process by which it is obtained is termed "elimination." We cannot combine the equations so as to eliminate the variables unless on the supposition that the equations are simultaneous, *i.e.* each of them satisfied by a common system of values; hence the equation $R=0$ is derived on this supposition, and the vanishing of R expresses the condition that the equations can be satisfied by a common system of values assigned to the variables.

Consider two binary equations of orders m and n respectively expressed in non-homogeneous form, viz.

$$\begin{gathered}f(x)=f=a_0x^m-a_1x^{m-1}+a_2x^{m-2}-\dots=0,\\ \phi(x)=\phi=b_0x^n-b_1x^{n-1}+b_2x^{n-2}-\dots=0.\end{gathered}$$

If $\alpha_1, \alpha_2, \dots\alpha_m$ be the roots of $f=0$, $\beta_1, \beta_2, \dots\beta_n$ the roots of $\phi=0$, the condition that some root of $\phi=0$ may cause f to vanish is clearly

$$R_{f,\phi}=f(\beta_1)f(\beta_2)\dots f(\beta_n)=0;$$

so that $R_{f,\phi}$ is the resultant of f and ϕ, and expressed as a function of the roots, it is of degree m in each root β, and of degree n in each root α, and also a symmetric function alike of the roots α and of the roots β; hence, expressed in terms of the coefficients, it is homogeneous and of degree n in the coefficients of f, and homogeneous and of degree m in the coefficients of ϕ.

Ex. gr.

$$f=a_0x^2-a_1x+a_2=0,\ \phi=b_0x^2-b_1x+b_2.$$

We have to multiply $a_0\beta_1^2-a_1\beta_1+a_2$ by $a_0\beta_2^2-a_1\beta_2+a_2$ and we obtain

$$a_0^2\beta_1^2\beta_2^2-a_0a_1(\beta_1^2\beta_2+\beta_1\beta_2^2)+a_0a_2(\beta_1^2+\beta_2^2)+a_1^2\beta_1\beta_2 \\ -a_1a_2(\beta_1+\beta_2)+a_2^2,$$

where

$$\beta_1+\beta_2=\frac{b_1}{b_0},\ \beta_1\beta_2=\frac{b_2}{b_0},\ \beta_1^2+\beta_2^2=\frac{b_1^2-2b_0b_2}{b_0^2},$$

and clearing of fractions

$$R_{f,\phi}=(a_0b_2-a_2b_0)^2+(a_1b_0-a_0b_1)(a_1b_2-a_2b_1).$$

We may equally express the result as

$$\phi(\alpha_1)\phi(\alpha_2)\dots\phi(\alpha_m)=0,$$

or as

$$\prod_{s,t}(\alpha_s-\beta_t)=0.$$

This expression of R shows that, as will afterwards appear, the resultant is a simultaneous invariant of the two forms.

The resultant being a product of mn root differences, is of degree mn in the roots, and hence is of weight mn in the coefficients of the forms; *i.e.* the sum of the suffixes in each term of the resultant is equal to mn.

Resultant Expressible as a Determinant.—From the theory of linear equations it can be gathered that the condition that p linear equations in p variables (homogeneous and independent) may be simultaneously satisfied is expressible as a determinant, viz. if

$$\begin{gathered}a_{11}x_1+a_{12}x_2+\dots+a_{1p}x_p=0,\\ a_{21}x_1+a_{22}x_2+\dots+a_{2p}x_p=0,\\ \cdot \quad \cdot \quad \dots \quad \cdot\\ a_{p1}x_1+a_{p2}x_2+\dots+a_{pp}x_p=0,\end{gathered}$$

be the system the condition is, in determinant form,

$$(a_{11}a_{22}\dots a_{pp})=0;$$

in fact the determinant is the resultant of the equations.

Now, suppose f and ϕ to have a common factor $x-\gamma$,

$$f(x)=f_1(x)(x-\gamma);\ \phi(x)=\phi_1(x)(x-\gamma),$$

f_1 and ϕ_1 being of degrees $m-1$ and $n-1$ respectively; we have the identity $\phi_1(x)f(x)=f_1(x)\phi(x)$ of degree $m+n-1$.

Assuming then ϕ_1 to have the coefficients $B_1, B_2, \dots B_n$
and f_1 the coefficients $A_1, A_2, \dots A_m$,

we may equate coefficients of like powers of x in the identity, and obtain $m+n$ homogeneous linear equations satisfied by the $m+n$ quantities $B_1, B_2, \dots B_n, A_1, A_2, \dots A_m$. Forming the resultant of these equations we evidently obtain the resultant of f and ϕ.

Thus to obtain the resultant of

$$f=a_0x^3+a_1x^2+a_2x+a_3,\ \phi=b_0x^2+b_1x+b_2$$

we assume the identity

$$(B_0x+B_1)(a_0x^3+a_1x^2+a_2x+a_3)=(A_0x^2+A_1x+A_2)(b_0x^2+b_1x+b_2),$$

and derive the linear equations

$$\begin{array}{llllll}B_0a_0 & & -A_0b_0 & & & =0,\\ B_0a_1 & +B_1a_0 & -A_0b_1 & -A_1b_0 & & =0,\\ B_0a_2 & +B_1a_1 & -A_0b_2 & -A_1b_1 & -A_2b_0 & =0,\\ B_0a_3 & +B_1a_2 & & -A_1b_2 & -A_2b_1 & =0,\\ & B_1a_3 & & & -A_2b_2 & =0,\end{array}$$

and by elimination we obtain the resultant

$$\begin{vmatrix} a_0 & 0 & b_0 & 0 & 0 \\ a_1 & a_0 & b_1 & b_0 & 0 \\ a_2 & a_1 & b_2 & b_1 & b_0 \\ a_3 & a_2 & 0 & b_2 & b_1 \\ 0 & a_3 & 0 & 0 & b_2 \end{vmatrix} \quad \text{a numerical factor being disregarded.}$$

This is Euler's method. Sylvester's leads to the same expression, but in a simpler manner.

He forms n equations from f by separate multiplication by x^{n-1}, x^{n-2},...x, 1, in succession, and similarly treats ϕ with m multipliers x^{m-1}, x^{m-2},...x, 1. From these $m+n$ equations he eliminates the $m+n$ powers x^{m+n-1}, x^{m+n-2},...x, 1, treating them as independent unknowns. Taking the same example as before the process leads to the system of equations

$$\begin{aligned} a_0x^4+a_1x^3+a_2x^2+a_3x \quad &=0,\\ a_0x^3+a_1x^2+a_2x+a^3 &=0,\\ b_0x^4+b_1x^3+b_2x^2 \quad &=0,\\ b_0x^3+b_1x^2+b_2x \quad &=0,\\ b_0x^2+b_1x+b_2 &=0, \end{aligned}$$

whence by elimination the resultant

$$\begin{vmatrix} a_0 & a_1 & a_2 & a_3 & 0 \\ 0 & a_0 & a_1 & a_2 & a_3 \\ b_0 & b_1 & b_2 & 0 & 0 \\ 0 & b_0 & b_1 & b_2 & 0 \\ 0 & 0 & b_0 & b_1 & b_2 \end{vmatrix}$$

which reads by columns as the former determinant reads by rows, and is therefore identical with the former. E. Bézout's method gives the resultant in the form of a determinant of order m or n, according as m is $\gtrless n$. As modified by Cayley it takes a very simple form. He forms the equation

$$f(x)\phi(x')-f(x')\phi(x)=0,$$

which can be satisfied when f and ϕ possess a common factor. He first divides by the factor $x-x'$, reducing it to the degree $m-1$ in both x and x' where $m>n$; he then forms m equations by equating to zero the coefficients of the various powers of x'; these equations involve the m powers x_0, x, x^2,...x^{m-1} of x, and regarding these as the unknowns of a system of linear equations the resultant is reached in the form of a determinant of order m. *Ex. gr.* Put

$$(a_0x^3+a_1x^2+a_2x+a_3)(b_0x'^2+b_1x'+b_2)-(a_0x'^3+a_1x'^2+a_2x'+a_3)$$
$$(b_0x^2+b_1x+b_2)=0;$$

after division by $x-x'$ the three equations are formed

$$\begin{aligned} a_0b_0x^2=a_0b_1x+a_0b_2 \quad &=0,\\ a_0b_1x^2+(a_0b_2+a_1b_1-a_2b_0)x+a_1b_2-a_3b_0 &=0,\\ a_0b_2x^2+(a_1b_2-a_3b_0)x+a_2b_2-a_3b_1 \quad &=0 \end{aligned}$$

and thence the resultant

$$\begin{vmatrix} a_0b_0 & a_0b_1 & a_0b_2 \\ a_0b_1 & a_0b_2+a_1b_1-a_2b_0 & a_1b_2-a_3b_0 \\ a_0b_2 & a_1b_2-a_3b_0 & a_2b_2-a_3b_1 \end{vmatrix}$$

which is a symmetrical determinant.

Case of Three Variables.—In the next place we consider the resultants of three homogeneous polynomials in three variables. We can prove that if the three equations be satisfied by a system of values of the variable, the same system will also satisfy the Jacobian or functional determinant. For if u, v, w be the polynomials of orders m, n, p respectively, the Jacobian is $(u_1\ v_2\ w_3)$, and by Euler's theorem of homogeneous functions

$$\begin{aligned} xu_1+yu_2+zu_3&=mu\\ xv_1\ +yv_2\ +zv_3&=nv\\ xw_1+yw_2+zw_3&=pw; \end{aligned}$$

denoting now the reciprocal determinant by $(U_1\ V_2\ W_3)$ we obtain $Jx=muU_1+nvV_1+pwW_1$; $Jy=...$, $Jz=...$, and it appears that the vanishing of u, v, and w implies the vanishing of J. Further, if $m=n=p$, we obtain by differentiation

$$J+x\frac{\partial J}{\partial x}=m\left(u\frac{\partial U_1}{\partial x}+v\frac{\partial V_1}{\partial x}+w\frac{\partial W_1}{\partial x}+u_1U_1+v_1V_1+w_1W_1\right).$$

or

$$x\frac{\partial J}{\partial x}=(m-1)J+m\left(u\frac{\partial U_1}{\partial x}+v\frac{\partial V_1}{\partial x}+w\frac{\partial W_1}{\partial x}\right).$$

Hence the system of values also causes $\frac{\partial J}{\partial x}$ to vanish in this case; and by symmetry $\frac{\partial J}{\partial y}$ and $\frac{\partial J}{\partial z}$ also vanish.

The proof being of general application we may state that a system of values which causes the vanishing of k polynomials in k variables causes also the vanishing of the Jacobian, and in particular, when the forms are of the same degree, the vanishing also of the differential coefficients of the Jacobian in regard to each of the variables.

There is no difficulty in expressing the resultant by the method of symmetric functions. Taking two of the equations

$$\begin{aligned} ax^m+(by\ +cz)x^{m-1}+...&=0,\\ a'x^n+(b'y+c'z)x^{n-1}+...&=0, \end{aligned}$$

we find that, eliminating x, the resultant is a homogeneous function of y and z of degree mn; equating this to zero and solving for the ratio of y to z we obtain mn solutions; if values of y and z, given by any solution, be substituted in each of the two equations, they will possess a common factor which gives a value of x which, combined with the chosen values of y and z, yields a system of values which satisfies both equations. Hence in all there are mn such systems. If, therefore, we have a third equation, and we substitute each system of values in it successively and form the product of the mn expressions thus formed, we obtain a function which vanishes if any one system of values, common to the first two equations, also satisfies the third. Hence this product is the required resultant of the three equations.

Now by the theory of symmetric functions, any symmetric functions of the mn values which satisfy the two equations, can be expressed in terms of the coefficient of those equations. Hence, finally, the resultant is expressed in terms of the coefficients of the three equations, and since it is at once seen to be of degree mn in the coefficient of the third equation, by symmetry it must be of degrees np and pm in the coefficients of the first and second equations respectively. Its weight will be mnp (see Salmon's *Higher Algebra*, 4th ed. § 77). The general theory of the resultant of k homogeneous equations in k variables presents no further difficulties when viewed in this manner.

The expression in form of a determinant presents in general considerable difficulties. If three equations, each of the second degree, in three variables be given, we have merely to eliminate the six products x^2, y^2, z^2, yz, zx, xy from the six equations $u=v=w=\frac{\partial J}{\partial x}=\frac{\partial J}{\partial y}=\frac{\partial J}{\partial z}=0$; if we apply the same process to these equations each of degree three, we obtain similarly a determinant of order 21, but thereafter the process fails. Cayley, however, has shown that, whatever be the degrees of the three equations, it is possible to represent the resultant as the quotient of two determinants (Salmon, *l.c.* p. 89).

Discriminants.—The discriminant of a homogeneous polynomial in k variables is the resultant of the k polynomials formed by differentiations in regard to each of the variables.

It is the resultant of k polynomials each of degree $m-1$, and thus contains the coefficients of each form to the degree $(m-1)^{k-1}$; hence the total degrees in the coefficients of the k forms is, by addition, $k(m-1)^{k-1}$; it may further be shown that the weight of each term of the resultant is constant and equal to $m(m-1)^{k-1}$ (Salmon, *l.c.* p. 100).

A binary form which has a square factor has its discriminant equal to zero. This can be seen at once because the factor in question being once repeated in both differentials, the resultant of the latter must vanish.

Similarly, if a form in k variables be expressible as a quadratic function of $k-1$, linear functions X_1, X_2, ... X_{k-1}, the coefficients being any polynomials, it is clear that the k differentials have, in common, the system of roots derived from $X_1=X_2=...=X_{k-1}=0$, and have in consequence a vanishing resultant. This implies the vanishing of the discriminant of the original form.

Expression in Terms of Roots.—Since $x\frac{\partial f}{\partial x}+y\frac{\partial f}{\partial y}=mf$, if we take any root x_1, y_1, of $\frac{\partial f}{\partial x}$, and substitute in mf we must obtain $y_1\left(\frac{\partial f}{\partial y}\right)_{\substack{x=x_1\\ y=y_1}}$; hence the resultant of $\frac{\partial f}{\partial x}$ and f is, disregarding numerical factors, $y_1y_2...y_{m-1}\times$discriminant of $f=a_0\times$disct. of f.

Now

$$f=(xy_1-x_1y)(xy_2-x_2y)...(xy_m-x_my),$$
$$\frac{\partial f}{\partial x}=\Sigma y_1(xy_2-x_2y)...(xy_m-x_my),$$

and substituting in the latter any root of f and forming the product, we find the resultant of f and $\frac{\partial f}{\partial x}$, viz.

$$y_1y_2...y_m(x_1y_2-x_2y_1)^2(x_1y_3-x_3y_1)^2...(x_ry_s-x_sy_r)^2...$$

and, dividing by $y_1y_2...y_m$, the discriminant of f is seen to be equal to the product of the squares of all the differences of any two roots of the equation. The discriminant of the product of two forms is equal to the product of their discriminants multiplied by the square of their resultant. This follows at once from the fact that the discriminant is

$$\Pi(\alpha_r-\alpha_s)^2\Pi(\beta_r-\beta_s)^2\{\Pi(\alpha_r-\beta_s)\}^2.$$

REFERENCES FOR THE THEORY OF DETERMINANTS.—T. Muir's "List of Writings on Determinants," *Quarterly Journal of Mathematics*, vol. xviii. pp. 110-149, October 1881, is the most important bibliographical article on the subject in any language; it contains 589 entries, arranged in chronological order, the first date being 1693 and the last 1880. The bibliography has been continued, and published at various dates (vol. xxi. pp. 299-320; vol. xxxvi. pp. 171-267) in the same periodical. These lists contain 1740 entries. T. Muir, *History of the Theory of Determinants* (2nd ed., London, 1906). School treatises are those of Thomson, Mansion, Bartl, Mollame, in English, French, German and Italian respectively.—Advanced treatises are those of William Spottiswoode (1851), Francesco Brioschi (1854), Richard Baltzer (1857), George Salmon (1859), N. Trudi (1862), Giovanni Garbieri (1874), Siegmund Günther (1875), Georges J. Dostor (1877), Baraniecki (the most extensive of all) (1879), R. F. Scott (2nd ed., 1904), T. Muir (1881).

II. The Theory of Symmetric Functions

Consider n quantities $\alpha_1, \alpha_2, \alpha_3, \ldots \alpha_n$.

Every rational integral function of these quantities, which does not alter its value however the n suffixes 1, 2, 3, ... n be permuted, is a rational integral symmetric function of the quantities. If we write $(1+\alpha_1 x)(1+\alpha_2 x)\ldots(1+x_n x)=1+a_1x+a_2x^2+\ldots+a_nx^n$, $a_1, a_2, \ldots a_n$ are called the elementary symmetric functions.

$$a_1=\alpha_1+\alpha_2+\ldots+\alpha_n=\Sigma\alpha_1$$
$$a_2=\alpha_1\alpha_2+\alpha_1\alpha_3+\alpha_2\alpha_3+\ldots=\Sigma\alpha_1\alpha_2$$
$$\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot$$
$$a_n=\alpha_1\alpha_2\alpha_3\ldots\alpha_n.$$

The general monomial symmetric function is

$$\Sigma\alpha_1^{p_1}\alpha_2^{p_2}\alpha_3^{p_3}\ldots\alpha_n^{p_n},$$

the summation being for all permutations of the indices which result in different terms. The function is written

$$(p_1p_2p_3\ldots p_n)$$

for brevity, and repetitions of numbers in the bracket are indicated by exponents, so that $(p_1p_1p_2)$ is written $(p_1^2p_2)$. The weight of the function is the sum of the numbers in the bracket, and the degree the highest of those numbers.

Ex. gr. The elementary functions are denoted by

$$(1), (1^2), (1^3), \ldots (1^n),$$

are all of the first degree, and are of weights 1, 2, 3,...n respectively.

Remark.—In this notation $(0)=\Sigma\alpha_1^0=\binom{n}{1}$; $(0^2)=\Sigma\alpha_1^0\alpha_2^0=\binom{n}{2}$;...$(0^s)=\binom{n}{s}$, &c. The binomial coefficients appear, in fact, as symmetric functions, and this is frequently of importance.

The order of the numbers in the bracket $(p_1p_2\ldots p_n)$ is immaterial; we may therefore always place them, as is most convenient, in descending order of magnitude; the numbers then constitute an ordered partition of the weight w, and the leading number denotes the degree.

The sum of the monomial functions of a given weight is called the *homogeneous-product-sum* or complete symmetric function of that weight; it is denoted by h_w; it is connected with the elementary functions by the formula

$$\frac{1}{1-a_1x+a_2x^2-a_3x^3+\ldots}=1+h_1x+h_2x^2+h_3x^3+\ldots,$$

which remains true when the symbols a and h are interchanged, as is at once evident by writing $-x$ for x. This proves, also, that in *any* formula connecting $a_1, a_2, a_3, \ldots$ with $h_1, h_2, h_3, \ldots$ the symbols a and h may be interchanged.

Ex. gr. from $h_2=a_1^2-a_2$ we derive $a_2=h_1^2-h_2$.

The function $\Sigma\alpha_1^{p_1}\alpha_2^{p_2}\ldots\alpha_n^{p_n}$ being as above denoted by a partition of the weight, viz. $p_1p_2\ldots p_n$), it is necessary to bring under view other functions associated with the same series of numbers: such, for example, as

$$\Sigma\alpha_1^{p_1}\alpha_2^{p_2}\Sigma\alpha_1^{p_3}\alpha_2^{p_4}\ldots\alpha_{n-1}^{p_{n-1}}=(p_1p_2)(p_3p_4\ldots p_{n-1}).$$

The expression just written is in fact a partition of a partition, and to avoid confusion of language will be termed a *separation* of a partition. A partition is *separated* into *separates* so as to produce a separation of the partition by writing down a set of partitions, each separate partition in its own brackets, so that when all the parts of these partitions are reassembled in a single bracket the partition which is separated is reproduced. It is convenient to write the distinct partitions or separates in descending order as regards weight. If the successive weights of the separates $w_1, w_2, w_3, \ldots$ be enclosed in a bracket we obtain a partition of the weight w which appertains to the separated partition. This partition is termed the *specification* of the separation. The degree of the separation is the sum of the degrees of the component separates. A separation is the symbolic representation of a product of monomial symmetric functions. A partition, $(p_1p_1p_1p_2p_2p_3)=(p_1^3p_2^2p_3)$, can be separated in the manner $(p_1p_2)(p_1p_2)(p_1p_3)=(p_1p_2)^2(p_1p_3)$, and we may take the general form of a partition to be $(p_1^{\pi_1}p_2^{\pi_2}p_3^{\pi_3}\ldots)$ and that of a separation $(\mathrm{J}_1)^{j_1}(\mathrm{J}_2)^{j_2}(\mathrm{J}_3)^{j_3}\ldots$ when $\mathrm{J}_1, \mathrm{J}_2, \mathrm{J}_3\ldots$ denote the distinct separates involved.

Theorem.— The function symbolized by (n), viz. the sum of the nth powers of the quantities, is expressible in terms of functions which are symbolized by separations of *any* partition $(n_1^{\nu_1}n_2^{\nu_2}n_3^{\nu_3}\ldots)$ of the number n. The expression is—

$$(-)^{\nu_1+\nu_2+\nu_3+\ldots}\frac{(\nu_1+\nu_2+\nu_3+\ldots-1)!}{\nu_1!\nu_2!\nu_3!\ldots}(n)$$
$$=\sum(-)^{j_1+j_2+j_3+\ldots}\frac{(j_1+j_2+j_3+\ldots-1)!}{j_1!j_2!j_3!\ldots}(\mathrm{J}_1)^{j_1}(\mathrm{J}_2)^{j_2}(\mathrm{J}_3)^{j_3}\ldots,$$

$(\mathrm{J}_1)^{j_1}(\mathrm{J}_2)^{j_2}(\mathrm{J}_3)^{j_3}\ldots$ being a separation of $(n_1^{\nu_1}n_2^{\nu_2}n_3^{\nu_3}\ldots)$ and the summation being in regard to all such separations. For the particular case $(n_1^{\nu_1}n_2^{\nu_2}n_3^{\nu_3}\ldots)=(1^n)$

$$(-)^n\frac{1}{n}(n)=\sum(-)^{j_1+j_2+j_3+\ldots}\frac{(j_1+j_2+j_3+\ldots-1)!}{j_1!j_2!j_3!\ldots}(1)^{j_1}(1^2)^{j_2}(1^3)^{j_3}\ldots.$$

To establish this write—

$$1+\mu\mathrm{X}_1+\mu^2\mathrm{X}_2+\mu^3\mathrm{X}_3+\ldots=\prod_\alpha(1+\mu\alpha_1x_1+\mu^2\alpha_1^2x_2+\mu^3\alpha_1^3x_3+\ldots),$$

the product on the right involving a factor for each of the quantities $\alpha_1, \alpha_2, \alpha_3, \ldots$, and μ being arbitrary.

Multiplying out the right-hand side and comparing coefficients

$$\mathrm{X}_1=(1)x_1,$$
$$\mathrm{X}_2=(2)x_2+(1^2)x_1^2,$$
$$\mathrm{X}_3=(3)x_3+(21)x_2x_1+(1^3)x_1^3,$$
$$\mathrm{X}_4=(4)x_4+(31)x_3x_1+(2^2)x_2^2+(21^2)x_2x_1^2+(1^4)x_1^4,$$
$$\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot$$
$$\mathrm{X}_m=\Sigma(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\ldots)x_{m_1}^{\mu_1}x_{m_2}^{\mu_2}x_{m_3}^{\mu_3}\ldots,$$

the summation being for all partitions of m.

Auxiliary Theorem.—The coefficient of $x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\ldots$ in the product $\frac{\mathrm{X}_{m_1}^{\mu_1}\mathrm{X}_{m_2}^{\mu_2}\mathrm{X}_{m_3}^{\mu_3}\ldots}{\mu_1!\mu_2!\mu_3!\ldots}$ is $\sum\frac{(\mathrm{J}_1)^{j_1}(\mathrm{J}_2)^{j_2}(\mathrm{J}_3)^{j_3}\ldots}{j_1!j_2!j_3!\ldots}$ where $(\mathrm{J}_1)^{j_1}(\mathrm{J}_2)^{j_2}(\mathrm{J}_3)^{j_3}\ldots$ is a separation of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\ldots)$ of specification $(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\ldots)$, and the sum is for all such separations.

To establish this observe the result.

$$\frac{1}{p!}\mathrm{X}^p=\sum\frac{(3)^{\pi_1}(21)^{\pi_2}(1^3)^{\pi_3}}{\pi_1!\pi_2!\pi_3!}x_3^{\pi_1}x_2^{\pi_2}x_1^{\pi_2+3\pi_3}$$

and remark that $(3)^{\pi_1}(21)^{\pi_2}(1^3)^{\pi_3}$ is a separation of $(3^{\pi_1}2^{\pi_2}1^{\pi_2+3\pi_3})$ of specification (3^p). A similar remark may be made in respect of

$$\frac{1}{\mu_1!}\mathrm{X}_{m_1}^{\mu_1}, \quad \frac{1}{\mu_2!}\mathrm{X}_{m_2}^{\mu_2}, \quad \frac{1}{\mu_3!}\mathrm{X}_{m_3}^{\mu_3}, \ldots$$

and therefore of the product of those expressions. Hence the theorem.

Now

$$\log(1+\mu\mathrm{X}_1+\mu^2\mathrm{X}_2+\mu^3\mathrm{X}_3+\ldots)$$
$$=\sum_\alpha\log(1+\mu\alpha_1x_1+\mu^2\alpha_1^2x_2+\mu^3\alpha_1^3x_3+\ldots)$$

whence, expanding by the exponential and multinomial theorems, a comparison of the coefficients of μ^n gives

$$(n)\sum(-)^{\nu_1+\nu_2+\nu_3+\ldots-1}\frac{(\nu_1+\nu_2+\nu_3+\ldots-1)!}{\nu_1!\nu_2!\nu_3!\ldots}x_{n_1}^{\nu_1}x_{n_2}^{\nu_2}x_{n_3}^{\nu_3}\ldots$$
$$=\sum(-)^{\nu_1+\nu_2+\nu_3+\ldots-1}\frac{(\nu_1+\nu_2+\nu_3+\ldots-1)!}{\nu_1!\nu_2!\nu_3!\ldots}\mathrm{X}_{n_1}^{\nu_1}\mathrm{X}_{n_2}^{\nu_2}\mathrm{X}_{n_3}^{\nu_3}\ldots$$

and, by the auxiliary theorem, any term $\mathrm{X}_{m_1}^{\mu_1}\mathrm{X}_{m_2}^{\mu_2}\mathrm{X}_{m_3}^{\mu_3}\ldots$ on the right-hand side is such that the coefficient of $x_{n_1}^{\nu_1}x_{n_2}^{\nu_2}x_{n_3}^{\nu_3}\ldots$ in $\frac{1}{\mu_1!\mu_2!\mu_3!\ldots}\mathrm{X}_{m_1}^{\mu_1}\mathrm{X}_{m_2}^{\mu_2}\mathrm{X}_{m_3}^{\mu_3}\ldots$ is

$$\sum\frac{(\mathrm{J}_1)^{j_1}(\mathrm{J}_2)^{j_2}(\mathrm{J}_3)^{j_3}\ldots}{j^1!j_2!j_3!\ldots},$$

where since $(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\ldots)$ is the specification of $(\mathrm{J}_1)^{j_1}(\mathrm{J}_2)^{j_2}(\mathrm{J}_3)^{j_3}\ldots$, $\mu_1+\mu_2+\mu_3+\ldots=j_1+j_2+j_3+\ldots$. Comparison of the coefficients of $x_{n_1}^{\nu_1}x_{n_2}^{\nu_2}x_{n_3}^{\nu_3}\ldots$ therefore yieids the result

$$(-)^{\nu_1+\nu_2+\nu_3+\ldots}\frac{(\nu_1+\nu_2+\nu_3+\ldots-1)!}{\nu_1!\nu_2!\nu_3!\ldots}(n)$$
$$=\sum(-)^{j_1+j_2+j_3+\ldots}\frac{(j_1+j_2+j_3+\ldots-1)!}{j_1!j_2!j_3!\ldots}(\mathrm{J}_1)^{j_1}(\mathrm{J}_2)^{j_2}(\mathrm{J}_3)^{j_3}\ldots,$$

for the expression of $\Sigma\alpha^n$ in terms of products of symmetric functions symbolized by separations of $(n_1^{\nu_1}n_2^{\nu_2}n_3^{\nu_3}\ldots)$.

Let $(n)_\alpha$, $(n)_x$, $(n)_X$ denote the sums of the nth powers of quantities whose elementary symmetric functions are $a_1, a_2, a_3, \ldots$; $x_1, x_2, x_3, \ldots$; $\mathrm{X}_1, \mathrm{X}_2, \mathrm{X}_3, \ldots$ respectively: then the result arrived at above from the logarithmic expansion may be written

$$(n)_\alpha(n_x)=(n)_\mathrm{X},$$

exhibiting $(n)_\mathrm{X}$ as an invariant of the transformation given by the expressions of $\mathrm{X}_1, \mathrm{X}_2, \mathrm{X}_3\ldots$ in terms of $x_1, x_2, x_3, \ldots$.

The inverse question is the expression of any monomial symmetric function by means of the power functions $(r)=s_r$.

Theorem of Reciprocity.—If

$$\mathrm{X}_{m_1}^{\mu_1}\mathrm{X}_{m_2}^{\mu_2}\mathrm{X}_{m_3}^{\mu_3}\ldots=\ldots+\theta(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\ldots)x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\ldots+\ldots,$$

where θ is a numerical coefficient, then also

$$\mathrm{X}_{s_1}^{\sigma_1}\mathrm{X}_{s_2}^{\sigma_2}\mathrm{X}_{s_3}^{\sigma_3}\ldots=\ldots+\theta(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\ldots)x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\ldots+\ldots.$$

We have found above that the coefficient of $(x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\ldots)$ in the product $\mathrm{X}_{m_1}^{\mu_1}\mathrm{X}_{m_2}^{\mu_2}\mathrm{X}_{m_3}^{\mu_3}\ldots$ is

$$\mu_1!\mu_2!\mu_3!\ldots\sum\frac{(\mathrm{J}_1)^{j_1}(\mathrm{J}_2)^{j_2}(\mathrm{J}_3)^{j_3}\ldots}{j_1!j_2!j_3!\ldots},$$

the sum being for all separations of $l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\ldots)$ which have the specification $(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\ldots)$. We can multiply out this expression so as to obtain a series of monomials of the form $\theta(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\ldots)$. It can be shown that the number θ enumerates distributions of a certain nature defined by the partitions $(m_1^{\mu_1}m_2^{\mu_2}\ldots)$, $(s_1^{\sigma_1}s_2^{\sigma_2}\ldots)$,

$(l_1^{\lambda_1}l_2^{\lambda_2}\ldots)$ and it is seen intuitively that the number θ remains unaltered when the first two of these partitions are interchanged (see COMBINATORIAL ANALYSIS). Hence the theorem is established.

Putting $x_1=1$ and $x_2=x_3=x_4=\ldots=0$, we find a particular law of reciprocity given by Cayley and Betti,

$$(1^{m_1})^{\mu_1}(1^{m_2})^{\mu_2}(1^{m_3})^{\mu_3}\ldots=\ldots+\theta(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\ldots)+\ldots,$$
$$(1^{s_1})^{\sigma_1}(1^{s_2})^{\sigma_2}(1^{s_3})^{\sigma_3}\ldots=\ldots+\theta(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\ldots)+\ldots;$$

and another by putting $x_1=x_2=x_3=\ldots=1$, for then X_m becomes h_m, and we have

$$h_{m_1}^{\mu_1}h_{m_2}^{\mu_2}h_{m_3}^{\mu_3}\ldots=\ldots+\theta'(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\ldots)+\ldots,$$
$$h_{s_1}^{\sigma_1}h_{s_2}^{\sigma_2}h_{s_3}^{\sigma_3}\ldots=\ldots+\theta'(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\ldots)+\ldots,$$

Theorem of Expressibility.—"If a symmetric function be symboilized by $(\lambda\mu\nu\ldots)$ and $(\lambda_1\lambda_2\lambda_3\ldots)$, $(\mu_1\mu_2\mu_3\ldots)$, $(\nu_1\nu_2\nu_3\ldots)\ldots$ be any partitions of λ, μ, $\nu\ldots$ respectively, the function $(\lambda\mu\nu\ldots)$ is expressible by means of functions symbolized by separation of

$$(\lambda_1\lambda_2\lambda_3\ldots\mu_1\mu_2\mu_3\ldots\nu_1\nu_2\nu_3\ldots)."$$

For, writing as before,

$$X_{m_1}^{\mu_1}X_{m_2}^{\mu_2}X_{m_3}^{\mu_3}\ldots=\Sigma\Sigma\theta(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\ldots)x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\ldots,$$
$$=\Sigma P x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\ldots,$$

P is a linear function of separations of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\ldots)$ of specification $(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\ldots)$, and if $X_{s_1}^{\sigma_1}X_{s_2}^{\sigma_2}X_{s_3}^{\sigma_3}\ldots=\Sigma P'x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\ldots$, P′ is a linear function of separations of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\ldots)$ of specification $(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\ldots)$. Suppose the separations of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\ldots)$ to involve k different specifications and form the k identities

$$X_{m_{1s}}^{\mu_{1s}}X_{m_{2s}}^{\mu_{2s}}X_{m_{3s}}^{\mu_{3s}}\ldots=\Sigma P^{(s)}x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\ldots(s=1,\ 2,\ \ldots k),$$

where $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\ldots)$ is one of the k specifications.

The law of reciprocity shows that

$$P^{(s)}=\sum_{t=1}^{t=k}\theta_{st}(m_{1t}^{\mu_{1t}}m_{2t}^{\mu_{2t}}m_{3t}^{\mu_{3t}}\ldots),$$

viz.: a linear function of symmetric functions symbolized by the k specifications; and that $\theta_{st}=\theta_{ts}$. A table may be formed expressing the k expressions $P^{(1)}$, $P^{(2)}$,…$P^{(k)}$ as linear functions of the k expressions $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\ldots)$, $s=1,\ 2,\ \ldots k$, and the numbers θ_{st} occurring therein possess row and column symmetry. By solving k linear equations we similarly express the latter functions as linear functions of the former, and this table will also be symmetrical.

Theorem.—"The symmetric function $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\ldots)$ whose partition is a specification of a separation of the function symbolized by $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\ldots)$ is expressible as a linear function of symmetric functions symbolized by separations of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\ldots)$ and a symmetrical table may be thus formed." It is now to be remarked that the partition $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\ldots)$ can be derived from $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\ldots)$ by substituting for the numbers m_{1s}, m_{2s}, m_{3s},… certain partitions of those numbers (*vide* the definition of the specification of a separation).

Hence the theorem of expressibility enunciated above. A new statement of the law of reciprocity can be arrived at as follows:—Since.

$$P^{(s)}=\mu_{1s}!\mu_{2s}!\mu_{3s}!\ldots\sum\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\ldots}{j_1!j_2!j_3!\ldots},$$

where $(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\ldots$ is a separation of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\ldots)$ of specification $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\ldots)$, placing s under the summation sign to denote the specification involved,

$$\mu_{1s}!\mu_{2s}!\mu_{3s}\ldots\sum_s\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\ldots}{j_1!j_2!j_3!\ldots}=\sum_{t=1}^{t=k}\theta_{st}(m_{1t}^{\mu_{1t}}m_{2t}^{\mu_{2t}}m_{3t}^{\mu_{3t}}\ldots),$$
$$\mu_{1t}!\mu_{2t}!\mu_{3t}!\ldots\sum_t\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\ldots}{j_1!j_2!j_3\ldots}=\sum_{s=1}^{s=k}\theta_{ts}(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\ldots),$$

where $\theta_{st}=\theta_{ts}$.

Theorem of Symmetry.—If we form the separation function

$$\sum\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\ldots}{j_1!j_2!j_3!\ldots}$$

appertaining to the function $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\ldots)$, each separation having a specification $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\ldots)$, multiply by $\mu_{1s}!\,\mu_{2s}!\,\mu_{3s}!\ldots$ and take therein the coefficient of the function $(m_{1t}^{\mu_{1t}}m_{2t}^{\mu_{2t}}m_{3t}^{\mu_{3t}}\ldots)$, we obtain the same result as if we formed the separation function in regard to the specification $(m_{1t}^{\mu_{1t}}m_{2t}^{\mu_{2t}}m_{3t}^{\mu_{3t}}\ldots)$, multiplied by $\mu_{1t}!\,\mu_{2t}!\,\mu_{3t}!\ldots$ and took therein the coefficient of the function $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\ldots)$.

Ex. gr., take $(l_1^{\lambda_1}l_2^{\lambda_2}\ldots)=(21^4)$; $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}\ldots)=(321)$; $(m_{1t}^{\mu_{1t}}m_{2t}^{\mu_{2t}}\ldots)=(31_3)$; we find

$$(21)(1^2)(1)+(1^2)(2)(1)\ =\ldots+13(31^3)+\ldots,$$
$$(21)(1)^3=\ldots+13(321)+\ldots$$

The Differential Operators.—Starting with the relation

$$(1+a_1x)(1+a_2x)\ldots(1+a_nx)=1+a_1x+a_2x^2+\ldots+a_nx^n$$

multiply each side by $1+\mu x$, thus introducing a new quantity μ; we obtain

$$(1+a_1x)(1+a_2x)\ldots(1+a_nx)(1+\mu x)=1+(a_1+\mu)x+(a_2+\mu a_1)x^2+\ldots$$

so that $f(a_1,\ a_2,\ a_3,\ldots a_n)=f$, a rational integral function of the elementary functions, is converted into

$$f(a_1+\mu,\ a_2+\mu a_1,\ldots a_n+\mu a_{n-1})=f+\mu d_1f+\frac{\mu^2}{2!}\overline{d_1^2}f+\frac{\mu^3}{3!}\overline{d_1^3}f+\ldots$$

where

$$d_1=\frac{\partial}{\partial a_1}+a_1\frac{\partial}{\partial a_2}+a_2\frac{\partial}{\partial a_3}+\ldots+a_{n-1}\frac{\partial}{\partial a_n}$$

and $\overline{d_1^s}$ denotes, not s successive operations of d_1, but the operator of order s obtained by raising d_1 to the sth power symbolically as in Taylor's theorem in the Differential Calculus.

Write also $\frac{1}{s!}\overline{d_1^s}=D_s$, so that

$$f(a_1+\mu,\ a_2+\mu a_1,\ \ldots a_n+\mu a_{n-1})=f+\mu D_1f+\mu^2D_2f+\mu^3D_3f+\ldots.$$

The introduction of the quantity μ converts the symmetric function $(\lambda_1\lambda_2\lambda_3\ldots)$ into

$$(\lambda_1\lambda_2\lambda_3+\ldots)+\mu^{\lambda_1}(\lambda_2\lambda_3\ldots)+\mu^{\lambda_2}(\lambda_1\lambda_3\ldots)+\mu^{\lambda_3}(\lambda_1\lambda_2\ldots)+\ldots.$$

Hence, if $f(a_1,\ a_2,\ \ldots a_n)=(\lambda_1\lambda_2\lambda_3\ldots)$,

$$(\lambda_1\lambda_2\lambda_3\ldots)+\mu^{\lambda_1}(\lambda_2\lambda_3\ldots)+\mu^{\lambda_2}(\lambda_1\lambda_3\ldots)+\mu^{\lambda_3}(\lambda_1\lambda_2\ldots)+\ldots$$
$$=(1+\mu D_1+\mu^2D_2+\mu^3D_3+\ldots)(\lambda_1\lambda_2\lambda_3\ldots).$$

Comparing coefficients of like powers of μ we obtain

$$D_{\lambda_1}(\lambda_1\lambda_2\lambda_3\ldots)=(\lambda_2\lambda_3\ldots),$$

while $D_s(\lambda_1\lambda_2\lambda_3\ldots)=0$ unless the partition $(\lambda_1\lambda_2\lambda_3\ldots)$ contains a part s. Further, if $D_{\lambda_1}D_{\lambda_2}$ denote successive operations of D_{λ_1} and D_{λ_2},

$$D_{\lambda_1}D_{\lambda_2}(\lambda_1\lambda_2\lambda_3\ldots)=(\lambda_3\ldots),$$

and the operations are evidently commutative.

Also $D_{p_1}^{\pi_1}D_{p_2}^{\pi_2}D_{p_3}^{\pi_3}\ldots(p_1^{\pi_1}p_2^{\pi_2}p_3^{\pi_3}\ldots)=1$, and the law of operation of the operators D upon a monomial symmetric function is clear.

We have obtained the equivalent operations

$$1+\mu D_1+\mu^2D_2+\mu^3D_3+\ldots=\overline{exp}\,\mu d_1$$

where $\overline{exp}$ denotes (by the rule over *exp*) that the multiplication of operators is symbolic as in Taylor's theorem. $\overline{d_1^s}$ denotes, in fact, an operator of order s, but we may transform the right-hand side so that we are only concerned with the successive performance of linear operations. For this purpose write

$$d_s=\partial_{a_s}+a_1\partial_{a_{s+1}}+a_2\partial_{a_{s+2}}+\ldots.$$

It has been shown (*vide* "Memoir on Symmetric Functions of the Roots of Systems of Equations," *Phil. Trans.* 1890, p. 490) that

$$\overline{exp}(m_1d_1+m_2d_2+m_3d_3+\ldots)=exp(M_1d_1+M_2d_2+M_3d_3+\ldots),$$

where now the multiplications on the dexter denote successive operations, provided that

$$exp(M_1\xi+M_2\xi^2+M_3\xi^3+\ldots)=1+m_1\xi+m_2\xi^2+m_3\xi^3+\ldots,$$

ξ being an undetermined algebraic quantity.

Hence we derive the particular cases

$$\overline{exp}\,d_1=exp(d_1-\tfrac{1}{2}d_2+\tfrac{1}{3}d_3-\ldots);$$
$$\overline{exp}\,\mu d_1=exp(\mu d_1-\tfrac{1}{2}\mu^2d_2+\tfrac{1}{3}\mu^3d_3-\ldots),$$

and we can express D_s in terms of d_1, d_2, d_3,…, products denoting successive operations, by the same law which expresses the elementary function a_s in terms of the sums of powers s_1, s_2, s_3,… Further, we can express d_s in terms of D_1, D_2, D_3, … by the same law which expresses the power function s_s in terms of the elementary functions a_1, a_2, a_3,…

Operation of D_s *upon a Product of Symmetric Functions.*—Suppose f to be a product of symmetric functions $f_1f_2\ldots f_m$. If in the identity $f=f_1f_2\ldots f_m$ we introduce a new root μ we change a_s into $a_s+\mu a_{s-1}$, and we obtain

$$\begin{aligned}&(1+\mu D_1+\mu^2D_2+\ldots+\mu^sD_s+\ldots)f\\=&(1+\mu D_1+\mu^2D_2+\ldots+\mu^sD_s+\ldots)f_1\\\times&(1+\mu D_1+\mu^2D_2+\ldots+\mu^sD_s+\ldots)f_2\\\times&\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\\\times&(1+\mu D_1+\mu^2D_2+\ldots+\mu^sD_s+\ldots)f_m,\end{aligned}$$

and now expanding and equating coefficients of like powers of μ

$$\begin{aligned}D_1f&=\Sigma(D_1f_1)f_2f_3\ldots f_m,\\D_2f&=\Sigma(D_2f_1)f_2f_3\ldots f_m+\Sigma(D_1f_1)(D_1f_2)f_3\ldots f_m,\\D_3f&=\Sigma(D_3f_1)f_2f_3\ldots f_m+\Sigma(D_2f_1)(D_1f_2)f_3\ldots f_m+\Sigma(D_1f_1)f_2f_3\ldots f_m,\\&\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\end{aligned}$$

the summation in a term covering every distribution of the operators of the type presenting itself in the term.

Writing these results

$$\begin{aligned}D_1f&=D_{(1)}f,\\D_2f&=D_{(2)}f+D_{(1^2)}f,\\D_3f&=D_{(3)}f+D_{(21)}f+D_{(1^3)}f,\end{aligned}$$

we may write in general

$$D_s f = \Sigma D_{(p_1p_2p_3..)} f,$$

the summation being for every partition $(p_1p_2p_3...)$ of s, and $D_{(p_1p_2p_3...)}f$ being $=\Sigma(D_{p_1}f_1)(D_{p_2}f_2)(D_{p_3}f_3)f_4...f_m$.

Ex. gr. To operate with D_3 upon $(21^3)(21^4)(1^5)$, we have

$$D_{(3)}f=(1^3)(21^4)(1^5)+(21^3)(1^4)(1^5),$$
$$D_{(1^3)}f=(12^2)(21^4)(1^5)+(21^3)(21^3)(1^4)+(21^2)(21^4)(1^4),$$

and hence

$$D_3 f=(21^4)(1^5)(1^5)+(21^3)(1^4)(1^4)+(21^3)(21^2)(1^4)+(21^3)^2(1^4)+(21^4)(21^2)(1^4).$$

Application to Symmetric Function Multiplication.—An example will explain this. Suppose we wish to find the coefficient of (52^41^3) in the product $(21^3)(21^4)(1^5)$.

Write

$$(21^3)(21^4)(1^5)=...+A(52^4)(1^3)+...;$$

then

$$D_5D_2^4D_1^3(21^3)(21^4)(1^5)=A;$$

every other term disappearing by the fundamental property of D_s. Since

$$D_5(21^3)(21^4)(1^5)=(1^3)(1^4)(1^4),$$

we have:—

$$D_2^4D_1^3(1^4)(1^4)(1^3)=A$$
$$D_2^3D_1^3\{(1^3)(1^3)(1^3)+2(1^4)(1^3)(1^2)\}=A$$
$$D_2^2D_1^3\{5(1^3)(1^2)(1^2)+2(1^4)(1^2)(1)+2(1^3)(1^3)(1)\}=A$$
$$D_2D_1^3\{12(1^2)(1^2)(1)+7(1^3)(1)(1)+2(1^4)(1)+6(1^3)(1^2)\}=A$$
$$D_1^3 12(1)^3=A.$$

where ultimately disappearing terms have been struck out. Finally $A=6\cdot 12=72$.

The operator $d_1=a_0\partial a_1+a_1\partial a_2+a_2\partial a_3+...$ which is satisfied by every symmetric fraction whose partition contains no unit (called by Cayley *non-unitary symmetric functions*), is of particular importance in algebraic theories. This arises from the circumstance that the general operator

$$\lambda_0 a_0\partial a_1+\lambda_1 a_1\partial a_2+\lambda_2 a_2\partial a_3+...$$

is transformed into the operator d_1 by the substitution

$$(a_0, a_1, a_2, ...a_s, ...)=(a_0, \lambda_0 a_1, \lambda_0\lambda_1 a_2, ..., \lambda_0\lambda_1...\lambda_{s-1}a_s,...),$$

so that the theory of the general operator is coincident with that of the particular operator d_1. For example, the theory of invariants may be regarded as depending upon the consideration of the symmetric functions of the differences of the roots of the equation

$$a_0x^n-\tbinom{n}{1}a_1x^{n-1}+\tbinom{n}{2}a_2x^{n-2}-...=0;$$

and such functions satisfy the differential equation

$$a_0\partial a_1+2a_1\partial a_2+3a_2\partial a_3+...+na_{n-1}\partial a_n=0.$$

For such functions remain unaltered when each root receives the same infinitesimal increment h; but writing $x-h$ for x causes a_0, a_1, a_2 a_3,... to become respectively a_0, a_1+ha_0, a_2+2ha_1, a_3+3ha_2, ... and $f(a_0, a_1, a_2, a_3,...)$ becomes

$$f+h(a_0\partial_{a_1}+2a_1\partial_{a_2}+3a_2\partial_{a_3}+...)f.$$

and hence the functions satisfy the differential equation. The important result is that the theory of invariants is from a certain point of view coincident with the theory of non-unitary symmetric functions. On the one hand we may state that non-unitary symmetric functions of the roots of $a_0x^n-a_1x^{n-1}+a_2x^{n-2}-...=0$, are symmetric functions of differences of the roots of

$$a_0x^n-1!\tbinom{n}{1}a_1x^{n-1}+2!\tbinom{n}{2}a_2x^{n-2}-...=0;$$

and on the other hand that symmetric functions of the differences of the roots of

$$a_0x^n-\tbinom{n}{1}a_1x^{n-1}+\tbinom{n}{2}a_2x^{n-2}-...=0,$$

are non-unitary symmetric functions of the roots of

$$a_0x^n-\frac{a_1}{1!}x^{n-1}+\frac{a_2}{2!}x^{n-2}-...=0.$$

An important notion in the theory of linear operators in general is that of MacMahon's *multilinear operator* ("Theory of a Multilinear partial Differential Operator with Applications to the Theories of Invariants and Reciprocants," *Proc. Lond. Math. Soc.* t. xviii. (1886), pp. 61-88). It is defined as having four elements, and is written

$$(\mu, \nu; m, n)$$
$$=\frac{1}{m}\Big[\mu a_0^m\partial_{a_n}+(\mu+\nu)\frac{m!}{(m-1)!1!}a_0^{m-1}a_1\partial_{a_{n+1}}$$
$$+(\mu+2\nu)\Big\{\frac{m!}{(m-1)!1!}a_0^{m-1}a_2+\frac{m!}{(m-2)!2!}a_0^{m-2}a_1^2\Big\}\partial_{a_{n+2}}$$
$$+(\mu+3\nu)\Big\{\frac{m!}{(m-1)!1!}a_0^{m-1}a_3+\frac{m!}{(m-2)!1!1!}a_0^{m-2}a_1a_2$$
$$+\frac{m!}{(m-3)!3!}a_0^{m-3}a_1^3\Big\}\partial_{a_{n+3}}$$
$$+...\Big],$$

the coefficient of $a_0^{k_0}a_1^{k_1}a_2^{k_2}...$ being $\frac{m!}{k_0!k_1!k_2!...}$. The operators $a_0\partial_{a_1}+a_1\partial_{a_2}+...$, $a_0\partial_{a_1}+2a_1\partial_{a_2}+...$ are seen to be (1, 0; 1, 1) and (1, 1; 1, 1) respectively. Also the operator of the Theory of Pure Reciprocants (see *Sylvester Lectures on the New Theory of Reciprocants*, Oxford, 1888) is

$$(4, 1; 2, 1)=\frac{1}{2}\Big\{4a_0^2\partial_{a_1}+10a_0a_1\partial_{a_2}+6(2a_0a_2+a_1^2)\partial_{a_3}+...\Big\}.$$

It will be noticed that

$$(\mu, \nu; m, n)=\mu(1, 0; m, n)+\nu(0, 1; m, n).$$

The importance of the operator consists in the fact that taking any two operators of the system

$$(\mu, \nu; m, n); (\mu^1, \nu^1: m^1, n^1),$$

the operator equivalent to

$$(\mu, \nu; m, n)(\mu^1, \nu^1; m^1, n^1)-(\mu^1, \nu^1; m^1, n^1)(\mu, \nu; m, n),$$

known as the "alternant" of the two operators, is also an operator of the same system. We have the theorem

$$(\mu, \nu; m, n)(\mu^1, \nu^1; m^1, n^1)-(\mu^1, \nu^1; m^1, n^1)(\mu, \nu; m, n)=(\mu_1, \nu_1; m_1, n_1);$$

where

$$\mu_1=(m^1+m-1)\Big\{\frac{\mu^1}{m^1}(\mu+n^1\nu)-\frac{\mu}{m}(\mu^1+n\nu^1)\Big\},$$
$$\nu_1=(n^1-n)\nu^1\nu+\frac{m-1}{m^1}\mu^1\nu-\frac{m^1-1}{m}\mu\nu^1,$$
$$m_1=m^1+m-1,$$
$$n_1=n^1+n,$$

and we conclude that *quâ* "alternation" the operators of the system form a "group." It is thus possible to study simultaneously all the theories which depend upon operations of the group.

Symbolic Representation of Symmetric Functions.—Denote the elementary symmetric function a_s by $\frac{\alpha_1^s}{s!}, \frac{\alpha_2^s}{s!}, \frac{\alpha_3^s}{s!}$, ...at pleasure; then, taking n equal to ∞, we may write

$$1+a_1x+a_2x^2+...=(1+\rho_1x)(1+\rho_2x)...=e^{\alpha_1x}=e^{\alpha_2x}=e^{\alpha_3x}=...$$

where

$$a_s=\sum\rho_1\rho_2...\rho_s=\frac{\alpha_1^s}{s!}=\frac{\alpha_2^s}{s!}=\frac{\alpha_3^s}{s!}=....$$

Further, let

$$1+b_1x+b_2x^2+...+b_mx^m=(1+\sigma_1x)(1+\sigma_2x)...(1+\sigma_mx);$$

so that

$$1+a_1\sigma_1+a_2\sigma_1^2+...=(1+\rho_1\sigma_1)(1+\rho_2\sigma_1)...=e^{\sigma_1\alpha_1},$$
$$1+a_1\sigma_2+a_2\sigma_2^2+...=(1+\rho_1\sigma_2)(1+\rho_2\sigma_2)...=e^{\sigma_2\alpha_2},$$
$$. \quad . \quad . \quad . \quad . \quad . \quad .$$
$$1+a_1\sigma_m+a_2\sigma_m^2+...=(1+\rho_1\sigma_m)(1+\rho_2\sigma_m)...=e^{\sigma_m\alpha_m};$$

and, by multiplication,

$$\prod_\sigma(1+a_1\sigma+a_2\sigma^2+...)=\prod_\rho(1+b_1\rho+b_2\rho^2+...+b_m\rho^m),$$
$$=e^{\sigma_1\alpha_1+\sigma_2\alpha_2+...+\sigma_m\alpha_m}.$$

Denote by brackets ( ) and [ ] symmetric functions of the quantities ρ and σ respectively. Then

$$1+a_1[1]+a_1^2[1^2]+a_2[2]+a_1^3[1^3]+a_1a_2[21]+a_3[3]+...$$
$$+a_{p_1}a_{p_2}a_{p_3}...a_{p_m}\big[p_1p_2p_3...p_m\big]+...$$
$$=1+b_1(1)+b_1^2(1^2)+b_2(2)+b_1^3(1^3)+b_1b_2(21)+b_3(3)+...$$
$$+b_1^{\pi_1}b_2^{\pi_2}b_3^{\pi_3}...b_m^{\pi_m}\big(m^{\pi_m}m-1^{\pi_{m-1}}...2^{\pi_2}1^{\pi_1}\big)+...$$
$$=e^{\sigma_1\alpha_1+\sigma_2\alpha_2...+\sigma_m\alpha_m}.$$

Expanding the right-hand side by the exponential theorem, and then expressing the symmetric functions of σ_1, σ_2, ...σ_m, which arise, in terms of b_1, b_2, ... b_m, we obtain by comparison with the middle series the symbolical representation of all symmetric functions in brackets ( ) appertaining to the quantities ρ_1, ρ_2, ρ_3,... To obtain particular theorems the quantities σ_1, σ_2, σ_3, ...σ_m are auxiliaries which are at our entire disposal. Thus to obtain *Strok's theory of seminvariants* put

$$b_1=\sigma_1+\sigma_2+...+\sigma_m=[1]=0;$$

we then obtain the expression of non-unitary symmetric functions of the quantities ρ as functions of differences of the symbols α_1, α_2, α_3, ...

Ex. gr. $b_2^2(2^2)$ with $m=2$ must be a term in

$$e^{\sigma_1\alpha_1+\sigma_2\alpha_2}=e^{\sigma_1(\alpha_1-\alpha_2)}=...+\frac{1}{4!}\sigma_1^4(\alpha_1-\alpha_2)^4+...,$$

and since $b_2^2=\sigma_1^4$ we must have

$$(2^2)=\frac{1}{24}(\alpha_1-\alpha_2)^4=\frac{1}{24}(\alpha_1^4+\alpha_2^4)-\frac{1}{6}(\alpha_1^3\alpha_2+\alpha_1\alpha_2^3)+\frac{1}{4}\alpha_1^2\alpha_2^2$$
$$=2a_4-2a_1a_3+a_2^2$$

as is well known.

Again, if σ_1, σ_2, σ_3...σ_m be the m, m^{th} roots of -1, $b_1=b_2=...=b_{m-1}=0$ and $b_m=1$, leading to

$$1+(m)+(m^2)+(m^3)+...=e^{\sigma_1\alpha_1+\sigma_2\alpha_2+...+\sigma_m\alpha_m}$$

and

$$\therefore\ (m^s)=\frac{1}{ms!}(\sigma_1\alpha_1+\sigma_2\alpha_2+...+\sigma_m\alpha_m)^{ms},$$

and we see further that $(\sigma_1a_1+\sigma_2a_2+\dots+\sigma_ma_m)^k$ vanishes identically unless $k\equiv 0 \pmod m$. If m be infinite and

$$1+b_1x+b_2x^2+\dots=(1+\sigma_1x)(1+\sigma_2x)\dots=e^{\beta_1x}=e^{\beta_2x}=\dots,$$

we have the symbolic identity

$$e^{\sigma_1a_1+\sigma_2a_2+\sigma_3a_3+\dots}=e^{\rho_1\beta_1+\rho_2\beta_2+\rho_3\beta_3+\dots}$$

and

$$(\sigma_1a_1+\sigma_2a_2+\sigma_3a_3+\dots)^p=(\rho_1\beta_1+\rho_2\beta_2+\rho_3\beta_3+\dots)^p.$$

Instead of the above symbols we may use equivalent differential operators. Thus let

$$\delta_a=a_1\partial_{a_0}+2a_2\partial_{a_1}+3a_3\partial_{a_2}+\dots$$

and let a, b, c, ... be equivalent quantities. Any function of differences of δ_a, δ_b, δ_c,... being formed, the expansion being carried out, an operand a_0 or b_0 or c_0 ... being taken and b, c,... being subsequently put equal to a, a non-unitary symmetric function will be produced.

Ex. gr.
$$\begin{aligned}(\delta_a-\delta_b)^2(\delta_a-\delta_c)&=(\delta_a^2-2\delta_a\delta_b+\delta_b^2)(\delta_a-\delta_c)\\&=\delta_a^3-2\delta_a^2\delta_b+\delta_a\delta_b^2-\delta_a^2\delta_c+2\delta_a\delta_b\delta_c-\delta_b^2\delta_c\\&=6a_3-4a_2b_1+2a_1b_2-2a_2c_1+2a_1b_1c_1-2b_2c_1\\&=2(a_1^3-3a_1a_2+3a_3)=2(3).\end{aligned}$$

The whole theory of these forms is consequently contained implicitly in the operation δ.

Symmetric Functions of Several Systems of Quantities.—It will suffice to consider two systems of quantities as the corresponding theory for three or more systems is obtainable by an obvious enlargement of the nomenclature and notation.

Taking the systems of quantities to be

$$\begin{gathered}\alpha_1,\ \alpha_2,\ \alpha_3,\dots\\ \beta_1,\ \beta_2,\ \beta_3,\dots\end{gathered}$$

we start with the fundamental relation

$$\begin{aligned}&(1+\alpha_1x+\beta_1y)(1+\alpha_2x+\beta_2y)(1+\alpha_3x+\beta_3y)\dots\\&=1+a_{10}x+a_{01}y+a_{20}x^2+a_{11}xy+a_{02}y^2+\dots+a_{pq}x^py^q+\dots\end{aligned}$$

As shown by L. Schläfli[1] this equation may be directly formed and exhibited as the resultant of two given equations, and an arbitrary linear non-homogeneous equation in two variables. The right-hand side may be also written

$$1+\Sigma\alpha_1x+\Sigma\beta_1y+\Sigma\alpha_1\alpha_2x^2+\Sigma\alpha_1\beta_2xy+\Sigma\beta_1\beta_2y^2+\dots$$

The most general symmetric function to be considered is

$$\Sigma\alpha_1^{p_1}\beta_1^{q_1}\alpha_2^{p_2}\beta_2^{q_2}\alpha_3^{p_3}\beta_3^{q_3}\dots$$

conveniently written in the symbolic form

$$(\overline{p_1q_1}\,\overline{p_2q_2}\,\overline{p_3q_3}\dots).$$

Observe that the summation is in regard to the expressions obtained by permuting the n suffixes 1, 2, 3, ...n. The weight of the function is bipartite and consists of the two numbers Σp and Σq; the symbolic expression of the symmetric function is a partition into biparts (multiparts) of the bipartite (multipartite) number $\overline{\Sigma p,\Sigma q}$. Each part of the partition is a bipartite number, and in representing the partition it is convenient to indicate repetitions of parts by power symbols. In this notation the fundamental relation is written

$$\begin{aligned}&(1+\alpha_1x+\beta_1y)(1+\alpha_2x+\beta_2y)(1+\alpha_3x+\beta_3y)\dots\\&=1+(\overline{10})x+(\overline{01})y+(\overline{10}^2)x^2+(\overline{10}\,\overline{01})xy+(\overline{01}^2)y^2\\&\quad+(\overline{10}^3)x^3+(\overline{10}^2\overline{01})x^2y+(\overline{10}\,\overline{01}^2)xy^2+(\overline{01}^3)y^3+\dots\end{aligned}$$

where in general $a_{pq}=(\overline{10}^p\,\overline{01}^q)$.

All symmetric functions are expressible in terms of the quantities a_{pq} in a rational integral form; from this property they are termed elementary functions; further they are said to be single-unitary since each part of the partition denoting a_{pq} involves but a single unit.

The number of partitions of a biweight $\overline{pq}$ into exactly μ biparts is given (after Euler) by the coefficient of $a^\mu x^py^q$ in the expansion of the generating function

$$\frac{1}{1-ax.\,1-ay.\,1-ax^2.\,1-axy.\,1-ay^2.\,1-ax^3.\,1-ax^2y.\,1-axy^2.\,1-ay^3\dots}$$

The partitions with one bipart correspond to the sums of powers in the single system or unipartite theory; they are readily expressed in terms of the elementary functions. For write $(\overline{pq})=s_{pq}$ and take logarithms of both sides of the fundamental relation; we obtain

$$\begin{gathered}s_{10}x+s_{01}y=\Sigma(\alpha_1x+\beta_1y)\\ s_{20}x^2+2s_{11}xy+s_{02}y^2=\Sigma(\alpha_1x+\beta_1y)^2,\ \&c.,\end{gathered}$$

and

$$\begin{aligned}&s_{10}x+s_{01}y-\frac{1}{2}(s_{20}x^2+2s_{11}xy+s_{02}y^2)+\dots\\&=\log\,(1+a_{10}x+a_{01}y+\dots+a_{pq}x^py^q+\dots.\end{aligned}$$

From this formula we obtain by elementary algebra

$$(-)^{p+q-1}\frac{(p+q-1)!}{p!\,q!}s_{pq}=\sum_{\pi}(-)^{\Sigma\pi-1}\frac{(\Sigma\pi-1)!}{\pi_1!\,\pi_2!\dots}a_{p_1q_1}^{\pi_1}a_{p_2q_2}^{\pi_2}\dots$$

corresponding to Thomas Waring's formula for the single system. The analogous formula appertaining to n systems of quantities which expresses s_{pq}... in terms of elementary functions can be at once written down.

Ex. gr. We can verify the relations

$$\begin{gathered}s_{30}=a_{10}^3-3a_{20}a_{10}+3a_{30},\\ s_{21}=a_{10}^2a_{01}-a_{20}a_{01}-a_{11}a_{10}+a_{21}.\end{gathered}$$

The formula actually gives the expression of $(\overline{pq})$ by means of separations of

$$(\overline{10}^p\,\overline{01}^q),$$

which is one of the partitions of $(\overline{pq})$. This is the true standpoint from which the theorem should be regarded. It is but a particular case of a general theory of expressibility.

To invert the formula we may write

$$\begin{aligned}&1+a_{10}x+a_{01}y+\dots+a_{pq}x^py^q+\dots\\&=exp\,\{(s_{10}x+s_{01}y)-\frac{1}{2}s_{20}x^2+2s_{11}xy+s_{02}y^2)+\dots\},\end{aligned}$$

and thence derive the formula—

$$\begin{aligned}&(-)^{p+q-1}a_{pq}\\&=\sum\left\{\frac{(p_1+q_1-1)!}{p_1!\,q_1!}\right\}^{\pi_1}\left\{\frac{(p_2+q_2-1)!}{p_2!\,q_2!}\right\}^{\pi_2}\dots\frac{(-)^{\Sigma\pi-1}}{\pi_1!\,\pi_2!\dots}s_{p_1q_1}^{\pi_1}s_{p_2q_2}^{\pi_2}\dots,\end{aligned}$$

which expresses the elementary functions in terms of the single bipart functions. The similar theorem for n systems of quantities can be at once written down.

It will be shown later that every rational integral symmetric function is similarly expressible.

The Function h_{pq}.—As the definition of h_{pq} we take

$$\begin{aligned}&1+h_{10}x+h_{01}y+\dots+h_{pq}x^py^q+\dots\\&=\frac{1}{(1-\alpha_1x-\beta_1y)(1-\alpha_2x-\beta_2y)\dots};\end{aligned}$$

and now expanding the right-hand side

$$h_{pq}=\sum\binom{p_1+q_1}{p_1}\binom{p_2+q_2}{p_2}\dots(\overline{p_1q_1}\,\overline{p_2q_2}\dots),$$

the summation being for all partitions of the biweight. Further writing

$$\begin{aligned}&1+h_{10}x+h_{01}y+\dots+h_{pq}x^py^q+\dots\\&=\frac{1}{1-a_{10}x-a_{01}y+\dots+(-)^{p+q}a_{pq}x^py^q+\dots},\end{aligned}$$

we find that the effect of changing the signs of both x and y is merely to interchange the symbols a and h; hence in any relation connecting the quantities h_{pq} with the quantities a_{pq} we are at liberty to interchange the symbols a and h. By the exponential and multinomial theorems we obtain the results—

$$(-)^{p+q-1}h_{pq}=\sum_{\pi}(-)^{\Sigma\pi-1}\frac{(\Sigma\pi)!}{\pi_1!\,\pi_2!\dots}a_{p_1q_1}^{\pi_1}a_{p_2q_2}^{\pi_2}\dots$$

and in this a and h are interchangeable.

$$\frac{(p+q-1)!}{p!\,q!}s_{pq}=\sum_{\pi}(-)^{\Sigma\pi-1}\frac{(\Sigma\pi-1)!}{\pi_1!\,\pi_2!\dots}h_{p_1q_1}^{\pi_1}h_{p_2q_2}^{\pi_2}\dots;$$

$$h_{pq}=\sum\left\{\frac{(p_1+q_1-1)!}{p_1!\,q_1!}\right\}^{\pi_1}\left\{\frac{(p_2+q_2-1)!}{p_2!\,q_2!\dots}\right\}^{\pi_2}\dots\frac{1}{\pi_1!\,\pi_2!\dots}s_{p_1q_1}^{\pi_1}s_{p_2q_2}^{\pi_2}\dots.$$

Differential Operations.—If, in the identity

$$\begin{aligned}&(1+\alpha_1x+\beta_1y)(1+\alpha_2x+\beta_2y)\dots(1+\alpha_nx+\beta_ny)\\&=1+a_{10}x+a_{01}y+a_{20}x^2+a_{11}xy+a_{02}y^2+\dots,\end{aligned}$$

we multiply each side by $(1+\mu x+\nu y)$, the right-hand side becomes

$$1+(a_{10}+\mu)x+(a_{01}+\nu)y+\dots+(a_{pq}+\mu a_{p-1,q}+\nu a_{p,q-1})x^py^q+\dots;$$

hence any rational integral function of the coefficients a_{10}, a_{01}, ... a_{pq}, ... say $f(a_{10},a_{01},\dots)\equiv f$ is converted into

$$\overline{exp}(\mu d_{10}+\nu d_{01})f$$

$$\text{where } d_{10}=\sum a_{p-1,q}\frac{d}{da_{pq}},\ d_{01}=\sum a_{p,q-1}\frac{d}{da_{pq}}.$$

The rule over exp will serve to denote that $\mu d_{10}+\nu d_{01}$ is to be raised to the various powers symbolically as in Taylor's theorem.

Writing
$$D_{pq}=\frac{1}{p!\,q!}d_{10}^pd_{01}^q,$$

$$\overline{exp}(\mu d_{10}+\nu d_{01})=(1+\mu D_{10}+\nu D_{01}+\dots+\mu^p\nu^qD_{pq}+\dots)f;$$

now, since the introduction of the new quantities μ, ν results in the addition to the function $(\overline{p_1q_1}\,\overline{p_2q_2}\,\overline{p_3q_3}\dots)$ of the new terms

$$\mu^{p_1}\nu^{q_1}(\overline{p_2q_2}\,\overline{p_3q_3}\dots)+\mu^{p_2}\nu^{q_2}(\overline{p_1q_1}\,\overline{p_3q_3}\dots)+\mu^{p_3}\nu^{q_3}(\overline{p_1q_1}\,\overline{p_2q_2}\dots)+\dots,$$

we find

$$D_{p_1q_1}(\overline{p_1q_1}\,\overline{p_2q_2}\,\overline{p_3q_3}\dots)=(\overline{p_2q_2}\,\overline{p_3q_3}\dots);$$

and thence

$$D_{p_1q_1}D_{p_2q_2}D_{p_3q_3}\dots(\overline{p_1q_1}\,\overline{p_2q_2}\,\overline{p_3q_3}\dots)=1;$$

while $D_{rs}f=0$ unless the part rs is involved in f. We may then state that D_{pq} is an operation which obliterates one part $\overline{pq}$ when such part is present, but in the contrary case causes the function to vanish. From the above D_{pq} is an operator of order pq, but it is convenient for some purposes to obtain its expression in the form of a number of terms, each of which denotes pq successive linear operations: to accomplish this write

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[1] Vienna *Transactions*, t. iv. 1852.

$$d_{pq}=\sum a_{rs}\frac{d}{a_{p+r,q+s}}$$

and note the general result [1]

$$\overline{exp}\,(m_{10}d_{10}+m_{01}d_{01}+\dots+m_{pq}d_{pq}+\dots)$$
$$=exp\,(M_{10}d_{10}+M_{01}d_{01}+\dots+M_{pq}d_{pq}+\dots);$$

where the multiplications on the left- and right-hand sides of the equation are symbolic and unsymbolic respectively, provided that m_{pq}, M_{pq} are quantities which satisfy the relation

$$exp\,(M_{10}\xi+M_{01}\eta+\dots+M_{pq}\xi^p\eta^q+\dots)$$
$$=1+m_{10}\xi+m_{01}\eta+\dots+m_{pq}\xi^p\eta^q+\dots;$$

where ξ, η are undetermined algebraic quantities. In the present particular case putting $m_{10}=\mu$, $m_{01}=\nu$ and $m_{pq}=0$ otherwise

$$M_{10}\xi+M_{01}\eta+\dots+M_{pq}\xi^p\eta^q+\dots=\log\,(1+\mu\xi+\nu\eta)$$

or

$$M_{pq}=(-)^{p+q-1}\frac{(p+q-1)!}{p!q!}\mu^p\nu^q;$$

and the result is thus

$$\overline{exp}(\mu d_{10}+\nu d_{01})$$
$$=exp\{\mu d_{10}+\nu d_{01}-\frac{1}{2}(\mu^2d_{20}+2\mu\nu d_{11}+\nu^2d_{02})+\dots\}$$
$$=1+\mu D_{10}+\nu D_{01}+\dots+\mu^p\nu^qD_{pq}+\dots;$$

and thence

$$\mu d_{10}+\nu d_{01}-\frac{1}{2}(\mu^2d_{20}+2\mu\nu d_{11}+\nu^2d_{02})+\dots$$
$$=\ \log\,(1+\mu D_{10}+\nu D_{01}+\dots+\mu^p\nu^qD_{pq}+\dots).$$

From these formulae we derive two important relations, viz.

$$(-)^{p+q-1}\frac{(p+q-1)!}{p!q!}d_{pq}+\sum_{\pi}(-)^{\Sigma\pi-1}\frac{(\Sigma\pi-1)!}{\pi_1!\pi_2!\dots}D^{\pi_1}_{p_1q_1}D^{\pi_2}_{p_2q_2}\dots,$$

$$(-)^{p+q-1}D_{pq}=\sum_{\pi}\left\{\frac{(p_1+q_1-1)!}{p_1!q_1!}\right\}^{\pi_1}\left\{\frac{(p_2+q_2-1)!}{p_2!q_2!}\right\}^{\pi_2}\dots$$
$$\dots\ \frac{(-)^{\Sigma\pi-1}}{\pi_1!\pi_2!\dots}d^{\pi_1}_{p_1q_1}d^{\pi_2}_{p_2q_2}\dots$$

the last written relation having, in regard to each term on th right-hand side, to do with $\Sigma\pi$ successive linear operations. Recalling the formulae above which connect s_{pq} and a_{pq}, we see that d_{pq} and D_{pq} are in co-relation with these quantities respectively, and may be said to be operations which correspond to the partitions (pq), $(\overline{10}^p\overline{01}^q)$ respectively. We might conjecture from this observation that every partition is in correspondence with some operation; this is found to be the case, and it has been shown (*loc. cit.* p. 493) that the operation

$$\frac{1}{\pi_1!}\frac{1}{\pi_2!}\dots d^{\pi_1}_{p_1q_1}d^{\pi_2}_{p_2q_2}\dots\quad\text{(multiplication symbolic)}$$

corresponds to the partition $(\overline{p_1q_1}^{\pi_1}\ \overline{p_2q_2}^{\pi_2}\dots)$. The partitions being taken as denoting symmetric functions we have complete correspondence between the algebras of quantity and operation, and from any algebraic formula we can at once write down an operation formula. This fact is of extreme importance in the theory of algebraic forms, and is easily representable whatever be the number of the systems of quantities.

We may remark the particular result

$$(-)^{p+q-1}\frac{(p+q-1)!}{p!q!}d_{pq}s_{pq}+D_{pq}(\overline{pq})+1;$$

d_{pq} causes every other signle part function to vanish, and must cause any monomial function to vanish which does not comprise one of the partitions of the biweight pq amongst its parts.

Since

$$d_{pq}+(-)^{p+q-1}\frac{(p+q-1)!}{p!q!}\frac{d}{ds_{pq}},$$

the solutions of the partial differential equation $d_{pq}=0$ are the single bipart forms, omitting s_{pq}, and we have seen that the solutions of $D_{pq}=0$ are those monomial functions in which the part $\overline{pq}$ is absent.

One more relation is easily obtained, viz.

$$\frac{d}{da_{pq}}=d_{pq}-h_{10}d_{p+1,q}-h_{01}d_{p,q+1}+\dots+(-)^{r+s}h_{rs}d_{p+r,q+s}+\dots.$$

References for Symmetric Functions.—Albert Girard, *Invention nouvelle en l'algèbre* (Amsterdam, 1629); Thomas Waring, *Meditationes Algebraicae* (London, 1782); Lagrange, *Mém. de l'acad. de Berlin* (1768); Meyer-Hirsch, *Sammlung von Aufgaben aus der Theorie der algebraischen Gleichungen* (Berlin, 1809); Serret, *Cours d'algèbre supérieure*, t. iii. (Paris, 1885); Unferdinger, *Sitzungsber. d. Acad. d. Wissensch. i. Wien*, Bd. lx. (Vienna, 1869); L. Schläfli, "Ueber die Resultante eines Systemes mehrerer algebraischen Gleichungen," *Vienna Transactions*, t. iv. 1852; MacMahon, "Memoirs on a New Theory of Symmetric Functions," *American Journal of Mathematics*, Baltimore, Md. 1888–1890; "Memoir on Symmetric Functions of Roots of Systems of Equations," *Phil. Trans.* 1890.

III. The Theory of Binary Forms

A binary form of order n is a homogeneous polynomial of the *nth* degree in two variables. It may be written in the form

$$ax_1^n+bx_1^{n-1}x_2+cx_1^{n-2}x_2^2+\dots;$$

or in the form

$$ax_1^n+\binom{n}{1}bx_1^{n-1}x_2+\binom{n}{2}cx_1^{n-2}x_2^2+\dots,$$

which Cayley denotes by

$$(a,\ b,\ c,\ \dots)(x_1,\ x_2)^n$$

$\binom{n}{1},\binom{n}{2}\dots$ being a notation for the successive binomial coefficients n, $\frac{1}{2}n(n-1)$,..... Other forms are

$$ax_1^n+nbx_1^{n-1}x_2+n(n-1)cx_1^{n-2}x_2^2+\dots,$$

the binomial coefficients $\binom{n}{s}$ being replaced by $s!\binom{n}{s}$, and

$$ax_1^n+\frac{1}{1!}bx_1^{n-1}x_2+\frac{1}{2!}cx_1^{n-2}x_2^2+\dots,$$

the special convenience of which will appear later. For present purposes the form will be written

$$\overline{a_0}x_1^n+\binom{n}{1}\overline{a_1}x_1^{n-1}x_2+\binom{n}{2}\overline{a_2}x_1^{n-2}x_2^2+\dots+\overline{a_n}x_2^n,$$

the notation adopted by German writers; the literal coefficients have a rule placed over them to distinguish them from umbral coefficients which are introduced almost at once. The coefficients $\overline{a_0}$, $\overline{a_1}$, $\overline{a_2}$,...$\overline{a_n}$, $n+1$ in number are arbitrary. If the form, sometimes termed a quantic, be equated to zero the $n+1$ coefficients are equivalent to but n, since one can be made unity by division and the equation is to be regarded as one for the determination of the ratio of the variables.

If the variables of the quantic $f(x_1, x_2)$ be subjected to the linear transformation

$$x_1=\alpha_{11}\xi_1+\alpha_{12}\xi_2,$$
$$x_2=\alpha_{21}\xi_1+\alpha_{22}\xi_2,$$

ξ_1, ξ_2 being new variables replacing x_1, x_2 and the coefficients α_{11}, α_{12}, α_{21}, α_{22}, termed the coefficients of substitution (or of transformation), being constants, we arrive at a transformed quantic

$$f(\xi_1,\xi_2)=\overline{a}'_0\xi_1^n+\binom{n}{1}\overline{a}'_1\xi_1^{n-1}\xi_2+\binom{n}{2}\overline{a}'_2\xi_1^{n-2}\xi_2^2+\dots+\overline{a}'_n\xi_2^n$$

in the new variables which is of the same order as the original quantic; the new coefficients $\overline{a}'_0$, $\overline{a}'_1$, $\overline{a}'_2$...$\overline{a}'_n$ are linear functions of the original coefficients, and also linear functions of products, of the coefficients of substitution, of the *nth* degree.

By solving the equations of transformation we obtain

$$r\xi_1=\ \ \alpha_{22}x_1-\alpha_{12}x_2,$$
$$r\xi_2=-\alpha_{21}x_1+\alpha_{11}x_2,$$
$$\text{where } r=\begin{vmatrix}\alpha_{11}\alpha_{12}\\ \alpha_{21}\alpha_{22}\end{vmatrix}=\alpha_{11}\alpha_{22}-\alpha_{12}\alpha_{21};$$

r is termed the determinant of substitution or modulus of transformation; we assure x_1, x_2 to be independents, so that r must differ from zero.

In the theory of forms we seek functions of the coefficients and variables of the original quantic which, save as to a power of the modulus of transformation, are equal to the like functions of the coefficients and variables of the transformed quantic. We may have such a function which does not involve the variables, viz.

$$F(\overline{a}'_0,\overline{a}'_1,\overline{a}'_2,\dots\overline{a}'_n)=r^{\lambda}F(\overline{a_0},\ \overline{a_1},\ \overline{a_2},\dots\overline{a_n}),$$

the function $F(\overline{a_0},\ \overline{a_1},\ \overline{a_2},\dots\overline{a_n})$ is then said to be an *invariant* of the quantic *quâ* linear transformation. If, however, F involve as well the variables, viz.

$$F(\overline{a}'_0,\overline{a}'_1,\overline{a}'_2,\dots;\xi_1,\ \xi_2)=r^{\lambda}F(\overline{a_0},\ \overline{a_1},\ \overline{a_2},\dots;\ x_1,\ x_2),$$

the function $F(\overline{a_0},\ \overline{a_1},\ \overline{a_2},\dots\ x_1,\ x_2)$ is said to be a *covariant* of the quantic. The expression "invariantive forms" includes both invariants and covariants, and frequently also other analogous forms which will be met with. Occasionally the word "invariants" includes covariants; when this is so it will be implied by the text. Invariantive forms will be found to be homogeneous functions alike of the coefficients and of the variables. Instead of a single quantic we may have several

$$f(\overline{a_0},\ \overline{a_1},\ \overline{a_2}\dots;\ x_1,\ x_2),\ \phi(\overline{b_0},\ \overline{b_1},\ \overline{b_2},\dots;\ x_1,\ x_2),\dots$$

which have different coefficients, the same variables, and are of the same or different degrees in the variables; we may transform them all by the same substitution, so that they become

$$f(\overline{a}'_0,\overline{a}'_1,\overline{a}'_2,\dots;\ \xi_1,\ \xi_2),\ \phi(\overline{b}'_0,\overline{b}'_1,\overline{b}'_2,\dots;\ \xi_1,\ \xi_2),\dots.$$

If then we find

$$F(\overline{a}'_0,\overline{a}'_1,\overline{a}'_2,\dots\overline{b}'_0,\overline{b}'_1,\overline{b}'_2,\dots\dots\dots;\ \xi_1,\ \xi_2),$$
$$=r^{\lambda}F(\overline{a_0},\ \overline{a_1},\ \overline{a_2},\dots\overline{b_0},\ \overline{b_1},\ \overline{b_2},\dots\dots\dots;\ x_1,\ x_2),$$

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[1] *Phil. Trans.*, 1890, p. 490.

the function F, on the right which multiplies *r*, is said to be a *simultaneous invariant* or covariant of the system of quantics. This notion is fundamental in the present theory because we will find that one of the most valuable artifices for finding invariants of a single quantic is first to find simultaneous invariants of several different quantics, and subsequently to make all the quantics identical. Moreover, instead of having one pair of variables x_1, x_2 we may have several pairs y_1, y_2; z_1, z_2;... in addition, and transform each pair to a new pair by substitutions, having the same coefficients $a_{11}, a_{12}, a_{21}, a_{22}$ and arrive at functions of the original coefficients and variables (of one or more quantics) which possess the above-definied invariant property. A particular quantic of the system may be of the same or different degrees in the pairs of variables which it involves, and these degrees may vary from quantic to quantic of the system. Such quantics have been termed by Cayley *multipartite*.

Symbolic Form.—Restricting consideration, for the present, to binary forms in a single pair of variables, we must introduce the symbolic form of Aronhold, Clebsch and Gordan; they write the form

$$(a_1x_1+a_2x_2)^n=a_1^nx_1^n+\binom{n}{1}a_1^{n-1}a_2x_1^{n-1}x_2+\ldots+a_2^nx_2^n=a_x^n$$

wherein a_1, a_2 are umbrae, such that

$$a_1^n,\ a_1^{n-1}a_2,\ldots a_1a_2^{n-1},\ a_2^n$$

are symbolical respreentations of the real coefficients $\bar{a}_0, \bar{a}_1, \ldots \bar{a}_{n-1}, \bar{a}_n$, and in general $a_1^{n-k}a_2^{k}$ is the symbol for $\bar{a}_k$. If we restrict ourselves to this set of symbols we can uniquely pass from a product of real coefficients to the symbolic representations of such product, but we cannot, uniquely, from the symbols recover the real form. This is clear because we can write

$$\bar{a}_1\bar{a}_3=a_1^{n-1}a_2,\ a_1^{n-3}a_2^3=a_1^{2n-4}a_2^4$$

while the same product of umbrae arises from

$$\bar{a}_0\bar{a}_4=a_1^n.a_1^{n-4}a_2^4=a_1^{2n-4}a_2^4.$$

Hence it becomes necessary to have more than one set of umbrae, so that we may have more than one symbolical representation of the same real coefficients. We consider the quantic to have any number of equivalent representations $a_x^n\equiv b_x^n\equiv c_x^n\equiv\ldots$. So that $a_1^{n-k}a_2^k\equiv b_1^{n-k}b_2^k\equiv c_1^{n-k}c_2^k\equiv\ldots=\bar{a}_k$; and if we wish to denote, by umbrae, a product of coefficients of degree *s* we employ *s* sets of umbrae.

Ex. gr. We write $\bar{a}_1\bar{a}_2=a_1^{n-1}a_2.b_1^{n-2}b_2^2$,

$$\bar{a}_2^3=a_1^{n-2}a_2^2.b_1^{n-2}b_2^2.c_1^{n-2}c_2^2,$$

and so on whenever we require to represent a product of real coefficients symbolically; we then have a one-to-one correspondence between the products of real coefficients and their symbolic forms. If we have a function of degree *s* in the coefficients, we may select any *s* sets of umbrae for use, and having made a selection we may when only one quantic is under consideration at any time permute the sets of umbrae in any manner without altering the real significance of the symbolism. *Ex. gr.* To express the function $\bar{a}_0\bar{a}_2-\bar{a}_1^2$, which is the discriminant of the binary quadratic $\bar{a}_0x_1^2+2\bar{a}_1x_1x_2+\bar{a}_2x_2^2=a_x^2=b_x^2$, in a symbolic form we have

$$\begin{aligned}2(a_0a_2-a_1^2)&=\bar{a}_0\bar{a}_2+\bar{a}_0\bar{a}_2-2\bar{a}_1\,.\,\bar{a}_1=a_1^2b_2^2+a_2^2b_1^2-2a_1a_2b_1b_2\\&=(a_1b_2-a_2b_1)^2.\end{aligned}$$

Such an expression as $a_1b_2-a_2b_1$, which is

$$\frac{\partial a_x}{\partial x_1}\frac{\partial b_x}{\partial x_2}-\frac{\partial a_x}{\partial x_2}\frac{\partial b_x}{\partial x_1},$$

is usually written (ab) for brevity; in the same notation the determinant, whose rows are a_1, a_2, a_3; b_1, b_2, b_3; c_1, c_2, c_3 respectively, is written (abc) and so on. It should be noticed that the real function denoted by $(ab)^2$ is not the square of a real function denoted by (ab). For a single quantic of the first order (ab) is the symbol of a function of the coefficients which vanishes identically; thus

$$(ab)=a_1b_2-a_2b_1=\bar{a}_0\bar{a}_1-\bar{a}_1\bar{a}_0=0$$

and, indeed, from a remark made above we see that (ab) remains unchanged by interchange of a and b; but (ab), $=-(ba)$, and these two facts necessitate $(ab)=0$.

To find the effect of linear transformation on the symbolic form of quantic we will disuse the coefficients $a_{11}, a_{12}, a_{21}, a_{22}$, and employ $\lambda_1, \mu_1, \lambda_2, \mu_2$. For the substitution

$$x_1=\lambda_1\xi_1+\mu_1\xi_2,\ x_2=\lambda_2\xi_1+\mu_2\xi_2,$$

$$\text{of modulus}\begin{vmatrix}\lambda_1 & \mu_1\\ \lambda_2 & \mu_2\end{vmatrix}=(\lambda_1\mu_2-\lambda_2\mu_1)=(\lambda\mu),$$

the quadratic form $\bar{a}_0x_1^2+2\bar{a}_1x_1x_2+\bar{a}_2x_2^2={}_x^2=f(x)$, becomes

$$\bar{A}_0\xi_1^2+2\bar{A}_1\xi_1\xi_2+\bar{A}_2\xi_2^2=A_\xi^2=\phi(\xi),$$

where

$$\begin{aligned}\bar{A}_0&=\bar{a}_0\lambda_1^2+2\bar{a}_1\lambda_1\lambda_2+\bar{a}_2\lambda_2^2,\\ \bar{A}_1&=\bar{a}_0\lambda_1\mu_1+\bar{a}_1(\lambda_1\mu_2+\lambda_2\mu_1)+\bar{a}_2\lambda_2\mu_2,\\ \bar{A}_2&=\bar{a}_0\mu_1^2+2\bar{a}_1\mu_1\mu_2+\bar{a}_2\mu_2^2.\end{aligned}$$

We pass to the symbolic forms

$$a_x^2=(a_1x_1+a_2x_2)^2,\ A_\xi^2=(A_1\xi_1+A_2\xi_2)^2,$$

by writing for

$$\begin{array}{lcl}\bar{a}_0,\ \bar{a}_1,\ \bar{a}_2 & \text{the symbols} & a_1^2,\ a_1a_2,\ a_2^2\\ \bar{A}_0,\ \bar{A}_1,\ \bar{A}_2 & ,, & A_1^2,\ A_1A_2,\ A_2^2\end{array}$$

and then

$$\begin{aligned}\bar{A}_0&=a_1^2\lambda_1^2+2a_1a_2\lambda_1\lambda_2+a_2^2\lambda_2^2=(a_1\lambda_1+a_2\lambda_2)^2=a_\lambda^2,\\ \bar{A}_1&=(a_1\lambda_1+a_2\lambda_2)(a_1\mu_1+a_2\mu_2)=a_\lambda a_\mu,\\ \bar{A}_2&=(a_1\mu_1+a_2\mu_2)^2=a_\mu^2;\end{aligned}$$

so that

$$A_\xi^2=a_\lambda^2\xi_1^2+2a_\lambda a_\mu\xi_1\xi_2+a_\mu^2\xi_2^2=(a_\lambda\xi_1+a_\mu\xi_2)^2;$$

whence A_1, A_2 become a_λ, a_μ respectively and

$$\phi(\xi)=(a_\lambda\xi_1+a_\mu\xi_2)^2;$$

The practical result of the transformation is to change the umbrae a_1, a_2 into the umbrae

$$a_\lambda=a_1\lambda_1+a_2\lambda_2,\ a_\mu=a_1\mu_1+a_2\mu_2$$

respectively.

By similarly transforming the binary n^{ic} form a_x^n we find

$$\begin{aligned}\bar{A}_0&=(a_1\lambda_1+a_2\lambda_2)^n=a_\lambda^n+A_1^n,\\ \bar{A}_1&=(a_1\lambda_1+a_2\lambda_2)^{n-1}(a_1\mu_1+a_2\mu_2)=a_\lambda^{n-1}a_\mu=A_1^{n-1}A_2,\\ &\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\\ \bar{A}_k&=(a_1\lambda_1+a_2\lambda_2)^{n-k}(a_1\mu_1+a_2\mu_2)^k=a_\lambda^{n-k}a_\mu^k=A_1^{n-k}A_2^k,\end{aligned}$$

so that the umbrae A_1, A_2 are a_λ, a_μ respectively.

Theorem.—When the binary form

$$a_x^n=(a_1x_1+a_2x_2)^n$$

is transformed to

$$A_\xi^n=(A_1\xi_1+A_2\xi_2)^n$$

by the substitutions

$$x_1=\lambda_1\xi_1+\mu_1\xi_2,\ x_2=\lambda_2\xi_1+\mu_2\xi_2,$$

the umbrae A_1, A_2 are expressed in terms of the umbrae a_1, a_2 by the formulae

$$A_1=\lambda_1a_1+\lambda_2a_2,\ A_2=\mu_1a_1+\mu_2a_2.$$

We gather that A_1, A_2 are transformed to a_1, a_2 in such wise that the determinant of transformation reads by rows as the original determinant reads by columns, and that the modulus of the transformation is, as before, $(\lambda\mu)$. For this reason the umbrae A_1, A_2 are said to be *contragredient* to x_1, x_2. If we solve the equations connecting the original and transformed unbrae we find

$$\begin{aligned}(\lambda\mu)(-a_2)&=\lambda_1(-A_2)+\mu_1A_1,\\ (\lambda\mu)a_1&=\lambda_2(-A_2)+\mu_2A_1,\end{aligned}$$

and we find that, except for the factor $(\lambda\mu)$, $-a_2$ and $+a_1$ are transformed to $-A_2$ and $+A_1$ by the same substitutions as x_1 and x_2 are transformed to ξ_1 and ξ_2. For this reason the umbrae $-a_2, a_1$ are said to be cogredient to x_1 and x_2. We frequently meet with cogredient and contragedient quantities, and we have in general the following definitions:—(1) "If two equally numerous sets of quantities $x, y, z, \ldots$ $x', y', z', \ldots$ are such that whenever one set $x, y, z, \ldots$ is expressed in terms of new quantities X, Y, Z, ... the second set $x', y', z', \ldots$ is expressed in terms of other new quantities X′, Y′, Z′, ... , by the same scheme of linear substitution the two sets are said to be *cogredient* quantities." (2) "Two sets of quantities $x, y, z, \ldots$; $\xi, \eta, \zeta, \ldots$ are said to be *contragredient* when the linear substitutions for the first set are

$$\begin{aligned}x&=\lambda_1X+\mu_1Y+\nu_1Z+\ldots,\\ y&=\lambda_2X+\mu_2Y+\nu_2Z+\ldots,\\ z&=\lambda_3X+\mu_3Y+\nu_3Z+\ldots,\\ &\cdot\quad\cdot\quad\cdot\quad\cdot\end{aligned}$$

and these are associated with the following formulae appertaining to the second set,

$$\begin{aligned}\Xi&=\lambda_1\xi+\lambda_2\eta+\lambda_3\zeta+\ldots,\\ \mathrm{H}&=\mu_1\xi+\mu_2\eta+\mu_3\zeta+\ldots,\\ \mathrm{Z}&=\nu_1\xi+\nu_2\eta+\nu_3\zeta+\ldots,\\ &\cdot\quad\cdot\quad\cdot\quad\cdot\end{aligned}$$

wherein it should be noticed that *new* quantities are expressed in terms of the *old*, as regards the latter set, and not *vice versa*."

Ex. gr. The symbols $\frac{d}{dx}, \frac{d}{dy}, \frac{d}{dz}$, ... are contragredient with the variables x, y, z, ... for when

$$(x, y, z, \ldots)=\begin{vmatrix}\lambda_1, & \mu_1, & \nu_1, & \ldots\\ \lambda_2, & \mu_2, & \nu_2, & \ldots\\ \lambda_3, & \mu_3, & \nu_3, & \ldots\\ \cdot & \cdot & \cdot & \cdot\end{vmatrix}(X, Y, Z, \ldots).$$

we find

$$\left(\frac{d}{dX},\ \frac{d}{dY},\ \frac{d}{dZ},\dots\right)=\begin{array}{|llll|}(\lambda_1, & \lambda_2, & \lambda_3, & \dots)\\ \mu_1, & \mu_2, & \mu_3, & \dots\\ \nu_1, & \nu_2, & \nu_3, & \dots\\ \cdot & \cdot & \cdot & \cdot\end{array}\left(\frac{d}{dx},\ \frac{d}{dy},\ \frac{d}{dz},\dots\right).$$

Observe the notation, which is that introduced by Cayley into the theory of matrices which he himself created.

Just as cogrediency leads to a theory of covariants, so contragrediency leads to a theory of contravariants. If u, a quantic in $x, y, z, \dots$, be expressed in terms of new variables X, Y, Z ...; and if $\xi, \eta, \zeta, \dots$, be quantities contragredient to $x, y, z, \dots$; there are found to exist functions of $\xi, \eta, \zeta, \dots$, and of the coefficients in u, which need, at most, be multiplied by powers of the modulus to be made equal to the same functions of Ξ, H, Z, ... of the transformed coefficients of u; such functions are called *contravariants* of u. There also exist functions, which involve both sets of variables as well as the coefficients of u, possessing a like property; such have been termed *mixed concomitants*, and they, like contravariants, may appertain as well to a system of forms as to a single form.

As between the original and transformed quantic we have the umbral relations

$$A_1=\lambda_1a_1+\lambda_2a_2,\ A_2=\mu_1a_1+\mu_2a_2,$$

and for a second form

$$B_1=\lambda_1b_1+\lambda_2b_2,\ B_2=\mu_1b_1+\mu_2b_2.$$

The original forms are a_x^n, b_x^n, and we may regard them *either* as *different* forms *or* as equivalent representations of the *same* form. In other words, B, b may be regarded as different or alternative symbols to A, a. In either case

$$(AB)=A_1B_2-A_2B_1=(\lambda\mu)(ab);$$

and, from the definition, (ab) possesses the invariant property. We cannot, however, say that it is an invariant unless it is expressible in terms of the real coefficients. Since $(ab)=a_1b_2-a_2b_1$, that this may be the case each form must be linear; and if the forms be different (ab) is an invariant (simultaneous) of the two forms, its real expression being $\bar a_0\bar b_1-\bar a_1\bar b_0$. This will be recognized as the resultant of the two linear forms. If the two linear forms be identical, the umbral sets a_1, a_2; b_1, b_2 are alternative, are ultimately put equal to one another and (ab) vanishes. A single linear form has, in fact, no invariant. When either of the forms is of an order higher than the first (ab), as not being expressible in terms of the actual coefficients of the forms, is not an invariant and has no significance. Introducing now other sets of symbols C, D, ...; c, d, ... we may write

$$(AB)^i(AC)^j(BC)^k\dots=(\lambda\mu)^{i+j+k+\dots}(ab)^i(ac)^j(bc)^k\dots,$$

so that the symbolic product

$$(ab)^i(ac)^j(bc)^k\dots,$$

possesses the invariant property. If the forms be all linear and different, the function is an invariant, viz. the ith power of that appertaining to a_x and b_x multiplied by the jth power of that appertaining to a_x and c_x multiplied by &c. If any two of the linear forms, say p_x, q_x, be supposed identical, any symbolic expression involving the factor (pq) is zero. Notice, therefore, that the symbolic product $(ab)^i(ac)^j(bc)^k\dots$ may be always viewed as a simultaneous invariant of a number of different linear forms $a_x, b_x, c_x, \dots$. In order that $(ab)^i(ac)^j(bc)^k\dots$ may be a simultaneous invariant of a number of different forms $a_x^{n_1}, b_x^{n_2}, c_x^{n_3},\dots$, where $n_1, n_2, n_3, \dots$ may be the same or different, it is necessary that every product of umbrae which arises in the expansion of the symbolic product be of degree n_1 in a_1, a_2; in the case of b_1, b_2 of degree n_2; in the case of c_1, c_2 of degree n_3; and so on. For these only will the symbolic product be replaceable by a linear function of products of real coefficients. Hence the condition is

$$\begin{aligned}i+j+\dots&=n_1,\\ i+k+\dots&=n_2,\\ j+k+\dots&=n_3,\\ \cdot\quad\cdot\quad\cdot&\quad\cdot\end{aligned}$$

If the forms $a_x^n, b_x^n, c_x^n,\dots$ be identical the symbols are alternative, and provided that the form does not vanish it denotes an invariant of the single form a_x^n.

There may be a number of forms $a_x^n, b_x^n, c_x^n,\dots$ and we may suppose such identities between the symbols that on the whole only two, three, or more of the sets of umbrae are not equivalent; we will then obtain invariants of two, three, or more sets of binary forms. The symbolic expression of a covariant is equally simple, because we see at once that since A_ξ, B_ξ, C_ξ,... are equal to $a_x, b_x, c_x, \dots$ respectively, the linear forms $a_x, b_x, c_x, \dots$ possess the invariant property, and we may write

$$\begin{aligned}&(AB)^i(AC)^j(BC)^k\dots A_\xi^\rho B_\xi^\sigma C_\xi^\tau\dots\\ &\qquad=(\lambda\mu)^{i+j+k+\dots}(ab)^i(ac)^j(bc)^k\dots a_x^\rho b_x^\sigma c_x^\tau\dots,\end{aligned}$$

and assert that the symbolic product

$$(ab)^i(ac)^j(bc)^k\dots a_x^\rho b_x^\sigma c_x^\tau\dots$$

possesses the invariant property. It is always an invariant or covariant appertaining to a number of different linear forms, and as before it may vanish if two such linear forms be identical. In general it will be simultaneous covariant of the different forms $a_x^{n_1}, b_x^{n_2}, c_x^{n_3}, \dots$ if

$$\begin{aligned}i+j+\dots+\rho&=n_1,\\ i+k+\dots+\sigma&=n_2,\\ j+k+\dots+\tau&=n_3,\\ \cdot\quad\cdot\quad\cdot&\quad\cdot\end{aligned}$$

It will also be a covariant if the symbolic product be factorizable into portions each of which satisfies these conditions. If the forms be identical the sets of symbols are ultimately equated, and the form, provided it does not vanish, is a covariant of the form a_x^n.

The expression $(ab)^4$ properly appertains to a quartic; for a quadratic it may also be written $(ab)^2(cd)^2$, and would denote the square of the discriminant to a factor *près*. For the quartic

$$\begin{aligned}(ab)^4&=(a_1b_2-a_2b_1)^4=a_1^4b_2^4-4a_1^3a_2b_1b_2^3+6a_1^2a_2^2b_1^2b_2^2\\ &\quad-4a_1a_2^3b_1^3b_2+a_2^4b_1^4=\bar a_0\bar a_4-4\bar a_1\bar a_3+6\bar a_2^2-4\bar a_1\bar a_3+\bar a_0\bar a_4\\ &=2(\bar a_0\bar a_4-4\bar a_1\bar a_3+3\bar a_2^2),\end{aligned}$$

one of the well-known invariants of the quartic.

For the cubic $(ab)^2a_xb_x$ is a covariant because each symbol a, b occurs three times; we can first of all find its real expression as a simultaneous covariant of two cubics, and then, by supposing the two cubics to merge into identity, find the expression of the quadratic covariant, of the single cubic, commonly known as the Hessian.

By simple multiplication

$$\begin{aligned}&(a_1^3b_1b_2^2-2a_1^2a_2b_1^2b_2+a_1a_2^2b_1^3)x_1^2\\ &+(a_1^3b_2^3-a_1a_2^2b_1^2b_2-a_1^2a_2b_1b_2^2+a_2^3b_1^3)x_1x_2\\ &+(a_1^2a_2b_2^3-2a_1a_2^2b_1b_2^2+a_2^3b_1^2b_2)x_2^2;\end{aligned}$$

and transforming to the real form,

$$\begin{aligned}(a_0b_2-2a_1b_1+a_2b_0)x_1^2&+(a_0b_3-a_1b_2-a_2b_1+a_3b_0)x_1x_2\\ &+(a_1b_3-2a_2b_2+a_3b_1)x_2^2,\end{aligned}$$

the simultaneous covariant; and now, putting $b=a$, we obtain twice the Hessian

$$(a_0a_2-a_1^2)x_1^2+(a_0a_3-a_1a_2)x_1x_2+(a_1a_3-a_2^2)x_2^2.$$

It will be shown later that all invariants, single or simultaneous, are expressible in terms of symbolic products. The degree of the covariant in the coefficients is equal to the number of different symbols $a, b, c, \dots$ that occur in the symbolic expression; the degree in the variables (*i.e.* the order of the covariant) is $\rho+\sigma+\tau+\dots$ and the weight[1] of the coefficient of the leading term $x_1^{\rho+\sigma+\tau+\dots}$ is equal to $i+j+k+\dots$. It will be apparent that there are four numbers associated with a covariant, viz. the orders of the quantic and covariant, and the degree and weight of the leading coefficient; calling these n, ϵ, θ, w respectively we can see that they are not independent integers, but that they are invariably connected by a certain relation $n\theta-2w=\epsilon$. For, if $\phi(\bar a_0,\dots x_1, x_2)$ be a covariant of order ϵ appertaining to a quantic of order n,

$$\phi(\bar A_0,\dots\xi_1\xi_2)=(\lambda\mu)^w\phi(\bar a_0,\dots\lambda_1\xi_1+\mu_1\xi_2,\lambda_2\xi_1+\mu_2\xi_2);$$

we find that the left- and right-hand sides are of degrees $n\theta$ and $2w+\epsilon$ respectively in $\lambda_1, \mu_1, \lambda_2, \mu_2$, and thence $n\theta=2w+\epsilon$.

Symbolic Identities.— For the purpose of manipulating symbolic expressions it is necessary to be in possession of certain simple identities which connect certain symbolic products. From the three equations

$$a_x=a_1x_1+a_2x_2,\ b_x=b_1x_1+b_2x_2,\ c_x=c_1x_1+c_2x_2,$$

we find by eliminating x_1 and x_2 the relation

$$a_x(bc)+b_x(ca)+c_x(ab)=0\quad .\quad .\quad .\quad (I.)$$

Introduce now new umbrae d_1, d_2 and recall that $+d_2-d_1$ are cogredient with x_1 and x_2. We may in any relation substitute for any pair of quantities any other cogredient pair so that writing $+d_2$, $-d_1$ for x_1 and x_2, and noting that g_x then becomes (gd), the above-written identity bceomes

$$(ad)(bc)+(bd)(ca)+(cd)(ab)=0\quad .\quad .\quad .\quad (II.)$$

Similarly in (I.), writing for c_1, c_2 the cogredient pair $-y_2, +y_1$, we obtain

$$a_xb_y-a_yb_x=(ab)(xy).\quad .\quad .\quad .\quad .\quad (III.)$$

Again in (I.) transposing $a_x(bc)$ to the other side and squaring, we obtain

$$2(ac)(bc)a_xb_x=(bc)^2a_x^2+(ac)^2b_x-(ab)^2c_x^2\quad .\quad (IV.)$$

and herein writing $d_2, -d_1$ for x_1, x_2,

$$2(ac)(bc)(ad)(bd)=(bc)^2(ad)^2+(ac)^2(bd)^2-(ab)^2(cd)^2.\quad (V.)$$

As an illustration multiply (IV.) throughout by $a_x^{n-2}b_x^{n-2}c_x^{n-2}$ so that each term may denote a covariant of an n^{ic}.

$$\begin{aligned}&2(ac)(bc)a_x^{n-1}b_x^{n-1}c_x^{n-1}\\ &=(bc)^2a_x^nb_x^{n-2}c_x^{n-2}+(ac)^2a_x^{n-2}b_x^nc_x^{n-2}-(ab)^2a_x^{n-2}b_x^{n-2}c_x^n.\end{aligned}$$

---

[1] The weight of a term $\bar a_0^{k_0}\bar a_1^{k_1}\dots\bar a_n^{k_n}$ is defined as being $k_1+2k_2+\dots+nk_n$.

Each term on the right-hand side may be shown by permutation of a, b, c to be the symbolical representation of the same covariant; they are equivalent symbolic products, and we may accordingly write

$$2(ac)(bc)a_x^{n-1}b_x^{n-1}c_x^{n-2}=(ab)^2a_x^{n-2}b_x^{n-2}c_x^{n},$$

a relation which shows that the form on the left is the product of the two covariants

$$(ab)^2a_x^{n-2}b_x^{n-2}\text{ and }c_x^n.$$

The identities are, in particular, of service in reducing symbolic products to standard forms. A symbolical expression may be always so transformed that the power of any determinant factor (ab) is even. For we may in any product interchange a and b without altering its signification; therefore

$$(ab)^{2m+1}\phi_1=-(ab)^{2m+1}\phi_1,$$

where ϕ_1 becomes ϕ_2 by the interchange, and hence

$$(ab)^{2m+1}\phi_1=\frac{1}{2}(ab)^{2m+1}(\phi_1-\phi_2);$$

and identity (I.) will always result in transforming $\phi_1-\phi_2$ so as to make it divisible by (ab).

Ex. gr.

$$\begin{aligned}(ab)(ac)b_xc_x&=-(ab)(bc)a_xc_x\\&=\frac{1}{2}(ab)c_x\{(ac)b_x-(bc)a_x\}=\frac{1}{2}(ab)^2c_x^2;\end{aligned}$$

so that the covariant of the quadratic on the left is half the product of the quadratic itself and its only invariant. To obtain the corresponding theorem concerning the general form of even order we multiply throughout by $(ab)^{2m-2}c_x^{2m-2}$ and obtain

$$(ab)^{2m-1}(ac)b_xc_x^{2m-1}=\frac{1}{2}(ab)^{2m}c_x^{2m}.$$

Paying attention merely to the determinant factors there is no form with one factor since (ab) vanishes identically. For two factors the standard form is $(ab)^2$; for three factors $(ab)^2(ac)$; for four factors $(ab)^4$ and $(ab)^2(cd)^2$; for five factors $(ab)^4(ac)$ and $(ab)^2(ac)(de)^2$; for six factors $(ab)^6$, $(ab)^2(bc)^2(ca)^2$, and $(ab)^2(cd)^2(ef)^2$. It will be a useful exercise for the reader to interpret the corresponding covariants of the general quantic, to show that some of them are simple powers or products of other covariants of lower degrees and order.

The Polar Process.—The μth polar of a_x^n with regard to y is

$$a_x^{n-\mu}a_y^{\mu},$$

i.e. μ of the symbolic factors of the form are replaced by μ others in which new variables y_1, y_2 replace the old variables x_1, x_2. The operation of taking the polar results in a symbolic product, and the repetition of the process in regard to new cogredient sets of variables results in symbolic forms. It is therefore an invariant process. All the forms obtained are invariants in regard to linear transformations, in accordance with the same scheme of substitutions, of the several sets of variables.

An important associated operation is

$$\frac{\partial^2}{\partial x_1\partial y_2}-\frac{\partial^2}{\partial x_2\partial y_1},$$

which, operating upon any polar, causes it to vanish. Moreover, its operation upon any invariant form produces an invariant form.

Every symbolic product, involving several sets of cogredient variables, can be exhibited as a sum of terms, each of which is a polar multiplied by a product of powers of the determinant factors

$$(xy),\ (xz),\ (yz),\ldots$$

Transvection.—We have seen that (ab) is a simultaneous invariant of the two different linear forms a_x, b_x, and we observe that (ab) is equivalent to

$$\frac{\partial f}{\partial x_1}\frac{\partial\phi}{\partial x_2}-\frac{\partial f}{\partial x_2}\frac{\partial\phi}{\partial x_1}$$

where $f=a_x$, $\phi=b_x$.

If $f=a_x^m$, $\phi=b_x^n$ be any two binary forms, we generalize by forming the function

$$\frac{(m-k)!}{m!}\frac{(n-k)!}{n!}\left(\frac{\partial f}{\partial x_1}\frac{\partial\phi}{\partial x_2}-\frac{\partial f}{\partial x_2}\frac{\partial\phi}{\partial x_1}\right)^k.$$

This is called the kth transvectant of f over ϕ; it may be conveniently denoted by

$$(f,\ \phi)^k.$$

Observing that

$$(a_x^m,\ b_x^n)^k=(ab)^ka^{m-k}b_x^{n-k},$$

it is clear that the kth transvectant is a simultaneous covariant of the two forms.

It has been shown by Gordan that every symbolic product is expressible as a sum of transvectants.

If $m\geq n$ there are $n+1$ transvectants corresponding to the values 0, 1, 2,... n of k; if $k=0$ we have the product of the two forms, and for all values of $k>n$ the transvectants vanish. In general we may have any two forms

$$\phi_x^p=(\phi_1x_1+\phi_2x_2)^p,\ \psi_x^q=(\psi_1x_1+\psi_2x_2)^q,$$

ϕ_1, ϕ_2, ψ_1, ψ_2 being the umbrae, as usual, and for the kth transvectant we have

$$(\phi_x^p,\ \psi_x^q)^k=(\phi\psi)^k\phi_x^{p-k}\psi_x^{q-k},$$

a simultaneous covariant of the two forms. We may suppose ϕ_x^p, ψ_x^q to be any two covariants appertaining to a system, and the process of transvection supplies a means of proceeding from them to other covariants.

The two forms a_x^m, b_x^n, or ϕ_x^p, ψ_x^q, may be identical; we then have the kth transvectant of a form over itself which may, or may not, vanish identically; and, in the latter case, is a covariant of the single form. It is obvious that, when k is uneven, the kth transvectant of a form over itself *does* vanish. We have seen that transvection is equivalent to the performance of partial differential operations upon the two forms, but, practically, we may regard the process as merely substituting $(ab)^k$, $(\phi\psi)^k$ for $a_x^kb_x^k$, $\phi_x^k\psi_x^k$ respectively in the symbolic product subjected to transvection. It is essentially an operation performed upon the product of two forms. If, then, we require the transvectants of the two forms $f+\lambda f'$, $\phi+\mu\phi'$, we take their product

$$f\phi+\lambda f'\phi+\mu f\phi'+\lambda\mu f'\phi',$$

and the kth transvectant is simply obtained by operating upon each term separately, viz.

$$(f,\ \phi)^k+\lambda(f',\ \phi)^k+\mu(f,\ \phi')^k+\lambda\mu(f',\ \phi')^k;$$

and, moreover, if we require to find the kth transvectant of one linear system of forms over another we have merely to multiply the two systems, and take the kth transvectant of the separate products.

The process of transvection is connected with the operations Ω; for

$$\Omega^k(a_x^mb_y^n)=(ab)^ka_x^{m-k}b_y^{n-k};$$

or

$$\Omega^k(a_x^mb_y^n)_{y=x}=(f,\ \phi)^k;$$

so also is the polar process, for since

$$f_y^k=a_x^{m-k}b_y^k,\ \phi_y^k=b_x^{n-k}b_y^k,$$

if we take the kth transvectant of f_y^k over ϕ_y^k, regarding y_1, y_2 as the variables,

$$(f_y^k,\ \phi_y^k)^k=(ab)^ka_x^{m-k}b_x^{n-k}=(f,\ \phi)^k;$$

or the kth transvectant of the kth polars, in regard to y, is equal to the kth transvectant of the forms. Moreover, the kth transvectant $(ab)^ka_x^{m-k}b_x^{n-k}$ is derivable from the kth polar of a_x^m, viz. $a_x^{m-k}a_y^k$ by substituting for y_1, y_2 the cogredient quantities b_2, $-b_1$, and multiplying by b_x^{n-k}.

First and Second Transvectants.—A few words must be said about the first two transvectants as they are of exceptional interest. Since, if $f=a_x^m$, $\phi=b_x^n$,

$$(f,\ \phi)^1=\frac{1}{mn}\left(\frac{\partial f}{\partial x_1}\frac{\partial\phi}{\partial x_2}-\frac{\partial f}{\partial x_2}\frac{\partial\phi}{\partial x_1}\right)=(ab)a_x^{m-1}b_x^{n-1}=\mathrm{J},$$

the first transvectant differs but by a numerical factor from the Jacobian or functional determinant, of the two forms. We can find an expression for the first transvectant of $(f,\ \phi)^1$ over another form c^p.

For

$$(m+n)(f,\phi)_y^1=nf.\phi_y^1+mf_y^1.\phi,$$

and

$$f.\phi_y^1-f_y.\phi=(a_xb_y-a_yb_x)a_x^{m-1}b_x^{n-1}=(xy)(f,\phi)^1;$$

$$\therefore(f,\phi)^1=f_y^1.\phi+\frac{n}{m+n}(xy)(f,\phi)^1.$$

Put $m-1$ for m, $n-1$ for n, and multiply through by (ab); then

$$\begin{aligned}\{(f,\phi)\}_y^1&=(ab)a_x^{m-2}a_yb_x^{n-1}+\frac{n-1}{m+n-2}(xy)(f,\phi)^2,\\&=(ab)a_x^{m-1}b_x^{n-2}b_y-\frac{m-1}{m+n-2}(xy)(f,\phi)^2.\end{aligned}$$

Multiply by c_x^{p-1} and for y_1, y_2 write c_2, $-c_1$; then the right-hand side becomes

$$(ab)(bc)a_x^{m-1}b_x^{n-2}c_x^{p-1}+\frac{m-1}{m+n-2}c_x^p(f,\phi)^2,$$

of which the first term, writing $c_x^p=\psi$, is

$$\begin{aligned}&a_x^{m-2}b_x^{n-2}c_x^{p-2}(ab)(bc)a_xc_x\\&=-\frac{1}{2}a_x^{m-2}b_x^{n-2}c_x^{p-2}\left\{(bc)^2a_x^2+(ab)^2c_x^2-(ac)^2b_x^2\right\}\\&=-\frac{1}{2}\left\{a_x^m(bc)^2b_x^{n-2}c_x^{p-2}+c_x^p(ab)^2a_x^{m-2}b_x^{n-2}-b_x^n(ac)^2a_x^{m-2}c_x^{p-2}\right\}\\&=-\frac{1}{2}\left\{(\phi,\psi)^2.f+(f,\phi)^2.\psi-(f,\psi)^2.\phi\right\};\end{aligned}$$

and, if $(f,\phi)^1=k_y^{m+n-2}$,

$$\left\{(f,\phi)^1\right\}_y^1.c_x^{p-1}=k_x^{m+n-3}k_yc_x^{p-1};$$

and this, on writing $c_2, -c_1$ for y_1, y_2, becomes

$$(kc)k_x^{m+n-3}c_x^{p-1} = \Big\} (f,\phi)^1 \cdot \psi \Big\{^1;$$

$$\therefore \{(f,\phi)^1,\psi\}^1 = \frac{1}{2}\Big\} \frac{m-n}{m+n-2}(f,\phi)^2\cdot\psi + (f,\psi)^2\cdot\phi - (\phi,\psi)^2\cdot f \Big\{;$$

and thence it appears that the first transvectant of $(f, \phi)^1$ over ψ is always expressible by means of forms of lower degree in the coefficients wherever each of the forms f, ϕ, ψ is of higher degree than the first in x_1, x_2.

The second transvectant of a form over itself is called the Hessian of the form. It is

$$(f,f')^2 = (ab)^2 a_x^{m-2} b_x^{m-2} = \mathrm{H}_x^{2m-4} = \mathrm{H};$$

unsymbolically it is a numerical multiple of the determinant $\frac{\partial^2 f}{\partial x_1^2}\frac{\partial^2 f}{\partial x_2^2} - \left(\frac{\partial^2 f}{\partial x \partial x_2}\right)^2$. It is also the first transvectant of the differential coefficients of the form with regard to the variables, viz. $\left(\frac{\partial f}{\partial x_1}, \frac{\partial f}{\partial x_2}\right)^1$. For the quadratic it is the discriminant $(ab)^2$ and for the cubic the quadratic covariant $(ab)^2\, a_x b_x$.

In general for a form in n variables the Hessian is

$$\begin{vmatrix} \frac{\partial^2 f}{\partial x_1^2} & \frac{\partial^2 x}{\partial x_1 \partial x_2} \cdots & \frac{\partial^2 f}{\partial x_1 \partial x_n} \\ \frac{\partial^2 f}{\partial x_1 \partial x_2} & \frac{\partial^2 f}{\partial x_2^2} \cdots & \frac{\partial^2 f}{\partial x_2 \partial x_n} \\ \vdots & \vdots & \vdots \\ \frac{\partial^2 f}{\partial x_1 \partial x_n} & \frac{\partial^2 f}{\partial x_2 \partial x_n} \cdots & \frac{\partial^2 f}{\partial x_n^2} \end{vmatrix} = \mathrm{H}_x^{n(m-2)} = \mathrm{H};$$

and there is a remarkable theorem which states that if H = 0 and $n = 2, 3$, or 4 the original form can be exhibited as a form in 1, 2, 3 variables respectively.

The Form $f+\lambda\phi$.—An important method for the formation of covariants is connected with the form $f+\lambda\phi$, where f and ϕ are of the same order in the variables and λ is an arbitrary constant. If the invariants and covariants of this composite quantic be formed we obtain functions of λ such that the coefficients of the various powers of λ are simultaneous invariants of f and ϕ. In particular, when ϕ is a covariant of f, we obtain in this manner covariants of f.

The Partial Differential Equations.—It will be shown later that covariants may be studied by restricting attention to the leading coefficient, viz. that affecting x_1^ϵ where ϵ is the order of the covariant. An important fact, discovered by Cayley, is that these coefficients, and also the complete covariants, satisfy certain partial differential equations which suffice to determine them, and to ascertain many of their properties. These equations can be arrived at in many ways; the method here given is due to Gordan. $\lambda_1, \lambda_2, \mu_1, \mu_2$ being as usual the coefficients of substitution, let

$$\lambda_1\frac{\partial}{\partial\lambda_1} + \lambda_2\frac{\partial}{\partial\lambda_2} = \mathrm{D}_{\lambda\lambda},\ \lambda_1\frac{\partial}{\partial\mu_1} + \lambda_2\frac{\partial}{\partial\mu_2} = \mathrm{D}_{\lambda\mu},$$

$$\mu_1\frac{\partial}{\partial\lambda_1} = \mu_2\frac{\partial}{\partial\lambda_2} = \mathrm{D}_{\mu\lambda},\ \mu_1\frac{\partial}{\partial\mu_1} + \mu_2\frac{\partial}{\partial\mu_2} = \mathrm{D}_{\mu\mu},$$

be linear operators. Then if j, J be the original and transformed forms of an invariant

$$\mathrm{J} = (\lambda\mu)^w j,$$

w being the weight of the invariant.

Operation upon J results as follows:—

$$\mathrm{D}_{\lambda\lambda}\mathrm{J} = w\mathrm{J};\ \mathrm{D}_{\lambda\mu}\mathrm{J} = 0;$$

$$\mathrm{D}_{\mu\lambda}\mathrm{J} = 0; \mathrm{D}_{\mu\mu}\mathrm{J} = w\mathrm{J}.$$

The first and fourth of these indicate that $(\lambda\mu)^w$ is a homogeneous function of λ_1, λ_2, and of μ_1, μ_2 separately, and the second and third arise from the fact that $(\lambda\mu)$ is caused to vanish by both $\mathrm{D}_{\lambda\mu}$ and $\mathrm{D}_{\mu\lambda}$.

Since $\mathrm{J} = \mathrm{F}(\overline{\mathrm{A}}_0, \overline{\mathrm{A}}_1, \ldots \overline{\mathrm{A}}_k, \ldots)$, where $\overline{\mathrm{A}}_k = a_\lambda^{n-k} a_\mu^k$,

we find that the results are equivalent to

$$\sum_k (\mathrm{D}_{\lambda\lambda}\bar{\mathrm{A}}_k)\frac{\partial \mathrm{J}}{\partial\bar{\mathrm{A}}_k} = w\mathrm{J};\ \sum_k (\mathrm{D}_{\lambda\mu}\bar{\mathrm{A}}_k)\frac{\partial \mathrm{J}}{\partial\bar{\mathrm{A}}_k} = 0;$$

$$\sum_k (\mathrm{D}_{\mu\lambda}\bar{\mathrm{A}}_k)\frac{\partial \mathrm{J}}{\partial\bar{\mathrm{A}}_k} = 0;\ \sum_k (\mathrm{D}_{\mu\mu}\bar{\mathrm{A}}_k)\frac{\partial \mathrm{J}}{\partial\bar{\mathrm{A}}_k} = w\mathrm{J}.$$

According to the well-known law for the changes of independent variables. Now

$$\mathrm{D}_{\lambda\lambda}\bar{\mathrm{A}}_k = (n-k)\bar{\mathrm{A}}_k; \mathrm{D}_{\lambda\mu}\bar{\mathrm{A}}_k = k\bar{\mathrm{A}}_{k-1};$$

$$\mathrm{D}_{\mu\lambda}\bar{\mathrm{A}}_k = (n-k)\bar{\mathrm{A}}_{k+1}; \mathrm{D}_{\mu\mu}\bar{\mathrm{A}}_k = k\bar{\mathrm{A}}_k;$$

so we obtain

$$\sum_k (n-k)\bar{\mathrm{A}}_k\frac{\partial \mathrm{J}}{\partial\bar{\mathrm{A}}_k} = w\mathrm{J};\ \sum_k k\bar{\mathrm{A}}_{k-1}\frac{\partial \mathrm{J}}{\partial\bar{\mathrm{A}}_k} = 0;$$

$$\sum_k (n-k)\bar{\mathrm{A}}_{k+1}\frac{\partial \mathrm{J}}{\partial\bar{\mathrm{A}}_k} = 0;\ \sum_k k\bar{\mathrm{A}}_k\frac{\partial \mathrm{J}}{\partial\bar{\mathrm{A}}_k} = w\mathrm{J};$$

equations which are valid when $\lambda_1, \lambda_2, \mu_1, \mu_2$ have arbitrary values, and therefore when the values are such that $\mathrm{J} = j$, $\bar{\mathrm{A}}_k = \bar{a}_k$.

Hence

$$n\bar{a}_0\frac{\partial j}{\partial\bar{a}_0} + (n-1)\bar{a}_1\frac{\partial j}{\partial\bar{a}_1} + (n-2)\bar{a}_2\frac{\partial j}{\partial\bar{a}_2} + \ldots = wj,$$

$$\bar{a}_0\frac{\partial j}{\partial\bar{a}_1} + 2\bar{a}_1\frac{\partial j}{\partial\bar{a}_2} + 3\bar{a}_2\frac{\partial j}{\partial\bar{a}_3} + \ldots = 0,$$

$$n\bar{a}_1\frac{\partial j}{\partial\bar{a}_0} + (n-1)\bar{a}_2\frac{\partial j}{\partial\bar{a}_1} + (n-2)\bar{a}_3\frac{\partial j}{\partial\bar{a}_2} + \ldots = 0,$$

$$\bar{a}_1\frac{\partial j}{\partial\bar{a}_1} + 2\bar{a}_2\frac{\partial j}{\partial\bar{a}_2} + 3\bar{a}_3\frac{\partial j}{\partial\bar{a}_3} + \ldots = wj,$$

the complete system of equations satisfied by an invariant. The fourth shows that every term of the invariant is of the same weight. Moreover, if we add the first to the fourth we obtain

$$\sum \bar{a}_k\frac{\partial j}{\partial\bar{a}_k} = \frac{2w}{n}j = \theta j,$$

where θ is the degree of the invariant; this shows, as we have before observed, that for an invariant

$$w = \frac{1}{2}n\theta.$$

The second and third are those upon the solution of which the theory of the invariant may be said to depend. An instantaneous deduction from the relation $w = \frac{1}{2}n\theta$ is that forms of uneven orders possess only invariants of even degree in the coefficients. The two operators

$$\Omega = \bar{a}_0\frac{\partial}{\partial\bar{a}_1} + 2\bar{a}_1\frac{\partial}{\partial\bar{a}_2} + \ldots + n\bar{a}_{n-1}\frac{\partial}{\partial\bar{a}_n}$$

$$\mathrm{O} = n\bar{a}_1\frac{\partial}{\partial\bar{a}_0} + (n-1)\bar{a}_2\frac{\partial}{\partial\bar{a}_1} + \ldots + \bar{a}_n\frac{\partial}{\partial\bar{a}_{n-1}}$$

have been much studied by Sylvester, Hammond, Hilbert and Elliott (Elliott, *Algebra of Quantics*, ch. vi.). An important reference is "The Differential Equations satisfied by Concomitants of Quantics," by A. R. Forsyth, *Proc. Lond. Math. Soc.* vol. xix.

The Evectant Process.—If we have a symbolic product, which contains the symbol a only in determinant factors such as (ab), we may write $x_2, -x_1$ for a_1, a_2, and thus obtain a product in which (ab) is replaced by b_x, (ac) by c_x and so on. In particular, when the product denotes an invariant we may transform each of the symbols $a, b, \ldots$ to x in succession, and take the sum of the resultant products; we thus obtain a covariant which is called the first evectant of the original invariant. The second evectant is obtained by similarly operating upon all the symbols remaining which only occur in determinant factors, and so on for the higher evectants.

Ex. gr. From $(ac)^2(bd)^2(ad)(bc)$ we obtain

$$(bd)^2(bc)c_x^2d_x + (ac)^2(ad)c_xd_x^2$$

$$-(bd)^2(ad)a_x^2b_x - (ac)^2(bc)a_xb_x^2$$

$$= 4(bd)^2(bc)c_x^2d_x \text{ the first evectant};$$

and thence $4c_x^3d_x^3$ the second evectant; in fact the two evectants are to numerical factors *près*, the cubic covariant Q, and the square of the original cubic.

If θ be the degree of an invariant j

$$\theta j = \bar{a}_0\frac{\partial j}{\partial\bar{a}_0} + \bar{a}_1\frac{\partial j}{\partial\bar{a}_1} + \ldots + \bar{a}_n\frac{\partial j}{\partial\bar{a}_n}$$

$$= a_1^n\frac{\partial j}{\partial\bar{a}_0} + a_1^{n-1}a_2\frac{\partial j}{\partial\bar{a}_1} + \ldots + a_2^n\frac{\partial j}{\partial\bar{a}_n}$$

and, herein transforming from a to x, we obtain the first evectant

$$p_x^n = \sum_k (-)^k x_1^k x_2^{n-k}\frac{\partial j}{\partial a_k}.$$

Combinants.—An important class of invariants, of several binary forms of the same order, was discovered by Sylvester. The invariants in question are invariants *quâ* linear transformation of the forms themselves as well as *quâ* linear transformation of the variables. If the forms be a_x^p, b_x^p, c_x^p,… The Aronhold process, given by the operation δ as between any two of the forms, causes such an invariant to vanish. Thus it has annihilators of the forms

$$\bar{a}_0\frac{d}{d\bar{b}_0} + \bar{a}_1\frac{d}{d\bar{b}_1} + \bar{a}_2\frac{d}{d\bar{b}_2} + \ldots$$

$$\bar{b}_0\frac{d}{d\bar{a}_0} + \bar{b}_1\frac{d}{d\bar{a}_1} + \bar{b}_2\frac{d}{d\bar{a}_2} + \ldots$$

and Gordan, in fact, takes the satisfaction of these conditions as defining those invariants which Sylvester termed "combinants." The existence of such forms seems to have been brought to Sylvester's notice by observation of the fact that the resultant of a_x^p and b_x^p must be a factor of the resultant of $\lambda a_x^p + \mu b_x^p$ and $\lambda' a_x^p + \mu' b_x^p$ for a common factor of the first pair must be also a common factor of the second pair; so that the condition for the existence of such common factor must be the same in the two cases. A leading proposition states that, if an invariant of λa_x^p and μb_x^p be considered as a form in the variables λ and μ, and an invariant of the latter be taken, the result will be a combinant of a_x^p and b_x^p. The idea can be generalized so as to have regard to ternary and higher forms each of the same order and of the same number of variables.

For further information see Gordan, *Vorlesungen über Invariantentheorie*, Bd. ii. § 6 (Leipzig, 1887); E. B. Elliott, *Algebra of Quantics*, Art. 264 (Oxford, 1895).

Associated Forms.—A system of forms, such that every form appertaining to the binary form is expressible as a rational and integral function of the members of the system, is difficult to obtain. If, however, we specify that all forms are to be rational, but not necessarily integral functions, a new system of forms arises which is easily obtainable. A binary form of order n contains n independent constants, three of which by linear transformation can be given determinate values; the remaining $n-3$ coefficients, together with the determinant of transformation, give us $n-2$ parameters, and in consequence one relation must exist between any $n-1$ invariants of the form, and fixing upon $n-2$ invariants every other invariant is a rational function of its members. Similarly regarding x_1, x_2 as additional parameters, we see that every covariant is expressible as a rational function of n fixed covariants. We can so determine these n covariants that every other covariant is expressed in terms of them by a fraction whose denominator is a power of the binary form.

First observe that with $f_x = a_x^n = b_x^n = \dots f_1 = a_1 a_x^{n-1}$, $f_2 = a_2 a_x^{n-1}$, $f_x = f_1x_1 + f_2x_2$, we find

$$(ab) = \frac{(af)b_x - (bf)a_x}{f_x};$$

and that thence every symbolic product is equal to a rational function of covariants in the form of a fraction whose denominator is a power of f_x. Making the substitution in any symbolic product the only determinant factors that present themselves in the numerator are of the form (af), (bf), (cf),...and every symbol a finally appears in the form.

$$\psi_k = (af)^k a_x^{n-k}.$$

ψ_k has f as a factor, and may be written $f.\,u_k$; for observing that $\psi_0 = f. = f.\,u_0$; $\psi_1 = 0 = f.\,u_1$; where $u_0 = 1$, $u_1 = 0$,

assume that $\psi_k = (af)^k a_x^{n-k} = f.\,u_k = a_x^n . u_x^{k(n-2)}$.

Taking the first polar with regard to y

$$(n-k)(af)_x^k a_x^{n-k-1} a_y + k(af)^{k-1} a_x^{n-k}(ab)(n-1) b_x^{n-2} b_y$$

$$= k(n-2)a^n u_x^{kn-2k-1} u_y + n a_x^{n-1} a_y u_x^{k(n-2)},$$

and, writing f_2 and $-f_1$ for y_1 and y_2,

$$(n-k)(af)^{k+1} a_x^{n-k-1} + k(n-1)(ab)(af)^{k-1}(bf) a_x^{n-k} b_x^{n-2}$$

$$= k(n-2) f.\,(uf) u_x^{kn-2k-1}.$$

Moreover the second term on the left contains

$$(af)^{k-2} b_x^{k-2} = \frac{1}{2}\left\{(af)^{k-2} b_x^{k-2} - (bf)^{k-2} a_x^{k-2}\right\}.$$

if k be uneven, and

$$(af)^{k-1} b_x^{k-1} = \frac{1}{2}\left\{(af)^{k-1} b_x^{k-1} - (bf)^{k-1} a_x^{k-1}\right\},$$

if k be even; in either case the factor

$$(af)b_x - (bf)a_x = (ab)f,$$

and therefore

$$(n-k)\psi_{k+1} + \mathrm{M}.f = k(n-2) f.(uf) u_x^{kn-2k-1};$$

and ψ_{k+1} is seen to be of the form $f.\,u_{k+1}$.

We may write therefore

$$u_k = \frac{(af)^k a_x^{n-k}}{f}$$

These forms, n in number, are called "associated forms" of f ("Schwesterformen," "formes associées").

Every covariant is rationally expressible by means of the forms f, u_2, u_3,... u_n since, as we have seen $u_0 = 1$, $u_1 = 0$. It is easy to find the relations

$$u_2 = \frac{1}{2}(f, f')^2,$$

$$u_3 = ((f, f')^2, f'')$$

$$u_4 = \frac{1}{2}(f, f')^4 . f^2 - \frac{3}{4}\{(f, f')^2\}^2,$$

and so on.

To exhibit any covariant as a function of u_0, u_1, u_2,... take $a_y^n = (a_1y_1 + a_2y_2)^n$ and transform it by the substitution

$$f_1y_1 + f_2y_2 = \xi \text{ where } f_1 = a_1 a_x^{n-1}, f_2 = a_2 a_x^{n-1},$$

$$x_2y_1 - x_1y_2 = \eta \qquad f = f_1x_1 + f_2x_2;$$

thence

$$f.\,y_1 = x_1\xi + f_2\eta;\ f.\,y_2 = x_2\xi - f_1\eta,$$
$$f.a_y = a_x\xi + (af)\eta,$$

and

$$f^{n-1}.a_y^n = u_0\xi^n + \binom{n}{2}u_2\xi^{n-2}\eta^2 + \binom{n}{3}u_3\xi^{n-3}\eta^3 + \dots + u_n\eta^n.$$

Now a covariant of $a_x^n = f$ is obtained from the similar covariant of a_y^n by writing therein x_1, x_2, for y_1, y_2, and, since y_1, y_2 have been linearly transformed to ξ and η, it is merely necessary to form the covariants in respect of the form $(u_1\xi + u_2\eta)^n$, and then division, by the proper power of f, gives the covariant in question as a function of f, $u_0 = 1$, u_2, u_3,...u_n.

Summary of Results.—We will now give a short account of the results to which the foregoing processes lead. Of any form a_x^n there exists a finite number of invariants and covariants, in terms of which all other covariants are rational and integral functions (cf. Gordan, Bd. ii. § 21). This finite number of forms is said to constitute the complete system. Of two or more binary forms there are also complete systems containing a finite number of forms. There are also algebraic systems, as above mentioned, involving fewer covariants which are such that all other covariants are rationally expressible in terms of them; but these smaller systems do not possess the same mathematical interest as those first mentioned.

The Binary Quadratic.—The complete system consists of the form itself, a_x^2, and the discriminant, which is the second transvectant of the form upon itself, viz.: $(f, f')^2 = (ab)^2$; or, in real coefficients, $2(a_0a_2 - a_1^2)$. The first transvectant, $(f f')^1 = (ab)\, a_x b_x$, vanishes identically. Calling the discriminate D, the solution of the quadratic $a_x^2 = 0$ is given by the formula

$$a_x^2 = \frac{1}{\bar{a}_0}\left(\bar{a}_0 x_1 + \bar{a}_1 x_2 - x_2\sqrt{-\frac{\mathrm{D}}{2}}\right)\left(\bar{a}_0 x_1 + \bar{a}_1 x_2 + x_2\sqrt{-\frac{\mathrm{D}}{2}}\right).$$

If the form a_x^2 be written as the product of its linear factors $p_x c_x$, the discriminant takes the form $-\frac{1}{2}(pq)^2$. The vanishing of this invariant is the condition for equal roots. The simultaneous system of two quadratic forms a_x^2, α_x^2, say f and ϕ, consists of six forms, viz. the two quadratic forms f, ϕ; the two discriminants $(f, f')^2$, $(\phi, \phi')^2$, and the first and second transvectants of f upon ϕ, $(f, \phi)^1$ and $(f, \phi)^2$, which may be written $(a\alpha)a_x\alpha_x$ and $(a\alpha)^2$. These fundamental or ground forms are connected by the relation

$$-2\{(f,\phi)^1\}^2 = f^2(\phi,\phi')^2 - 2f\phi(f,\phi)^2 + \phi^2(f,f')^2.$$

If the covariant $(f,\phi)^1$ vanishes f and ϕ are clearly proportional, and if the second transvectant of $(f, \phi)^1$ upon itself vanishes, f and ϕ possess a common linear factor; and the condition is both necessary and sufficient. In this case $(f, \phi)^1$ is a perfect square, since its discriminant vanishes. If $(f,\phi)^1$ be not a perfect square, and r_x, s_x be its linear factors, it is possible to express f and ϕ in the canonical forms $\lambda_1(r_x)^2 + \lambda_2(s_x)^2$, $\mu_1(r_x)^2 + \mu_2(s_x)^2$ respectively. In fact, if f and ϕ have these forms, it is easy to verify that $(f, \phi)^1 = (\lambda\mu)(rs)r_xs_x$. The fundamental system connected with n quadratic forms consists of (i.) the n forms themselves f_1, f_2,...f_n, (ii.) the $\binom{n}{2}$ functional determinants $(f_i f_k)^1$, (iii.) the $\binom{n+1}{2}$ invariants $(f_i, f_k)^2$, (iv.) the $\binom{n}{3}$ forms $(f_i, (f_k, f_m))^2$, each such form remaining unaltered for any permutations of i, k, m. Between these forms various relations exist (cf. Gordan, § 134).

The Binary Cubic.—The complete system consists of

$$f = a_x^3,\ (f,f')^2 = (ab)^2 a_x b_x = \Delta_x^2,\ (f, \Delta) = (ab)^2(ca)b_x c_x^2 = \mathrm{Q}_x^3,$$

and

$$(\Delta,\Delta')^2 = (ab)^2(cd)^2(ad)(bc) = \mathrm{R}.$$

To prove that this system is complete we have to consider

$$(f,\Delta)^2,\ (\Delta,\Delta')^1,\ (f,\mathrm{Q})^1,\ (f,\mathrm{Q})^2,\ (f,\mathrm{Q})^3,\ (\Delta,\mathrm{Q})^1,\ (\Delta,\mathrm{Q})^2,$$

and each of these can be shown either to be zero or to be a rational integral function of f, Δ Q and R. These forms are connected by the relation

$$2\mathrm{Q}^2 + \Delta^3 + \mathrm{R}f^2 = 0.$$

The discriminant of f is equal to the discriminant of Δ, and is therefore $(\Delta, \Delta')^2 = \mathrm{R}$; if it vanishes both f and Δ have two roots equal. Δ is a rational factor of f and Q is a perfect cube; the cube root being equal, to a numerical factor *près*, to the square root of Δ. The Hessian $\Delta = \Delta_x^2$ is such that $(f, \Delta)^2 = 0$, and if f is expressible in the form $\lambda(p_x)^3 + \mu(q_x)^3$, that is as the sum of two perfect cubes, we find that Δ_x^2 must be equal to $p_x q_x$ for then

$$\{\lambda(p_x)^3 + \mu(q_x)^3,\ p_xq_x\}^2 = 0.$$

Hence, if p_x, q_x be the linear factors of the Hessian Δ_x^2, the cubic can be put into the form $\lambda(p_x)^3 + \mu(q_x)^3$ and immediately solved. This method of solution fails when the discriminant R vanishes, for then the Hessian has equal roots, as also the cubic f. The Hessian in that case is a factor of f, and Q is the third power of the linear factor which occurs to the second power in f. If, moreover, Δ vanishes identically f is a perfect cube.

The Binary Quartic.—The fundamental system consists of five forms $a_x^4=f$; $(f,f')^2=(ab)^2a_x^2b_x^2=\Delta_x^4$; $(f,f')^4=(ab)^4=i$; $(f,\Delta)^1=(a\Delta)a_x^3\Delta_x^3=(ab)^2(cb)a_x^2b_xc_x^3=t$; $(f,\Delta)^4=(a\Delta)^4=(ab)^2(bc)^2(ca)^2=j$, viz. two invariants, two quartics and a sextic. They are connected by the relation

$$2t^2=\frac{1}{2}if^2\Delta-\Delta^3-\frac{1}{3}jf^3.$$

The discriminant, whose vanishing is the condition that f may possess two equal roots, has the expression $j^2-\frac{1}{6}i^3$; it is nine times the discriminant of the cubic resolvent $k^3-\frac{1}{2}ik-\frac{1}{3}j$, and has also the expression $4(t,t')^6$. The quartic has four equal roots, that is to say, is a perfect fourth power, when the Hessian vanishes identically; and conversely. This can be verified by equating to zero the five coefficients of the Hessian $(ab)^2a_x^2b_x^2$. Gordan has also shown that the vanishing of the Hessian of the binary n^{ic} is the necessary and sufficient condition to ensure the form being a perfect n^{th} power. The vanishing of the invariants i and j is the necessary and sufficient condition to ensure the quartic having three equal roots. On the one hand, assuming the quartic to have the form $4x_1^3x_2$, we find $i=j=0$, and on the other hand, assuming $i=j=0$, we find that the quartic must have the form $a_0x_1^4+4a_1x_1^3x_2$ which proves the proposition. The quartic will have two pairs of equal roots, that is, will be a perfect square, if it and its Hessian merely differ by a numerical factor. For it is easy to establish the formula $(yx)^2\Delta_x^4=2f.f_y^2-2(f_y^1)^2$ connecting the Hessian with the quartic and its first and second polars; now α, a root of f, is also a root of Δ_x^4, and consequently the first polar $f_y^1=y_1\frac{\partial f}{\partial x_1}+y_2\frac{\partial f}{\partial x_2}$ must also vanish for the root α, and thence $\frac{\partial f}{\partial x_1}$ and $\frac{\partial f}{\partial x_2}$ must also vanish for the same root; which proves that α is a double root of f, and f therefore a perfect square. When $f=6x_1^2x_2^2$ it will be found that $\Delta=-f$. The simplest form to which the quartic is in general reducible is $f=x_1^4+6mx_1^2x_2^2+x_2^4$, involving one parameter m; then $\Delta_x^4=2m(x_1^4+x_2^4)+2(1-3m^2)x_1^2x_2^2$; $i=2(1+3m^2)$; $j=6m(1-m)^2$; $t=(1-9m^2)(x_1^2-x_2^2)(x_1^2+x_2^2)x_1x_2$. The sextic covariant t is seen to be factorizable into three quadratic factors $\phi=x_1x_2$, $\psi=x_1^2+x_2^2$, $\psi=x_1^2-x_2^2$, which are such that the three mutual second transvectants vanish identically; they are for this reason termed conjugate quadratic factors. It is on a consideration of these factors of t that Cayley bases his solution of the quartic equation. For, since $-2t^2=\Delta^3-\frac{1}{2}if^2\Delta-\frac{1}{3}j(-f)^3$, he compares the right-hand side with cubic resolvent $k^3-\frac{1}{2}i\lambda^2k-\frac{1}{3}j\lambda^3$, of $f=0$, and notices that they become identical on substituting Δ for k, and $-f$ for λ; hence, if k_1, k_2, k_3 be the roots of the resolvent

$$-2t^2=(\Delta+k_1f)(\Delta+k_2f)(\Delta+k_3f);$$

and now, if all the roots of f be different, so also are those of the resolvent, since the latter, and f, have practically the same discriminant; consequently each of the three factors, of $-2t^2$, must be perfect squares and taking the square root

$$t=\frac{1}{\sqrt{-2}}\phi.\chi.\psi;$$

and it can be shown that ϕ, χ, ψ are the three conjugate quadratic factors of t above mentioned. We have $\Delta+k_1f=\phi^2$, $\Delta+k_2f=\chi^2$, $\Delta+k_3f=\psi^2$, and Cayley shows that a root of the quartic can be expressed in the determinant form

$$\begin{vmatrix} 1, & k_1, & \phi_y^{\frac{1}{2}} \\ 1, & k_2, & \chi_y^{\frac{1}{2}} \\ 1, & k_3, & \psi_y^{\frac{1}{2}} \end{vmatrix}$$

the remaining roots being obtained by varying
the signs which occur in the radicals $\phi_y^{\frac{1}{2}}$, $\chi_y^{\frac{1}{2}}$, $\psi_y^{\frac{1}{2}}$.
The transformation to the normal form reduces
the quartic to a quadratic. The new variables
$y_1=0$ are the linear factors of ϕ. If $\phi=r_x.s_x$, the
$y_2=1$ normal form of a_x^4, can be shown to be given by

$$(rs)^4a_x^4=(ar)^4s_x^4+6(ar)^2(as)^2r_x^2s_x^2+(as)^4r_x^4;$$

ϕ is any one of the conjugate quadratic factors of t, so that, in determining r_x, s_x from $\sqrt{\Delta+k_1f}=0$, k_1 is any root of the resolvent. The transformation to the normal form, by the solution of a cubic and a quadratic, therefore, supplies a solution of the quartic. If $(\lambda\mu)$ is the modulus of the transformation by which a_x^4 is reduced to the normal form, i becomes $(\lambda\mu)^4i$, and j, $(\lambda\mu)^6j$; hence $\frac{i^3}{j^2}$ is absolutely unaltered by transformation, and is termed the absolute invariant. Since therefore $\frac{i^3}{j^2}=\frac{2}{9}\frac{(1+3m^2)^3}{m^2(1-m^2)^2}$ we have a cubic equation for determining m^2 as a function of the absolute invariant.

Remark.—Hermite has shown (*Crelle*, Bd. lii.) that the substitution, $z=\frac{i}{j}\,\frac{\Delta}{f}$, reduces $\frac{x_2\partial x_1-x_1\partial x_2}{\sqrt{f}}$ to the form

$$\frac{1}{2i}\sqrt{-\frac{j}{2}}\,\frac{\partial z}{\sqrt{\frac{1}{3}-\frac{1}{2}z^2+\frac{j^2}{i^3}z^3}}.$$

The Binary Quintic.—The complete system consists of 23 forms, of which the simplest are $f=a_x^5$; the Hessian $\mathrm{H}=(f,f')^2=(ab)^2a_x^3b_x^3$; the quadratic covariant $i=(f,f')^4=(ab)^4a_xb_x$; and the nonic covariant $\mathrm{T}=(f,(f',f'')^2)^1=(f,\mathrm{H})^1=(a\mathrm{H})a_x^4\mathrm{H}_x^5=(ab)^2(ca)a_x^3b_x^3c_x^4$; the remaining 19 are expressible as transvectants of compounds of these four.

There are four invariants $(i,i')^2$; $(i^3,\mathrm{H})^6$; $(f^3,i^5)^{10}$; $(f^2,i^7)^{14}$
four linear forms $(f,i^2)^4$; $(f,i^3)^5$; $(i^4,\mathrm{T})^8$; $(i^5,\mathrm{T})^9$
three quadratic forms i; $(\mathrm{H},i^2)^4$; $(\mathrm{H},i^3)^6$
three cubic forms $(f,i)^2$; $(f,i^2)^3$; $(i^3,\mathrm{T})^6$
two quartic forms $(\mathrm{H},i)^2$; $(\mathrm{H},i^2)^3$.
three quintic forms f; $(f,i)^1$; $(i^3,\mathrm{T})^4$
two sextic forms H; $(\mathrm{H},i)^1$
one septic form $(i,\mathrm{T})^2$
one nonic form T.

We will write the cubic covariant $(f,i)^2=j$, and then remark that the result, $(f,j)^3=0$, can be readily established. The form j is completely defined by the relation $(f,j)^3=0$ as no other covariant possesses this property.

Certain convariants of the quintic involve the same determinant factors as appeared in the system of the quartic; these are f, H, i, T and j, and are of special importance. Further, it is convenient to have before us two other quadratic covariants, viz. $\tau=(j,j)^2j_xj_x$; $\theta=(i\tau)i_x\tau_x$; four other linear covariants, viz. $\alpha=-(ji)^2j_x$; $\beta=(i\alpha)i_x$; $\gamma=(\tau\alpha)\tau_x$; $\delta=(\tau\beta)\tau_x$. Further, in the case of invariants, we write $\mathrm{A}=(i,i')^2$ and take three new forms $\mathrm{B}=(i,\tau)^2$; $\mathrm{C}=(\tau,\tau')^2$; $\mathrm{R}=(\beta\gamma)$. Hermite expresses the quintic in a *forme-type* in which the constants are invariants and the variables linear covariants. If α, β be the linear forms, above defined, he raises the identity $a_x(\alpha\beta)=\alpha_x(a\beta)-\beta_x(a\alpha)$ to the fifth power (and in general to the power n) obtaining

$$(\alpha\beta)^5f=(a\beta)^5\alpha_x^5-5(a\beta)^4(a\alpha)\alpha_x^4\beta_x+\ldots-(a\alpha)^5\beta_x^5;$$

and then expresses the coefficients, on the right, in terms of the fundamental invariants. On this principle the covariant j is expressible in the form

$$\mathrm{R}^2j=\delta^3+\frac{3}{2}\mathrm{B}\delta^2\alpha+\frac{3}{4}\mathrm{AC}\delta\alpha^2+\frac{3}{8}\mathrm{C}(3\mathrm{AB}-4\mathrm{C})\alpha^3$$

when δ, α are the above defined linear forms.

Hence, solving the cubic,

$$\mathrm{R}^2j=(\delta-m_1\alpha)(\delta-m_2\alpha)(\delta-m_3\alpha)$$

wherein m_1 m_2, m_3 are invariants.

Sylvester showed that the quintic might, in general, be expressed as the sum of three fifth powers, viz. in the canonical form $f=k_1(p_x)^5+k_2(q_x)^5+k_3(r_x)^5$. Now, evidently, the third transvectant of f, expressed in this form, with the cubic $p_xq_xr_x$ is zero, and hence from a property of the covariant j we must have $j=p_xq_xr_x$; showing that the linear forms involved are the linear factors of j. We may therefore write

$$f=k_1(\delta-m_1\alpha)^5+k_2(\delta-m_2\alpha)^5+k_3(\delta-m_3\alpha)^5;$$

and we have merely to determine the constants k_1, k_2, k_3. To determine them notice that $\mathrm{R}=(\alpha\delta)$ and then

$$\begin{aligned}(f,\alpha^5)^5&=-\mathrm{R}^5(k_1+k_2+k_3),\\(f,\alpha^4\delta)^5&=-5\mathrm{R}^5(m_1k_1+m_2k_2+m_3k_3),\\(f,\alpha^3\delta^2)^5&=-10\mathrm{R}^5(m_1^2k_1+m_2^2k_2+m_3k_3),\end{aligned}$$

three equations for determining k_1, k_2, k_3. This canonical form depends upon j having three unequal linear factors. When C vanishes j has the form $j=p_x^2q_x$, and $(f,j)^3=(ap)^2(aq)a_x^2=0$. Hence, from the identity $a_x(pq)=p_x(aq)-q_x(ap)$, we obtain $(pq)^5f=(aq)^5p_x^5-5(ap)(aq)^4p_x^4q_x-(ap)^5q_x^5$, the required canonical form. Now, when $\mathrm{C}=0$, clearly (see *ante*) $\mathrm{R}^2j=\delta^2\rho$ where $\rho=\delta+\frac{3}{2}\mathrm{B}\alpha$; and Gordan then proves the relation

$$6\mathrm{R}^4.f=\mathrm{B}\delta^5+5\mathrm{B}\delta^4\rho-4\mathrm{A}^2\rho^5,$$

which is Bring's form of quintic at which we can always arrive, by linear transformation, whenever the invariant C vanishes.

Remark.—The invariant C is a numerical multiple of the resultant of the covariants i and j, and if $\mathrm{C}=0$, ρ is the common factor of i and j.

The discriminant is the resultant of $\frac{\partial f}{\partial x_1}$ and $\frac{\partial f}{\partial x_2}$ and of degree 8 in the coefficients; since it is a rational and integral function of the fundamental invariants it is expressible as a linear function of A^2 and B; it is independent of C, and is therefore unaltered when C vanishes; we may therefore take f in the canonical form

$$6\mathrm{R}^4f=\mathrm{B}\delta^5+5\mathrm{B}\delta^4\rho-4\mathrm{A}^2\rho^5.$$

The two equations

$$\frac{\partial f}{\partial \delta} = 5B\delta^4 + 4B\delta^3\rho) = 0,$$
$$\frac{\partial f}{\partial \rho} = 5(B\delta^4 - 4A^3\rho^4) = 0,$$

yield by elimination of δ and ρ the discriminant

$$D = 64B - A^2.$$

The general equation of degree 5 cannot be solved algebraically, but the roots can be expressed by means of elliptic modular functions. For an algebraic solution the invariants must fulfil certain conditions. When $R = 0$, and neither of the expressions $AC - B^2$, $2AB - 3C$ vanishes, the covariant α_x is a linear factor of f; but, when $R = AC - B^2 = 2AB - 3C = 0$, α_x also vanishes, and then f is the product of the form j_x^3 and of the Hessian of j_x^3. When α_x and the invariants B and C all vanish, either A or j must vanish; in the former case j is a perfect cube, its Hessian vanishing, and further f contains j as a factor; in the latter case, if ρ_x, σ_x be the linear factors of i, f can be expressed as $(\rho\sigma)^5 f = c_1\rho_x^5 + c_2\sigma_x^5$; if both A and j vanish i also vanishes identically, and so also does f. If, however, the condition be the vanishing of i, f contains a linear factor to the fourth power.

The Binary Sextic.—The complete system consists of 26 forms, of which the simplest are $f = a_x^6$; the Hessian $H = (ab)^2 a_x^4 b_x^4$; the quartic $i = (ab)^4 a_x^2 b_x^2$; the covariants $l = (ai)^4 a_x^2$; $T = (ab)^2(cb) a_x^4 b_x^3 c_x^6$; and the invariants $A = (ab)^6$; $B = (ii')^4$. There are

5 invariants: $(a, b)^6$, $(i, i')^4$, $(l, l')^2$, $(f, l^3)^6$, $((f, i), l^4)^8$;
6 of order 2: l, $(i, l)^2$, $(f, l^2)^4$, $(i, l^2)^3$, $(f, l^3)^5$, $((f, i), l^3)^6$;
5 of order 4: i, $(f, l)^2$, (i, l), $(f, l^2)^3$, $((f, i), l^2)^4$;
5 of order 6: f, $p = (ai)^2 a_x^4 i_x^2$, (f, l), $((f, i), l)^2$, (p, l);
3 of order 8: H, (f, i), (H, l);
1 of order 10: (H, i);
1 of order 12: T.

For a further discussion of the binary sextic see Gordan, *loc. cit.*, Clebsch, *loc. cit.* The complete systems of the quintic and sextic were first obtained by Gordan in 1868 (*Journ. f. Math.* lxix. 323-354). August von Gall in 1880 obtained the complete system of the binary octavic (*Math. Ann.* xvii. 31-52, 139-152, 456); and, in 1888, that of the binary septimic, which proved to be much more complicated (*Math. Ann.* xxxi. 318-336). Single binary forms of higher and finite order have not been studied with complete success, but the system of the binary form of infinite order has been completely determined by Sylvester, Cayley, MacMahon and Stroh, each of whom contributed to the theory.

As regards simultaneous binary forms, the system of two quadratics, and of any number of quadratics, is alluded to above and has long been known. The system of the quadratic and cubic, consisting of 15 forms, and that of two cubics, consisting of 26 forms, were obtained by Salmon and Clebsch; that of the cubic and quartic we owe to Sigmund Gundelfinger (*Programm Stuttgart*, 1869, 1-43); that of the quadratic and quintic to Winter (*Programm Darmstadt*, 1880); that of the quadratic and sextic to von Gall (*Programm Lemgo*, 1873); that of two quartics to Gordan (*Math. Ann.* ii. 227-281, 1870); and to Eugenio Bertini (*Batt. Giorn.* xiv. 1-14, 1876; also *Math. Ann.* xi. 30-41, 1877). The system of four forms, of which two are linear and two quadratic, has been investigated by Perrin (*S. M. F. Bull.* xv. 45-61, 1887).

Ternary and Higher Forms.—The ternary form of order n is represented symbolically by

$$(a_1x_1 + a_2x_2 + a_3x_3)^n = a_x^n;$$

and, as usual, b, c, d,... are alternative symbols, so that

$$a_x^n = b_x^n = c_x^n = d_x^n = \dots .$$

To form an invariant or covariant we have merely to form a product of factors of two kinds, viz. determinant factors (abc), (abd), (bce), etc...., and other factors a_x, b_x, c_x,... in such manner, that each of the symbols a, b, c,... occurs n times. Such a symbolic product, if its does not vanish identically, denotes an invariant or a covariant, according as factors a_x, b_x, c_x,... do not or do appear. To obtain the real form we multiply out, and, in the result, substitute for the products of symbols the real coefficients which they denote.

For example, take the ternary quadratic

$$(a_1x_1 + a_2x_2 + a_3x_3)^2 = a_x^2,$$

or in real form $ax_1^2 + bx_2^2 + cx_3^2 + 2fx_2x_3 + 2gx_3x_1 + 2hx_1x_2$. We can see that $(abc)a_xb_xc_x$ is not a covariant, because it vanishes identically, the interchange of a and b changing its sign instead of leaving it unchanged; but $(abc)^2$ is an invariant. If a_x^2, b_x^2, c_x^2 be different forms we obtain, after development of the squared determinant and conversion to the real form (employing single and double dashes to distinguish the real coefficients of b_x^2 and c_x^2),

$$\begin{aligned} &a(b'c'' + b''c' - 2f'f'') + b(c'a'' + c''a' - 2g'g'') \\ &+ c(a'b'' + a''b' - 2h'h'') + 2f(g'h'' + g''h' - a'f'' - a''f') \\ &+ 2g(h'f'' + h''f' - b'g'' - b''g') + 2h(f'g'' + f''g' - c'h'' - c''h'); \end{aligned}$$

a simultaneous invariant of the three forms, and now suppressing the dashes we obtain

$$6(abc + 2fgh - af^2 - bg^2 - ch^2),$$

the expression in brackets being the well-known invariant of a_x^2, the vanishing of which expresses the condition that the form may break up into two linear factors, or, geometrically, that the conic may represent two right lines. The complete system consists of the form itself and this invariant.

The ternary cubic has been investigated by Cayley, Aronhold, Hermite, Brioschi and Gordan. The principal reference is to Gordan (*Math. Ann.* i. 90-128, 1869, and vi. 436-512, 1873). The complete covariant and contravariant system includes no fewer than 34 forms; from its complexity it is desirable to consider the cubic in a simple canonical form; that chosen by Cayley was $ax^3 + by^3 + cz^3 + 6dxyz$ (*Amer. J. Math.* iv. 1-16, 1881). Another form, associated with the theory of elliptic functions, has been considered by Dingeldey (*Math. Ann.* xxxi. 157-176, 1888), viz. $zy^2 - 4z^3 + g_2x^2y + g_3x^3$, and also the special form $axz^2 - 4by^3$ of the cuspidal cubic. An investigation, by non-symbolic methods, is due to F. C. J. Mertens (*Wien. Ber.* xcv. 942-991, 1887). Hesse showed independently that the general ternary cubic can be reduced, by linear transformation, to the form

$$x^3 + y^3 + z^3 + 6mxyz,$$

a form which involves 9 independent constants, as should be the case; it must, however, be remarked that the counting of constants is not a sure guide to the existence of a conjectured canonical form. Thus the ternary quartic is not, in general, expressible as a sum of five 4th powers as the counting of constants might have led one to expect, a theorem due to Sylvester. Hesse's canonical form shows at once that there cannot be more than two independent invariants; for if there were three we could, by elimination of the modulus of transformation, obtain two functions of the coefficients equal to functions of m, and thus, by elimination of m, obtain a relation between the coefficients, showing them not to be independent, which is contrary to the hypothesis.

The simplest invariant is $S = (abc)(abd)(acd)(bcd)$ of degree 4, which for the canonical form of Hesse is $m(1 - m^3)$; its vanishing indicates that the form is expressible as a sum of three cubes. The Hessian is symbolically $(abc)^2 a_xb_xc_x = H_x^3$, and for the canonical form $(1 + 2m^3)xyz - m^2(x^3 + y^3 + z^3)$. By the process of Aronhold we can form the invariant S for the cubic $a_x^3 + \lambda H_x^3$, and then the coefficient of λ is the second invariant T. Its symbolic expression, to a numerical factor *près*, is

$$(Hbc)(Hbd)(Hcd)(bcd),$$

and it is clearly of degree 6.

One more covariant is requisite to make an *algebraically* complete set. This is of degree 8 in the coefficients, and degree 6 in the variables, and, for the canonical form, has the expression

$$\begin{aligned} &-9m^6(x^3 + y^3 + z^3)^2 - (2m + 5m^4 + 20m^7)(x^3 + y^3 + z^3)xyz \\ &-(15m^2 + 78m^5 - 12m^8)x^2y^2z^2 + (1 + 8m^3)^2(y^3z^3 + z^3x^3 + x^3y^3). \end{aligned}$$

Passing on to the ternary quartic we find that the number of ground forms is apparently very great. Gordan (*Math. Ann.* xvii. 217-233), limiting himself to a particular case of the form, has determined 54 ground forms, and G. Maisano (*Batt. G.* xix. 198-237, 1881) has determined all up to and including the 5th degree in the coefficients.

The system of two ternary quadratics consists of 20 forms; it has been investigated by Gordan (*Clebsch-Lindemann's Vorlesungen* i. 288, also *Math. Ann.* xix. 529-552); Perrin (*S. M. F. Bull.* xviii. 1-80, 1890); Rosanes (*Math. Ann.* vi. 264); and Gerbaldi (*Annali* (2), xvii. 161-196).

Ciamberlini has found a system of 127 forms appertaining to three ternary quadratics (*Batt. G.* xxiv. 141-157).

A. R. Forsyth has discussed the *algebraically* complete sets of ground forms of ternary and quaternary forms (see *Amer. J.* xii. 1-60, 115-160, and *Camb. Phil. Trans.* xiv. 409-466, 1889). He proves, by means of the six linear partial differential equations satisfied by the concomitants, that, if any concomitant be expanded in powers of x_1, x_2, x_3, the point variables—and of u_1, u_2, u_3, the contragredient line variables—it is completely determinate if its leading coefficient be known. For the unipartite ternary quantic of order n he finds that the fundamental system contains $\frac{1}{2}(n+4)(n-1)$ individuals. He successfully considers the systems of two and three simultaneous ternary quadratics. In Part III. of the Memoir he discusses bi-ternary quantics, and in particular those which are lineo-linear, quadrato-linear, cubo-linear, quadrato-quadratic, cubo-cubic, and the system of two lineo-linear quantics. He shows that the system of the bi-ternary $n^{ic}m^{ic}$ comprises

$$\frac{1}{4}(n+1)(n+2)(m+1)(m+2) - 3 \text{ individuals.}$$

Bibliographical references to ternary forms are given by Forsyth (*Amer. J.* xii. p. 16) and by Cayley (*Amer. J.* iv., 1881). Clebsch, in 1872, in papers in *Abh. d. K. Akad. d. U. zu Göttingen*, t. xvii. and *Math. Ann.* t. v., established the important result that in the case of a form in n variables, the concomitants of the form, or of a system of such forms, involve in the aggregate $n-l$ classes of variables. For instance, those of a ternary form involve two classes which may be geometrically interpreted as point and line co-ordinates in a plane; those of a quaternary form involve three classes which may be geometrically interpreted as point, line and plane co-ordinates in space.

IV. Enumerating Generating Functions

Professor Michael Roberts (*Quart. Math. J.* iv.) was the first to remark that the study of covariants may be reduced to the study of their leading coefficients, and that from any relations connecting the latter are immediately derivable the relations connecting the former. It has been shown above that a covariant, in general, satisfies four partial differential equations. Two of these show that the leading coefficient of any covariant is an isobaric and homogeneous function of the coefficients of the form; the remaining two may be regarded as operators which cause the vanishing of the covariant. These may be written, for the binary n^{ic},

$$\Sigma k a_{k-1}\frac{d}{da_k}-x_2\frac{d}{dx_1}=0;$$

$$\Sigma(n-k)a_{k+1}\frac{d}{da_k}-x_1\frac{d}{dx_2}=0;$$

or in the form

$$\Omega-x_2\frac{d}{dx_1}=0,\ \mathrm{O}-x_1\frac{d}{dx_2}=0;$$

where

$$\Omega=a_0\frac{d}{da_1}+2a_1\frac{d}{da_2}+\ldots+na_{n-1}\frac{d}{da_n},$$

$$\mathrm{O}=na_1\frac{d}{da_0}+(n-1)a_2\frac{d}{da_1}+\ldots+a_n\frac{d}{da_{n-1}}.$$

Let a covariant of degree ϵ in the variables, and of degree θ in the coefficients (the weight of the leading coefficient being w and $n\theta-2w=\epsilon$), be

$$\mathrm{C}_0x_1^{\epsilon}+\epsilon c_1x_1^{\epsilon-1}x_2+\ldots.$$

Operating with $\Omega-x_2\frac{d}{dx_1}$ we find $\Omega\mathrm{C}_0=0$; that is to say, C_0 satisfies *one* of the two partial differential equations satisfied by an invariant. It is for this reason called a seminvariant, and every seminvariant is the leading coefficient of a covariant. The whole theory of invariants of a binary form depends upon the solutions of the equation $\Omega=0$. Before discussing these it is best to transform the binary form by substituting $1!a_1, 2!a_2, 3!a_3, \ldots n!a_n$, for $a_1, a_2, a_3 \ldots a_n$ respectively;
it then becomes

$$a_0x_1^n+na_1x_1^{n-1}x_2+n(n-1)a_2x_1^{n-2}x_2^2+\ldots+n!a_nx_2^n,$$

and Ω takes the simpler form

$$a_0\frac{d}{da_1}+a_1\frac{d}{da_2}+a_2\frac{d}{da_3}+\ldots+a_{n-1}\frac{d}{da_n}.$$

One advantage we have obtained is that, if we now write $a_0=0$, and substitute a_{s-1} for a_s, when $s>0$, we obtain

$$a_0\frac{d}{da_1}+a_1\frac{d}{da_2}+a_2\frac{d}{da_3}+\ldots+a_{n-2}\frac{d}{da_{n-1}}$$

which is the form of Ω for a binary $(n-1)^{ic}$.

Hence by merely diminishing each suffix in a seminvariant by unity, we obtain another seminvariant of the same degree, and of weight $w-\theta$, appertaining to the $(n-1)^{ic}$. Also, if we increase each suffix in a seminvariant, we obtain terms, free from a_0, of some seminvariant of degree θ and weight $w+\theta$. *Ex. gr.* from the invariant $a_2^2-2a_1a_3+2a_0a_4$ of the quartic the diminishing process yields $a_1^2-2a_0a_2$, the leading coefficient of the Hessian of the cubic, and the increasing process leads to $a_3^2-2a_2a_4+2a_1a_5$ which only requires the additional term $-2a_0a_6$ to become a seminvariant of the sextic. A more important advantage, springing from the new form of Ω, arises from the fact that if

$$x^n-a_1x^{n-1}+a_2x^{n-2}-\ldots(-)^na_n=(x-\alpha_1)(x-\alpha_2)\ldots(x-\alpha_n),$$

the sums of powers $\Sigma\alpha^2, \Sigma\alpha^3, \Sigma\alpha^4, \ldots\Sigma\alpha^n$ all satisfy the equation $\Omega=0$. Hence, excluding a_0, we may, in partition notation, write down the fundamental solutions of the equation, viz.—

$$(2),\ (3),\ (4), \ldots (n),$$

and say that with a_0, we have an *algebraically* complete system. Every symmetric function denoted by partitions, not involving the figure unity (say a non-unitary symmetric function), which remains unchanged by any increase of n, is also a seminvariant, and we may take if we please another fundamental system, viz.—

$$a_0, (2), (3), (22), (32), \ldots (2^{\frac{1}{2}n}) \text{ or } (32^{\frac{1}{2}(n-3)}).$$

Observe that, if we subject any symmetric function $(p_1p_2p_3\ldots)$ to the diminishing process, it becomes $a_0^{p_1-p_2}(p_2p_3\ldots)$.

Next consider the solutions of $\Omega=0$ which are of degree θ and weight w. The general term in a solution involves the product $a_0^{\pi_0}a_1^{\pi_1}a_2^{\pi_2}\ldots a_n^{\pi_n}$ wherein $\Sigma\pi=\theta$, $\Sigma s\pi_s=w$; the number of such products that may appear depends upon the number of partitions of w into θ or fewer parts limited not to exceed n in magnitude. Let this number be denoted by $(w; \theta, n)$. In order to obtain the seminvariants we would write down the $(w; \theta, n)$ terms each associated with a literal coefficient; if we now operate with Ω we obtain a linear function of $(w-1; \theta, n)$ products, for the vanishing of which the literal coefficients must satisfy $(w-1; \theta, n)$ linear equations; hence $(w; \theta, n)-(w-1; \theta, n)$ of these coefficients may be assumed arbitrarily, and the number of linearly independent solutions of $\Omega=0$, of the given degree and weight, is precisely $(w; \theta, n)-(w-1; \theta, n)$. This theory is due to Cayley; its validity depends upon showing that the $(w-1; \theta, n)$ linear equations satisfied by the literal coefficients are independent; this has only recently been established by E. B. Elliott. These seminvariants are said to form an asyzygetic system. It is shown in the article on Combinatorial Analysis that $(w; \theta, n)$ is the coefficient of $a^\theta z^w$ in the ascending expansion of the fraction

$$\frac{1}{1-a.1-az.1-az^2.\ldots1-az^n}.$$

Hence $(w; \theta, n)-(w-1; \theta, n)$ is given by the coefficient of $a^\theta z^w$ in the fraction

$$\frac{1-z}{1-a.1-az.1-az^2.\ldots1-az^n},$$

the enumerating generating function of asyzygetic seminvariants. We may, by a well-known theorem, write the result as a coefficient of z^w in the expansion of

$$\frac{1-z^{n+1}.1-z^{n+2}.\ldots1-z^{n+\theta}}{1-z^2.1-z^3\ldots1-z^\theta};$$

and since this expression is unaltered by the interchange of n and θ we prove Hermite's Law of Reciprocity, which states that the asyzygetic forms of degree θ for the n^{ic} are equinumerous with those of degree n for the θ^{ic}.

The degree of the covariant in the variables is $\epsilon=n\theta-2w$; consequently we are only concerned with positive terms in the developments and $(w, \theta, n)-(w-1; \theta, n)$ will be negative unless $n\theta-2w\geq 0$. It is convenient to enumerate the seminvariants of degree θ and order $\epsilon=n\theta-2w$ by a generating function; so, in the first written generating function for seminvariants, write $\frac{1}{z^2}$ for z and az^n for a; we obtain

$$\frac{1-z^{-2}}{1-az^n.1-az^{n-2}.1-az^{n-4}.\ldots1-az^{-n+4}.1-az^{-n+2}.1-az^{-n}}$$

in which we have to take the coefficient of $a^\theta z^{n\theta-2w}$, the expansion being in ascending powers of a. As we have to do only with that part of the expansion which involves positive powers of z, we must try to isolate that portion, say $A_n(z)$. For $n=2$ we can prove that the complete function may be written

$$\mathrm{A}_2(z)-\frac{1}{z^2}\mathrm{A}_2\left(\frac{1}{z}\right),$$

where

$$\mathrm{A}_2(z)=\frac{1}{1-az^2.1-a^2};$$

and this is the reduced generating function which tells us, by its denominator factors, that the complete system of the quadratic is composed of the form itself of degree order 1, 2 shown by az^2, and of the Hessian of degree order 2, 0 shown by a^2.

Again, for the cubic, we can find

$$\mathrm{A}_3(z)=\frac{1-a^6z^6}{1-az^3.1-a^2z^2.1-a^3z^3.1-a^4},$$

where the ground forms are indicated by the denominator factors, viz.: these are the cubic itself of degree order 1, 3; the Hessian of degree order 2, 2; the cubi-covariant G of degree order 3, 3, and the quartic invariant of degree order 4, 0. Further, the numerator factor establishes that these are not all algebraically independent, but are connected by a syzygy of degree order 6, 6.

Similarly for the quartic

$$\mathrm{A}_4(z)=\frac{1-a^6z^{12}}{1-az^4.1-a^2.1-a^2z^4.1-a^3.1-a^3z^6},$$

establishing the 5 ground forms and the syzygy which connects them.

The process is not applicable with complete success to quintic and higher ordered binary forms. This arises from the circumstance that the simple syzygies between the ground forms are not all independent, but are connected by second syzygies, and these again by third syzygies, and so on; this introduces new difficulties which have not been completely overcome. As regards invariants a little further progress has been made by Cayley, who established the two generating functions for the quintic

$$\frac{1-a^{36}}{1-a^4.1-a^8.1-a^{12}.1-a^{18}},$$

and for the sextic

$$\frac{1-a^{30}}{1-a^2.1-a^4.1-a^6.1-a^{10}.1-a^{15}}.$$

Accounts of further attempts in this direction will be found in Cayley's *Memoirs on Quantics* (Collected Papers), in the papers of Sylvester and Franklin (*Amer. J.* i.-iv.), and in Elliott's *Algebra of Quantics*, chap. viii.

Perpetuants.—Many difficulties, connected with binary forms of finite order, disappear altogether when we come to consider the form of infinite order. In this case the ground forms, called also perpetuants, have been enumerated and actual representative seminvariant forms established. Putting n equal to ∞, in a generating function obtained above, we find that the function, which enumerates the asyzygetic seminvariants of degree θ, is

$$\frac{1}{1-z^2.1-z^3.1-z^4....1-z^\theta}$$

that is to say, of the weight w, we have one form corresponding to each non-unitary partition of w into the parts 2, 3, 4,...θ. The extraordinary advantage of the transformation of Ω to association with non-unitary symmetric functions is now apparent; for we may take, as representative forms, the symmetric functions which are symbolically denoted by the partitions referred to. *Ex. gr.*, of degree 3 weight 8, we have the two forms $(3^2 2)$, $a(2^4)$. If we wish merely to enumerate those whose partitions contain the figure θ, and do not therefore contain any power of a as a factor, we have the generator

$$\frac{z^\theta}{1-z^2.1-z^3.1-z^4....1-z^\theta}.$$

If $\theta=2$, every form is obviously a ground form or perpetuant, and the series of forms is denoted by (2), (2^2), (2^3),....$(2^{\kappa+1})$.... Similarly, if $\theta=3$, every form $(3^{\kappa+1}2^\lambda)$ is a perpetuant. For these two cases the perpetuants are enumerated by

$$\frac{z^2}{1-z^2}\text{ and }\frac{z^3}{1-z^2.1-z^3}$$

respectively.

When $\theta=4$ it is clear that no form, whose partition contains a part 3, can be reduced; but every form, whose partition is composed of the parts 4 and 2, is by elementary algebra reducible by means of perpetuants of degree 2. These latter forms are enumerated by $\frac{z^4}{1-z^2.1-z^4}$; hence the generator of quartic perpetuants must be

$$\frac{z^4}{1-z^2.1-z^3.1-z^4}-\frac{z^4}{1-z^2.1-z^4}=\frac{z^7}{1-z^2.1-z^3.1-z^4};$$

and the general form of perpetuants is $(4^{\kappa+1}\,3^{\lambda+1}\,2^\mu)$.

When $\theta\geqq 5$, the reducible forms are connected by syzygies which there is some difficulty in enumerating. Sylvester, Cayley and MacMahon succeeded, by a laborious process, in establishing the generators for $\theta=5$, and $\theta=6$, viz.:

$$\frac{z^{15}}{1-z^2.1-z^3.1-z^4.1-z^5},\quad\frac{z^{31}}{1-z^2.1-z^3.1-z^4.1-z^5.1-z^6};$$

but the true method of procedure is that of Stroh which we are about to explain.

Method of Stroh.—In the section on "Symmetric Function," it was noted that Stroh considers

$$(\sigma_1\alpha_1+\sigma_2\alpha_2+\ldots+\sigma_\theta\alpha_\theta)^w,$$

where $\sigma_1+\sigma_2+\ldots+\sigma_\theta=0$ and $\frac{\alpha_1^s}{s!}=\frac{\alpha_2^s}{s!}=\ldots=\frac{\alpha_\theta^s}{s!}=a_s$ symbolically, to be the fundamental form of seminvariant of degree θ and weight w; he observes that every form of this degree and weight is a linear function of such symbolic expressions. We may write

$$(1+\sigma_1\xi)(1+\sigma_2\xi)\ldots(1+\sigma_\theta\xi)=1+A_2\xi^2+A_3\xi^3+\ldots+A_\theta\xi^\theta.$$

If we expand the symbolic expression by the multinomial theorem, and remember that any symbolic product $\alpha_1^{\pi_1}\alpha_2^{\pi_2}\alpha_3^{\pi_3}\ldots$ retains the same value, however the suffixes be permuted, we shall obtain a sum of terms, such as $w!\frac{\alpha_1^{\pi_1}}{\pi_1!}\frac{\alpha_2^{\pi_2}}{\pi_2!}\frac{\alpha_3^{\pi_3}}{\pi_3!}\ldots\Sigma\sigma_1^{\pi_1}\sigma_2^{\pi_2}\sigma_3^{\pi_3}\ldots$, which in real form is $w!\,a_{\pi_1}a_{\pi_2}a_{\pi_3}\ldots\Sigma\sigma_1^{\pi_1}\sigma_2^{\pi_2}\sigma_3^{\pi_3}\ldots$; and, if we express $\Sigma\sigma_1^{\pi_1}\sigma_2^{\pi_2}\sigma_3^{\pi_3}\ldots$ in terms of A_2, A_3,...., and arrange the whole as a linear function of products of A_2, A_3,...., each coefficient will be a seminvariant, and the aggregate of the coefficients will give us the complete asyzygetic system of the given degree and weight.

When the proper degree θ is $< w$ a factor $a_0^{w-\theta}$ must be of course understood.

Ex. gr.

$$\frac{1}{2!}(\sigma_1\alpha_1+\sigma_2\alpha_2+\sigma_3\alpha_3+\sigma_4\alpha_4)^2=\frac{\alpha_1^2}{2!}\Sigma\sigma_1^2+\alpha_1\alpha_2\Sigma\sigma_1\sigma_2$$

$$=a_2(-2A_2)+a_1^2A_2=(a_1^2-2a_2)A_2=(2)A_2\equiv a_0^2(2)A_2.$$

In general the coefficient, of any product $A_{\pi_1}A_{\pi_2}A_{\pi_3}$...., will have, as coefficient, a seminvariant which, when expressed by partitions, will have as leading partition (preceding in dictionary order all others) the partition $(\pi_1\pi_2\pi_3\ldots)$. Now the symbolic expression of the seminvariant can be expanded by the binomial theorem so as to be exhibited as a sum of products of seminvariants, of lower degrees if $\sigma_1\alpha_1+\sigma_2\alpha_2+\ldots+\sigma_\theta\alpha_\theta$ can be broken up into any two portions

$$(\sigma_1\alpha_1+\sigma_2\alpha_2+\ldots+\sigma_s\alpha_s)+(\sigma_{s+1}\alpha_{s+1}+\sigma_{s+2}\alpha_{s+2}+\ldots+\sigma_\theta\alpha_\theta),$$

such that $\sigma_1+\sigma_2+\ldots+\sigma_s=0$, for then

$$\sigma_{s+1}+\sigma_{s+2}+\ldots+\sigma_\theta=0;$$

and each portion raised to any power denotes a seminvariant. Stroh assumes that every reducible seminvariant can in this way be reduced. The existence of such a relation, as $\sigma_1+\sigma_2+\ldots+\sigma_\theta=0$, necessitates the vanishing of a certain function of the coefficients A_2, A_3,...A_θ, and as a consequence *one* product of these coefficients can be eliminated from the expanding form and no seminvariant, which appears as a coefficient to such a product (which may be the whole or only a part of the complete product, with which the seminvariant is associated), will be capable of reduction.

Ex. gr. for $\theta=2$, $(\sigma_1\alpha_1+\sigma_2\alpha_2)^w$; either σ_1 or σ_2 will vanish if $\sigma_1\sigma_2=A_2=0$; but every term, in the development, is of the form $(222\ldots)A_2^{\frac{1}{2}w}$ and therefore vanishes; so that none are left to undergo reduction. Therefore every form of degree 2, except of course that one whose weight is zero, is a perpetuant. The generating function is $\frac{z^2}{1-z^2}$.

For $\theta=3$, $(\sigma_1\alpha_1+\sigma_2\alpha_2+\sigma_3\alpha_3)^w$; the condition is clearly $\sigma_1\sigma_2\sigma_3=A_3=0$, and since every seminvariant, of proper degree 3, is associated, as coefficient, with a product containing A_3, all such are perpetuants. The general form is $(3^\kappa 2^\lambda$ and the generating function $\frac{z^3}{1-z^2.1-z^3}$.

For $\theta=4$, $(\sigma_1\alpha_1+\sigma_2\alpha_2+\sigma_3\alpha_3+\sigma_4\alpha_4)^w$; the condition is

$$\sigma_1\sigma_2\sigma_3\sigma_4(\sigma_1+\sigma_2)(\sigma_1+\sigma_3)(\sigma_1+\sigma_4)=A_4A_3=0.$$

Hence every product of A_1, A_2, A_3, A_4, which contains the product A_4A_3 disappears *before* reduction; this means that every seminvariant, whose partition contains the parts 4, 3, is a perpetuant. The general form of perpetuant is $(4^\kappa 3^\lambda 2^\mu)$ and the generating function

$$\frac{z^7}{1-z^2.1-z^3.1-z^4}$$

In general when θ is even and $=2\phi$, the condition is

$$\sigma_1\sigma_2\ldots\sigma_{2\phi}\Pi(\sigma_1+\sigma_2)\Pi(\sigma_1+\sigma_2+\sigma_3)\ldots\Pi(\sigma_1+\sigma_2+\ldots+\sigma_\phi)=0;$$

and we can determine the lowest weight of a perpetuant; the degree in the quantities σ is

$$2\phi+\binom{2\phi}{2}+\binom{2\phi}{3}+\ldots+\frac{1}{2}\binom{2\phi}{\phi}=2^{2\phi-1}-1=2^{\theta-1}-1.$$

Again, if θ is uneven $=2\phi+1$, the condition is

$$\sigma_1\sigma_2\ldots\sigma_{2\phi+1}\Pi(\sigma_1+\sigma_2)\Pi(\sigma_1+\sigma_2+\sigma_3)\ldots\Pi(\sigma_1+\sigma_2+\ldots+\sigma_\phi)=0;$$

and the degree, in the quantities σ, is

$$2\phi+1+\binom{2\phi+1}{2}+\binom{2\phi+1}{3}+\ldots+\binom{2\phi+1}{\phi}$$

$$=2^{2\phi}-1=2^{\theta-1}-1.$$

Hence the lowest weight of a perpetuant is $2^{\theta-1}-1$, when θ is >2. The generating function is thus

$$\frac{z^{2^{\theta-1}-1}}{(1-z^2)(1-z^3)(1-z^4)\ldots(1-z^\theta)}.$$

The actual form of a perpetuant of degree θ has been shown by MacMahon to be

$$(\theta^{\kappa_\theta+1}\,\overline{\theta-1}^{\kappa_{\theta-1}+1}\,\overline{\theta-2}^{\kappa_{\theta-2}+2}\,\overline{\theta-3}^{\kappa_{\theta-3}+4},\ldots 3^{\kappa_3+2^{\theta-4}},2^{\kappa_2}),$$

$\kappa_\theta,\kappa_{\theta-1},\ldots\kappa_2$ being given any zero or positive integer values.

Simultaneous Seminvariants of two Binary Forms.—Taking the two forms to be

$$a_0x_1^p+pa_1x_1^{p-1}x_2+p(p-1)a_2x_1^{p-2}x_2^2+\ldots+a_px_2^p,$$

$$b_0x_1^q+qb_1x_1^{q-1}x_2+q(q-1)b_2x_1^{q-2}x_2^2+\ldots+b_qx_2^q,$$

every leading coefficient of a simultaneous covariant vanishes by the operation of

$$\Omega_a+\Omega_b=a_0\frac{d}{da_1}+a_1\frac{d}{da_2}+\ldots+a_{p-1}\frac{d}{da_p}+b_0\frac{d}{db_1}+b_1\frac{d}{db_2}+\ldots+b_{q-1}\frac{d}{db_q}.$$

Observe that we may employ the principle of suffix diminution to obtain from any seminvariant one appertaining to a $(p-1)^{ic}$ and a $q-1^{ic}$, and that suffix augmentation produces a portion of a higher seminvariant, the degree in each case remaining unaltered. Remark, too, that we are in association with non-unitary symmetric functions of two systems of quantities which will be denoted by partitions in brackets $(\ )_a$, $(\ )_b$ respectively. Solving the equation

$$(\Omega_a+\Omega_b)u=0,$$

by the ordinary theory of linear partial differential equations, we obtain $p+q+1$ independent solutions, of which p appertain to $\Omega_a u=0$, q to $\Omega_b u=0$; the remaining one is $J_{ab}=a_0b_1-a_1b_0$, the leading coefficient of the Jacobian of the two forms. This constitutes an algebraically complete system, and, in terms of its members, all seminvariants can be rationally expressed. A similar theorem holds in the case of any number of binary forms, the mixed seminvariants being derived from the Jacobians of the several pairs of forms. If the seminvariant be of degree θ, θ' in the coefficients, the forms of orders p, q respectively, and the weight w, the degree of the covariant in the variables will be $p\theta+q\theta'-2w=\epsilon$, an easy generalization of the theorem connected with a single form.

The general term of a seminvariant of degree θ, θ' and weight w will be

$$a_0^{\rho_0}a_1^{\rho_1}a_2^{\rho_2}\dots a_p^{\rho_p}b_0^{\sigma_0}b_1^{\sigma_1}b_2^{\sigma_2}\dots b_q^{\sigma_q}$$

where $\sum_1^p\rho_s=\theta$, $\sum_1^q\sigma_s=\theta'$ and $\sum_1^p s\rho_s+\sum_1^q s\sigma_s=w$.

The number of such terms is the number of partitions of w into $\theta+\theta'$ parts, the part magnitudes, in the two portions, being limited not to exceed p and q respectively. Denote this number by $(w;\theta,p;\theta',q)$. The number of linearly independent seminvariants of the given type will then be denoted by

$$(w;\theta,p;\theta',q)-(w-1;\theta,p;\theta',q);$$

and will be given by the coefficient of $a^\theta b^{\theta'}z^w$ in

$$\frac{1-z}{1-a.1-az.1-az^2.\dots1-az^p.1-b.1-bz.1-bz^2\dots1-bz^q};$$

that is, by the coefficient of z^w in

$$\frac{1-z^{p+1}.1-z^{p+2}.\dots1-z^{p+\theta}.1-z^{q+1}.1-z^{q+2}.\dots1-z^{q+\theta'}}{1-z.1-z^2.1-z^3.\dots1-z^\theta.1-z.1-z^2.\dots1-z^{\theta'}};$$

which preserves its expression when θ and p and θ' and q are separately or simultaneously interchanged.

Taking the first generating function, and writing az^p, bz^q, $\frac{1}{z^2}$ for a, b and z respectively, we obtain the coefficient of

$$a^\theta b^{\theta'}z^{p\theta+q\theta'-2w},\text{ that is of } a^\theta b^{\theta'}z^\epsilon, \text{ in}$$

$$\frac{1-z^{-2}}{1-az^p.1-az^{p-2}\dots1-az^{-p+2}.1-az^{-p}.1-bz^q.1-bz^{q-2}\dots1-bz^{-q+2}.1-bz^{-q}};$$

the unreduced generating function which enumerates the covariants of degrees θ, θ' in the coefficients and order ϵ in the variables. Thus, for two linear forms, $p=q=1$, we find

$$\frac{1-z^{-2}}{1-az.1-az^{-1}.1-bz.1-bz^{-1}},$$

the positive part of which is

$$\frac{1}{1-az.1-bz.1-ab};$$

establishing the ground forms of degrees-order (1, 0; 1), (0, 1; 1), (1, 1; 0), viz:—the linear forms themselves and their Jacobian J_{ab}. Similarly, for a linear and a quadratic, $p=1$, $q=2$, and the reduced form is found to be

$$\frac{1-a^2b^2z^2}{1-az.1-bz^2.1-abz.1-b^2.1-a^2b},$$

where the denominator factors indicate the forms themselves, their Jacobian, the invariant of the quadratic and their resultant; connected, as shown by the numerator, by a syzygy of degrees-order (2, 2; 2).

The complete theory of the perpetuants appertaining to two or more forms of infinite order has not yet been established. For two forms the seminvariants of degrees 1, 1 are enumerated by $\frac{1}{1-z}$, and the only one which is reducible is a_0b_0 of weight zero; hence the perpetuants of degrees 1, 1 are enumerated by

$$\frac{1}{1-z}-1=\frac{z}{1-z};$$

and the series is evidently

$$a_0b_1-a_1b_0,$$
$$a_0b_2-a_1b_1+a_2b_0,$$
$$a_0b_3-a_1b_2+a_2b_1-a_3b_0,$$

one for each of the weights 1, 2, 3...*ad infin.*

For the degrees 1, 2, the asyzygetic forms are enumerated by $\frac{1}{1-z.1-z^2}$, and the actual forms for the first three weights are

$$a_0b_0^2,$$
$$(a_0b_1-a_1b_0)b_0,$$
$$(a_0b_2-a_1b_1+a_2b_0)b_0,$$
$$a_0(b_1^2-2b_0b_2),$$
$$(a_0b_3-a_1b_2+a_2b_1-a_3b_0)b_0,$$
$$a_0(b_1b_2-3b_0b_3)-a_1(b_1^2-2b_0b_2);$$

amongst these forms are included all the asyzygetic forms of degrees 1, 1, multiplied by b_0, and also all the perpetuants of the second binary form multiplied by a_0; hence we have to subtract from the generating function $\frac{1}{1-z}$ and $\frac{z^2}{1-z^2}$, and obtain the generating function of perpetuants of degrees 1, 2.

$$\frac{1}{1-z.1-z^2}-\frac{1}{1-z}-\frac{z^2}{1-z^2}=\frac{z^3}{1-z.1-z^2}.$$

The first perpetuant is the last seminvariant written, viz.:—

$$a_0(b_0b_3-3b_0b_3)-a_1(b_1^2-2b_0b_2),$$

or, in partition notation,

$$a_0(21)_b-(1)_a(2)_b;$$

and, in this form, it is at once seen to satisfy the partial differential equation. It is important to notice that the expression

$$(\theta)_a(\theta'1^s)_b-(\theta1)_a(\theta'1^{s-1})_b+(\theta1^2)_a(\theta'1^{s-2})_b-\dots\pm(\theta1^s)_a(\theta')_b$$

denotes a seminvariant, if θ, θ', be neither of them unity, for, after operation, the terms destroy one another in pairs: when $\theta=0$, $(\theta)_a$ must be taken to denote a_0 and so for θ'. In general it is a seminvariant of degrees θ, θ', and weight $\theta+\theta'+s$; to this there is an exception, viz., when $\theta=0$, or when $\theta'=0$, the corresponding partial degrees are 1 and 1. When $\theta=\theta'=0$, we have the general perpetuant of degrees 1, 1. There is a still more general form of seminvariant; we may have instead of θ, θ' any collections of non-unitary integers not exceeding θ, θ' in magnitude respectively, *Ex. gr.*

$$(2^{\lambda_2}3^{\lambda_3}\dots\theta^{\lambda_\theta})_a(1^s2^{\mu_2}3^{\mu_3}\dots\theta'^{\mu_{\theta'}})_b$$
$$-(12^{\lambda_2}3^{\lambda_3}\dots\theta^{\lambda_\theta})_a(1^{s-1}2^{\mu_2}3^{\mu_3}\dots\theta'^{\mu_{\theta'}})_b$$
$$+(1^22^{\lambda_2}3^{\lambda_3}\dots\theta^{\lambda_\theta})_a(1^{s-2}2^{\mu_2}3^{\mu_3}\dots\theta'^{\mu_{\theta'}})_b$$
$$-\dots\dots$$
$$(-)^s(1^s2^{\lambda_2}3^{\lambda_3}\dots\theta^{\lambda_\theta})_a(2^{\mu_2}3^{\mu_3}\dots\theta'^{\mu_{\theta'}})_b,$$

is a seminvariant; and since these forms are clearly enumerated by

$$\frac{1}{1-z.1-z^2.\dots1-z^\theta.1-z^2.1-z^3.\dots1-z^{\theta'}},$$

an expression which also enumerates the asyzygetic seminvariants, we may regard the form, written, as denoting the general form of asyzygetic seminvariant; a very important conclusion. For the case in hand, from the simplest perpetuant of degrees 1, 2, we derive the perpetuants of weight w,

$$a_0(21^{w-2})_b-a_1(21^{w-3})_b+a_2(21^{w-4})_b-\dots\pm a_{w-2}(2)_b,$$
$$a_0(2^21^{w-4})_b-a_1(2^21^{w-5})_b+a_2(2^21^{w-6})_b-\dots\pm a_{w-4}(2^2)_b,$$
$$a_0(2^31^{w-6})_b-a_1(2^31^{w-7})_b+a_2(2^31^{w-8})_b-\dots\pm a_{w-6}(2^3)_b,$$

a series of $\frac{1}{2}(w-2)$ or of $\frac{1}{2}(w-1)$ forms according as w is even or uneven. Their number for any weight w is the number of ways of composing $w-3$ with the parts 1, 2, and thus the generating function is verified. We cannot, by this method, easily discuss the perpetuants of degrees 2, 2, because a syzygy presents itself as early as weight 2. It is better now to proceed by the method of Stroh.

We have the symbolic expression of a seminvariant.

$$\frac{1}{w!}(\sigma_1\alpha_1+\sigma_2\alpha_2+\dots+\sigma_\theta\alpha_\theta+\tau_1\beta_1+\tau_2\beta_2+\dots+\tau_{\theta'}\beta_{\theta'})^w$$

where

$$\frac{\alpha_1^s}{s!}=\frac{\alpha_2^s}{s!}=\dots=a_s;\ \frac{\beta_1^s}{s!}=\frac{\beta_2^s}{s!}=\dots=b_s;$$

and
$$\sigma_1+\sigma_2+\dots+\sigma_\theta+\tau_1+\tau_2+\dots+\tau_\theta=0.$$

Proceeding as we did in the case of the single binary form we find that for a given total degree $\theta+\theta'$, the condition which expresses reducibility is of total degree $2^{\theta+\theta'-1}-1$ in the coefficients σ and τ; combining this with the knowledge of the generating function of asyzygetic forms of degrees θ, θ', we find that the perpetuants of these degrees are enumerated by

$$\frac{z^{2^{\theta+\theta'-1}}-1}{1-z.1-z^2.1-z^3.\dots1-z^\theta.1-z^2.1-z^3.\dots1-z^{\theta'}},$$

and this is true for $\theta+\theta'=2$ as well as for other values of $\theta+\theta'$ (compare the case of the single binary form).

Observe that, if there be more than two binary forms, the weight of the simplest perpetuant of degrees θ, θ', θ'',... is $2^{\theta+\theta'+\theta''+\dots-1}-1$, as can be seen by reasoning of a similar kind.

To obtain information concerning the actual forms of the perpetuants, write

$$(1+\sigma_1x)(1+\sigma_2x)\dots(1+\sigma_\theta x)=1+A_1x+A_2x^2+\dots+A_\theta x^\theta$$
$$(1+\tau_1x)(1+\tau_2x)\dots(1+\tau_{\theta'}x)=1+B_1x+B_2x^2+\dots+B_{\theta'}x^{\theta'}$$

where
$$A_1+B_1=0.$$

For the case $\theta=1$, $\theta'=1$, the condition is

$$\sigma_1\tau_1=A_1B_1=0,$$

which since $A_1+B_1=0$, is really a condition of weight unity. For $w=1$ the form is $A_1a_1+B_1b_1$, which we may write $a_0b_1-a_1b_0=a_0(1)_b-(1)_ab_0$; the remaining perpetuants, enumerated by $\frac{z}{1-z}$, have been set forth above.

For the case $\theta=1$, $\theta'=2$, the condition is $\sigma_1\tau_1\tau_2=A_1B_2=0$; and the simplest perpetuant, derived directly from the product A_1B_2, is $(1)_a(2)_b-(21)_b$; the remainder of those enumerated by $\frac{z^3}{1-z.1-z^2}$ may be represented by the form

$$(1^{\lambda_1+1})_a(2^{\mu_2+1})_b-(1^{\lambda_1})_a(2^{\mu_2+1}1)_b+\dots\pm(2^{\mu_2+1}1^{\lambda_1+1})_b;$$

λ_1 and μ_2 each assuming all integer (including zero) values. For the case $\theta=\theta'=2$, the condition is

$$\sigma_1\sigma_2\tau_1\tau_2(\sigma_1+\sigma_2)(\sigma_1+\tau_1)(\sigma_1+\tau_2)=-A_2^2B_1B_2-A_1A_2B_2^2=0.$$

To represent the simplest perpetuant, of weight 7, we may take as base either $A_2^2B_1B_2$ or $A_1A_2B_2^2$, and since $A_1+B_1=0$ the former is equivalent to $A_1A_2^2B_2$ and the latter to $A_2B_1B_2^2$; so that we have, apparently, a choice of four products. $A_1^2B_1B_2$ gives $(2^2)_a(21)_b-(2^21)_a(2)_b$, and $A_1A_2^2B_2$, $(2^21)_a(2)_b-(2^2)_a(21)_b$; these two merely differ in sign; and similarly $A_2B_1B_2^2$ yields $(2)_a(2^21)_b-(21)_a(2^2)_b$, and that due to $A_1A_2B_2^2$ merely differs from it in sign. We will choose from the forms in such manner that the product of letters A is either a power of A_1, or does not contain A_1; this rule leaves us with $A_1^2B_1B_2$ and $A_2B_1B_2^2$; of these forms we will choose that one which in letters B is earliest in ascending dictionary order; this is $A_1^2B_1B_2$, and our earliest perpetuant is

$$(2^2)_a(21)_b-(2^21)_a(2)_b,$$

and thence the general form enumerated by the generating function $\frac{z^7}{(1-z)(1-z^2)^2}$ is

$$(2^{\lambda_2+2})_a(2^{\mu_2+1}1^{\mu_1+1})_b-(2^{\lambda_2+2}1)_a(2^{\mu_2+1}1^{\mu_1})_b+\dots$$
$$\pm(2^{\lambda_2+2}1^{\mu_1+1})_a(2^{\mu_2+1})_b.$$

For the case $\theta=1$, $\theta'=3$, the condition is

$$\sigma_1\tau_1\tau_2\tau_3(\sigma_1+\tau_1)(\sigma_1+\tau_2)(\sigma_1+\tau_3)=A_1B_3^2+A_1^2B_2B_3=0.$$

By the rules adopted we take $A_1^2B_2B_3$, which gives

$$(1^2)_a(32)_b-(1)_a(321)_b+a_0(321^2)_b,$$

the simplest perpetuant of weight 7; and thence the general form enumerated by the generating function

$$\frac{z^7}{1-z.\,1-z^2.\,1-z^3},$$

viz:— $(1^{\lambda_1+2})_a(3^{\mu_3+1}2^{\mu_2+1})_b-\dots\pm a_0(3^{\mu_3+1}2^{\mu_2+1}1^{\lambda_1+2})_b$.

For the case $\theta=2$, $\theta'=3$, the condition is

$$\sigma_1\sigma_2\tau_1\tau_2\tau_3(\sigma_1+\sigma_2)(\sigma_1+\tau_1)(\sigma_1+\tau_2)(\sigma_1+\tau_3)(\sigma_2+\tau_1)(\sigma_2+\tau_2)(\sigma_2+\tau_3)$$
$$\times(\tau_1+\tau_2)(\tau_1+\tau_3)(\tau_2+\tau_3)=0.$$

The calculation results in

$$-A_2^4B_3B_2B_1^2+2A_2^3B_3B_2^2B_1^2-A_2^2B_3B_2^3B_1^2+A_2^4B_2^2B_1-2A_2^3B_3^2B_2B_1$$
$$-A_2^2B_3^2B_2B_1^2+A_2^2B_3^2B_2^2B_1+A_2B_3^2B_2^2B_1^2+A_2^2B_3^3B_1^2-2A_2B_3^3B_2B_1^2$$
$$+A_2B_3^4B_1=0.$$

By the rules we select the product $A_2^4B_3B_2B_1^2$, giving the simplest perpetuant of weight 15, viz:—

$$(2^4)_a(321^2)_b-(2^41)_a(321)_b+(2^41^2)_a(32)_b;$$

and thence the general form

$$(2^{\lambda_2+4})_a(3^{\mu_3+1}2^{\mu_2+1}1^{\mu_1+2})_b-\dots\pm(2^{\lambda_2+4}1^{\mu_1+2})_a(3^{\mu_3+1}2^{\mu_2+1})_b,$$

due to the generating function

$$\frac{z^{15}}{(1-z)(1-z^2)^2(1-z^3)}.$$

For the case $\theta=1$, $\theta'=4$, the condition is

$$\sigma_1\tau_1\tau_2\tau_3\tau_4(\sigma_1+\tau_1)(\sigma_1+\tau_2)(\sigma_1+\tau_3)(\sigma_1+\tau_4)\Pi(\tau_s+\tau_t)=0;$$

the calculation gives

$$A_1B_4(A_1^2B_2+A_1B_3+B_4)(-B_3^2-A_1B_2B_3-A_1^2B_4)=0.$$

Selecting the product $A_1^4B_4B_3B_2^2$, we find the simplest perpetuant

$$(1^4)_a(432^2)_b-(1^3)_a(432^21)_b+(1^2)_a(432^21^2)_b-(1)_a(432^21^3)_b$$
$$+a_0(432^21^4)_b,$$

and thence the general form

$$(1^{\lambda_1+4})_a(4^{\mu_4+1}3^{\mu_3+1}2^{\mu_2+2})_b-\dots\pm a_0(4^{\mu_4+1}3^{\mu_3+1}2^{\mu_2+2}1^{\lambda_1+4})_b,$$

due to the generating function

$$\frac{z^{15}}{1-z.\,1-z^2.\,1-z^3.\,1-z^4}.$$

The series may be continued, but the calculations soon become very laborious.

V. Restricted Substitutions

We may regard the factors of a binary n^{ic} equated to zero as denoting n straight lines through the origin, the co-ordinates being Cartesian and the axes inclined at any angle. Taking the variables to be x, y and effecting the linear transformation

$$x=\lambda_1X+\mu_1Y,$$
$$y=\lambda_2X+\mu_2Y,$$

so that

$$\frac{y}{x}=\frac{\lambda_2+\mu_2\frac{Y}{X}}{\lambda_1+\mu_1\frac{Y}{X}},\quad\frac{Y}{X}=\frac{\lambda_1\frac{y}{x}-\lambda_2}{\mu_2-\mu_1\frac{y}{x}};$$

it is seen that the two lines, on which lie (x, y), (X, Y), have a definite projective correspondence. The linear transformation replaces points on lines through the origin by corresponding points on projectively corresponding lines through the origin; it therefore replaces a pencil of lines by another pencil, which corresponds projectively, and harmonic and other properties of pencils which are unaltered by linear transformation we may expect to find indicated in the invariant system. Or, instead of looking upon a linear substitution as replacing a pencil of lines by a projectively corresponding pencil retaining the same axes of co-ordinates, we may look upon the substitution as changing the axes of co-ordinates retaining the same pencil. Then a binary n^{ic}, equated to zero, represents n straight lines through the origin, and the x, y of any line through the origin are given constant multiples of the sines of the angles which that line makes with two fixed lines, the axes of co-ordinates. As new axes of co-ordinates we may take any other pair of lines through the origin, and for the X, Y corresponding to x, y any new constant multiples of the sines of the angles which the line makes with the new axes. The substitution for x, y in terms of X, Y is the most general linear substitution in virtue of the four degrees of arbitrariness introduced, viz. two by the choice of axes, two by the choice of multiples. If now the n^{ic} denote a given pencil of lines, an invariant is the criterion of the pencil possessing some particular property which is independent alike of the axes and of the multiples, and a covariant expresses that the pencil of lines which it denotes is a fixed pencil whatever be the axes or the multiples.

Besides the invariants and covariants, hitherto studied, there are others which appertain to particular cases of the general linear substitution. Thus what have been called seminvariants are not all of them invariants for the general substitution, but are invariants for the particular substitution

$$x_1=\lambda_1\xi_1+\mu_1\xi_2,$$
$$x_2=\qquad\mu_2\xi_2.$$

Again, in plane geometry, the most general equations of substitution which change from old axes inclined at ω to new axes inclined at $\omega'=\beta-\alpha$, and inclined at angles α, β to the old axis of x, without change of origin, are

$$x=\frac{\sin(\omega-\alpha)}{\sin\omega}X+\frac{\sin(\omega-\beta)}{\sin\omega}Y,$$
$$y=\frac{\sin\alpha}{\sin\omega}X\quad+\frac{\sin\beta}{\sin\omega}Y,$$

a transformation of modulus

$$\frac{\sin\omega'}{\sin\omega}.$$

The theory of invariants originated in the discussion, by George Boole, of this system so important in geometry. Of the quadratic

$$ax^2+2bxy+cy^2,$$

he discovered the two invariants

$$ac-b^2,\ a-2b\cos\omega+c,$$

and it may be verified that, if the transformed of the quadratic be

$$AX^2+2BXY+CY^2,$$
$$AC-B^2=\left(\frac{\sin\omega'}{\sin\omega}\right)^2(ac-b^2),$$
$$A-2B\cos\omega'+C=\left(\frac{\sin\omega'}{\sin\omega}\right)^2(a-2b\cos\omega+c).$$

The fundamental fact that he discovered was the invariance of $x^2+2\cos\omega\,xy+y^2$, viz.—

$$x^2+2\cos\omega\,xy+y^2=X^2+2\cos\omega'XY+Y^2,$$

from which it appears that the Boolian invariants of $ax^2+2bxy-y^2$ are nothing more than the full invariants of the simultaneous quadratics

$$ax^2+2bxy+y^2,\ x^2+2\cos\omega\,xy+y^2,$$

the word invariant including here covariant. In general the Boolian system, of the general n^{ic}, is coincident with the simultaneous system of the n^{ic} and the quadratic $x^2+2\cos\omega\,xy+y^2$.

Orthogonal System.—In particular, if we consider the transformation from one pair of rectangular axes to another pair of rectangular axes we obtain an orthogonal system which we will now briefly inquire into. We have $\cos\omega'=\cos\omega=0$ and the substitution

$$x_1=\cos\theta X_1-\sin\theta X_2$$
$$x_2=\sin\theta X_1+\cos\theta X_2,$$

with modulus unity. This is called the *direct* orthogonal substitution, because the sense of rotation from the axis of X_1 to the axis of X_2 is the same as that from that of x_1 to that of x_2. If the senses of rotation be opposite we have the skew orthogonal substitution

$$x_1=\cos\theta X_1+\sin\theta X_2,$$
$$x_2=\sin\theta X_1-\cos\theta X_2,$$

of modulus -1. In both cases $\frac{d}{dx_1}$ and $\frac{d}{dx_2}$ are cogredient with x_1 and x_2; for, in the case of direct substitution,

$$\frac{d}{dx_1}=\cos\theta\frac{d}{dX_1}-\sin\theta\frac{d}{dX_2},$$
$$\frac{d}{dx_2}=\sin\theta\frac{d}{dX_1}+\cos\theta\frac{d}{dX_2};$$

and for skew substitution

$$\frac{d}{dx_1}=\cos\theta\frac{d}{dX_1}+\sin\theta\frac{d}{dX_2},$$
$$\frac{d}{dx_2}=\sin\theta\frac{d}{dX_1}-\cos\theta\frac{d}{dX_2}.$$

Hence, in both cases, contragrediency and cogrediency are identical. and contravariants are included in covariants.

Consider the binary n^{ic}. $(a_1x_1+a_2x_2)^n=a_x^n$, and the direct substitution

$$x_1=\lambda X_1-\mu X_2,$$
$$x_2=\mu X_1+\lambda X_2,$$

where $\lambda^2+\mu^2=1$; λ, μ replacing $\cos\theta$, $\sin\theta$ respectively. In the notation

$$a_x=a_1x_1+a_2x_2,$$

observe that

$$a_a=a_1^2+a_2^2,$$
$$a_b=a_1b_1+a_2b_2.$$

Suppose that

$$a_x=b_x=c_x=\ldots$$

is transformed into

$$A_X=B_X=C_X=\ldots$$

then of course $(AB)=(ab)$ the fundamental fact which appertains to the theory of the general linear substitution; now here we have additional and equally fundamental facts; for since

$$A_1=\lambda a_1+\mu a_2,\ A_2=-\mu a_1+\lambda a_2,$$
$$A_A=A_1^2+A_2^2=(\lambda^2+\mu^2)(a_1^2+a_2^2)=a_a;$$
$$A_B=A_1B_1+A_2B_2=(\lambda^2+\mu^2)(a_1b_1+a_2b_2)=a_b;$$
$$(XA)=X_1A_2-X_2A_1=(\lambda x_1+\mu x_2)(-\mu a_1+\lambda a_2)$$
$$-(-\mu x_1+\lambda x_2)(\lambda a_1+\mu a_2)=(\lambda^2+\mu^2)(x_1a_2-x_2a_1)=(xa);$$

showing that, in the present theory, a_a, a_b, and (xa) possess the invariant property. Since $x_1^2+x_2^2=x_x$ we have six types of symbolic factors which may be used to form invariants and covariants, viz.—

$$(ab),\ a_a,\ a_b,\ (xa),\ a_x,\ x_x.$$

The general form of covariant is therefore

$$(ab)^{h_1}(ac)^{h_2}(bc)^{h_3}\ldots a_a^{i_1}b_b^{i_2}c_c^{i_3}\ldots a_b^{j_1}a_c^{j_2}b_c^{j_3}\ldots$$
$$\times(xa)^{k_1}(xb)^{k_2}(xc)^{k_3}\ldots a_x^{l_1}b_x^{l_2}c_x^{l_3}\ldots x_x^m$$
$$=(AB)^{h_1}(AC)^{h_2}(BC)^{h_3}\ldots A_A^{i_1}B_B^{i_2}C_C^{i_3}\ldots A_B^{j_1}A_C^{j_2}B_C^{j_3}\ldots$$
$$\times(XA)^{k_1}(XB)^{k_2}(XC)^{k_3}\ldots A_X^{l_1}B_X^{l_2}C_X^{l_3}\ldots X_X^m.$$

If this be of order ϵ and appertain to an n^{ic}

$$\Sigma k+\Sigma l+2m=\epsilon,$$
$$h_1+h_2+\ldots+2i_1+j_1+j_2+\ldots+k_1+l_1=n,$$
$$h_1+h_3+\ldots+2i_2+j_1+j_3+\ldots+k_2+l_2=n,$$
$$h_2+h_3+\ldots+2i_3+j_2+j_3+\ldots+k_3+l_3=n;$$

. . . . . .

viz., the symbols $a, b, c,\ldots$ must each occur n times. It may denote a simultaneous orthogonal invariant of forms of orders $n_1, n_2, n_3,\ldots$; the symbols must then present themselves $n_1, n_2, n_3\ldots$ times respectively. The number of different symbols $a, b, c,\ldots$ denotes the degree θ of the covariant in the coefficients. The coefficients of the covariants are homogeneous, but not in general isobaric functions, of the coefficients of the original form or forms. Of the above general form of covariant there are important transformations due to the symbolic identities:—

$$(ab)^2=a_ab_b-a_b^2;\quad (xa)^2=a_ax_x-a_x^2;$$

as a consequence any even power of a determinant factor may be expressed in terms of the other symbolic factors, and any uneven power may be expressed as the product of its first power and a function of the other symbolic factors. Hence in the above general form of covariant we may suppose the exponents

$$h_1,\ h_2,\ h_3,\ldots k_1,\ k_2,\ k_3,\ldots$$

if the determinant factors to be, each of them, either zero or unity. Or, if we please, we may leave the determinant factors untouched and consider the exponents $j_1, j_2, j_3,\ldots l_1, l_2, l_3,\ldots$ to be, each of them, either zero or unity. Or, lastly, we may leave the exponents h, k, j, l, untouched and consider the product

$$a_a^{i_1}b_b^{i_2}c_c^{i_3}\ldots x_x^m,$$

to be reduced either to the form g_g^i where g is a symbol of the series $a, b, c,\ldots$ or to a power of x_x. To assist us in handling the symbolic products we have not only the identity

$$(ab)c_x+(bc)a_x+(ca)b_x=0,$$

but also

$$(ab)x_x+(bx)a_x+(ax)b_x=0,$$
$$(ab)a_c+(bc)a_a+(ca)a_b=0,$$

and many others which may be derived from these in the manner which will be familiar to students of the works of Aronhold, Clebsch and Gordan. Previous to continuing the general discussion it is useful to have before us the orthogonal invariants and covariants of the binary linear and quadratic forms.

For the linear forms $\bar{a}_0x_1+\bar{a}_1x_2=a_x=b_x$ there are four fundamental forms

(i.) $a_x=\bar{a}_0x_1+\bar{a}_1x_2$ of degree-order (1, 1),
(ii.) $x_x=x_1^2+x_2^2$ „ (0, 2),
(iii.) $(xa)=\bar{a}_1x_1-\bar{a}_0x_2$ „ (1, 1),
(iv.) $a_a=a_0^2+a_1^2$ „ (2, 0).

(iii.) and (iv.) being the linear covariant and the quadrinvariant respectively. Every other concomitant is a rational integral function of these four forms. The linear covariant, obviously the Jacobian of a_x and x_x is the line perpendicular to a_x, and the vanishing of the quadrinvariant a_a is the condition that a_x passes through one of the circular points at infinity. In general any pencil of lines, connected with the line a_x by descriptive or metrical properties, has for its equation a rational integral function of the four forms equated to zero.

For the quadratic $\bar{a}_0x_1^2+2\bar{a}_1x_1x_2+\bar{a}_2x_2^2$, we have

(i.) $a_x^2=\bar{a}_0x_1^2+2\bar{a}_1x_1x_2+\bar{a}_2x_2^2$,
(ii.) $x_x=x_1^2+x_2^2$,
(iii.) $(ab)^2=2(\bar{a}_0\bar{a}_2-\bar{a}_1^2)$,
(iv.) $a_a=\bar{a}_0+\bar{a}_2$,
(v.) $(xa)a_x=\bar{a}_1x_1^2+(\bar{a}_2-\bar{a}_0)x_1x_2-\bar{a}_1x_2^2$.

This is the fundamental system; we may, if we choose, replace $(ab)^2$ by $a_b^2=\bar{a}_0^2+2\bar{a}_1^2+\bar{a}_2^2$ since the identity $a_ab_b-a_b^2=(ab)^2$ shows the syzygetic relation

$$(\bar{a}_0+\bar{a}_2)^2-(\bar{a}_0^2+2\bar{a}_1^2+\bar{a}_2^2)=2(\bar{a}_0\bar{a}_2-\bar{a}_1^2).$$

There is no linear covariant, since it is impossible to form a symbolic product which will contain x once and at the same time appertain to a quadratic. (v.) is the Jacobian; geometrically it denotes the bisectors of the angles between the lines a_x^2, or, as we may say, the common harmonic conjugates of the lines a_x^2 and the lines x_x. The linear invariant a_a is such that, when equated to zero, it determines the lines a_x^2 as harmonically conjugate to the lines x_x; or, in other words, it is the condition that a_x^2 may denote lines at right angles.

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ALGECIRAS, or ALGEZIRAS, a seaport of southern Spain in the province of Cadiz, 6 m. W. of Gibraltar, on the opposite side of the Bay of Algeciras. Pop. (1900) 13,302. Algeciras stands at the head of a railway from Granada, but its only means of access to Gibraltar is by water. Its name, which signifies in Arabic the island, is derived from a small islet on one side of the harbour. It is supplied with water by means of a beautiful aqueduct. The fine winter climate of Algeciras attracts many invalid visitors, on whom the town largely depends for its prosperity. The harbour is bad, but at the beginning of the 20th century it became important as a fishing-station. Whiting, soles, bream, bass and other fish are caught in great quantities by the Algeciras steam-trawlers, which visit the Moroccan coast, as well as Spanish and neutral waters. There is also some trade in farm produce and building materials which supplies a fleet of small coasters with cargo.

Algeciras was perhaps the *Portus Albus* of the Romans, but it was probably refounded in 713 by the Moors, who retained possession of it until 1344. It was then taken by Alphonso XI. of Castile after a celebrated siege of twenty months, which attracted crusaders from all parts of Europe; among them being the English earl of Derby, grandson of Edward III. It is said that during this siege gunpowder was first used by the Moors in the wars of Europe. The Moorish city was destroyed by Alphonso; it was first reoccupied by Spanish colonists from Gibraltar in 1704; and the modern town was erected in 1760 by King Charles III. During the siege of Gibraltar in 1780–1782, Algeciras was the station of the Spanish fleet and floating batteries. On the 6th of July 1801 the English admiral Sir James Saumarez attacked a Franco-Spanish fleet off Algeciras, and sustained a reverse; but on the 12th he again attacked the enemy, whose fleet was double his own strength, and inflicted on them a complete defeat. The important international conference on Moroccan affairs, which resulted in an agreement between France and Germany, was held at Algeciras from the 16th of January to the 7th of April 1906. (See Morocco).

ALGER OF LIÉGE (d *c.* 1131), known also as Alger of Cluny and Algerus Magister, a learned French priest who lived in the first half of the 12th century. He was first a deacon of the church of St Bartholomew at Liége, his native town, and was then appointed (*c.* 1100) to the cathedral church of St Lambert. He declined many offers from German bishops and finally retired to the monastery of Cluny, where he died about 1131 at a great age and leaving a good reputation for piety and intelligence. His *History of the Church of Liége*, and many of his other works, are lost. The most important of those still extant are: 1. *De Misericordia et Justitia*, a collection of biblical and patristic extracts with a commentary (an important work for the history of church law and discipline), which is to be found in the *Anecdota* of Martène, vol. v. 2. *De Sacramentis Corporis et Sanguinis Domini*; a treatise, in three books, against the Berengarian heresy, highly commended by Peter of Cluny and Erasmus. 3. *De Gratia et Libero Arbitrio*; given in B. Pez's *Anecdota*, vol. iv. 4. *De Sacrificio Missae*; given in the *Collectio Scriptor. Vet.* of Angelo Mai, vol. ix. p. 371.

See Migne, *Patrol Ser. Lat.* vol. clxxx. pp. 739–972: Herzog-Hauck, *Realencyk. für prot. Theol.*, art. by S. M. Deutsch.

ALGER, RUSSELL ALEXANDER (1836–1907), American soldier and politician, was born in Lafayette township, Medina county, Ohio, on the 27th of February 1836. Left an orphan at an early age, he worked on a farm to pay his expenses at Richfield (Ohio) Academy, was a schoolmaster for two winters, and, having studied law in the meantime, was admitted to the bar in 1859. He began practice at Cleveland, Ohio, but early in 1860 he removed to Michigan, where he abandoned his profession and engaged in the lumber business. Enlisting in a Michigan cavalry regiment in September 1861, he rose from captain to colonel, distinguished himself in the Gettysburg campaign and under Sheridan in the Shenandoah Valley, and in 1864 and 1865 respectively received the brevets of brigadier-general and major-general of volunteers. After the war he invested extensively in pine lands in Michigan, and accumulated a large fortune in the lumber business. In 1884 he was elected governor of Michigan on the Republican ticket, serving from 1885 to 1887. In 1889–1890 he was commander-in-chief of the Grand Army of the Republic. From 1897 to 1899 he was secretary of war in President McKinley's cabinet. His administration of the war department during the Spanish-American War was severely criticized for extravagance in army contracts, for unpreparedness, and for general inefficiency, charges which he answered in his *The Spanish-American War* (1901). The extent of his personal responsibility is at least uncertain. In 1902 he was appointed by the governor of Michigan, and in 1903 was elected by the state legislature, as United States senator to complete the unexpired term of James McMillan (1838–1902). He died at Washington, D.C., on the 24th of January 1907.

ALGERIA (*Algérie*), a country of North Africa belonging to France, bounded N. by the Mediterranean, W. by Morocco, S. by the Sahara and E. by Tunisia. The boundaries, however, are in part not accurately determined. Algeria extends for about 650 m. along the coast, and stretches inland from 320 to 380 m., lying between 2° 10′ W. and 8° 50′ E., and 32° and 37° N. It is divided, politically, into three departments,—Oran in the west, Algiers in the centre and Constantine in the east. Its area is 184,474 sq. m., exclusive of the dependent Saharan regions, which have an area of some 750,000 sq. m. (see Sahara, Tuat, &c.).

Physical Features.—The character of the Algerian coast is severe and inhospitable. The western half is bordered by a hilly rampart, broken only here and there, in the bays where the larger streams find their outlet, by flat and sandy plains. Between Dellys and Philippeville high mountains rise almost sheer from the sea, leaving only a narrow strip of beach. East of Philippeville the mountains recede from the coast, and the rampart of hills reappears. Only between Bona and La Calle is the general character of the sea-board low and sandy. Save near the towns and in the cultivated district of Kabylia, the coast is bare and uninhabited; and in spite of numerous indentations, of which the most important going from west to east are the Gulf of Oran, the Gulf of Arzeu, the Bay of Algiers, and the gulfs of Bougie, Stora and Bona, there are few good harbours. From time immemorial, indeed, this coast has had an evil reputation among mariners, quite apart from the pirates who for centuries made it the base of their depredations. A violent current, starting from the Straits of Gibraltar, rushes eastward along the shore, and, hurled back from the headlands, is deflected to the west. In summer the east wind brings dense and sudden fogs; while in winter the northerly gales blow straight into the mouths of the harbours. In these circumstances navigation is especially perilous for sailing craft. The terrors of this "savage sea and inhospitable shore," once described by Sallust, have, however, been greatly mitigated by the introduction of steam, the improvement of the harbours, and the establishment by the French government of an excellent system of lighthouses.

Southward from the sea the country falls naturally into three divisions, clearly distinguished by their broad physical characteristics. The healthy, and on the whole fertile coast region, from 50 to 100 m. in width, is known, as in Morocco and Tunisia, as the Tell (Arabic for "hill"). It is a mountainous country intersected with rocky cañons and fertile valleys, which occasionally broaden out into alluvial plains like that of the Shelif, or the Metija near Algiers, or those in the neighbourhood of Oran and Bona. Behind the Tell is a lofty table-land with an average elevation of 3000 ft., consisting of vast plains, for the most part arid or covered with esparto grass, in the depressions of which are great salt lakes and swamps (Arabic, *shats*) fed by streams which can find no outlet to the sea through the encircling hills. To the south this region is divided by the Great Atlas from the deserts of the Sahara, with its oases, in which the boundary of Algeria is lost.

The country is traversed by lofty ranges of the Atlas system, which run nearly parallel to the coast, and rise in places over 7000 ft. These are commonly divided into two leading chains, distinguished as the Great[1] and Little Atlas. The Great, or Saharan Atlas contains some of the highest points in the country. The chief ranges are Ksur and Amur in the west and the Aures in the east. The peak of Shellia, the highest point in Algeria, in the Aures range, has a height of 7611 ft. In the Amur are Jebel Ksel (6594 ft.) and Tuila Makna (6561 ft.). The Little Atlas, otherwise the Tell or Maritime Atlas, lies between the sea and the Saharan Atlas, and is composed of many distinct ranges, generally of no great elevation and connected by numerous transverse chains forming extensive table-lands and elevated valleys. The principal ranges of the Little Atlas—from west to east—are the Tlemçen (5500 ft.); the Warsenis (with Kef Sidi Omar, 6500 ft.); the Titeri (4900 ft.); the Jurjura, with the peak of Lalla Kedija (7542 ft.) and Mount Babor (6447 ft.); and the Mejerda (3700 ft.), which extends into Tunisia. The Jurjura range, forming the background of the plains between Algiers and Bougie, extends through the district of Kabylia, with which for grandeur of scenery no other part of Algeria can compare. South of the Jurjura and separated from it by the valley of the Sahel, is the Biban range with a famous double pass of the same name, through which alone access is gained to the highlands beyond. The Bibans or *Portes de fer* (Iron Gates) consist of two defiles with stupendous walls of rock, which by erosion have assumed the most fantastic shapes. In the case of the *Petite porte* the walls in some places are not more than twelve feet apart. The Dahra range (see Mostaganem) overlooks the sea, and is separated from the Warsenis by the valley of the Shelif (see Atlas Mountains, Sahara and Tuat).

The rivers are numerous but the majority are short. Most

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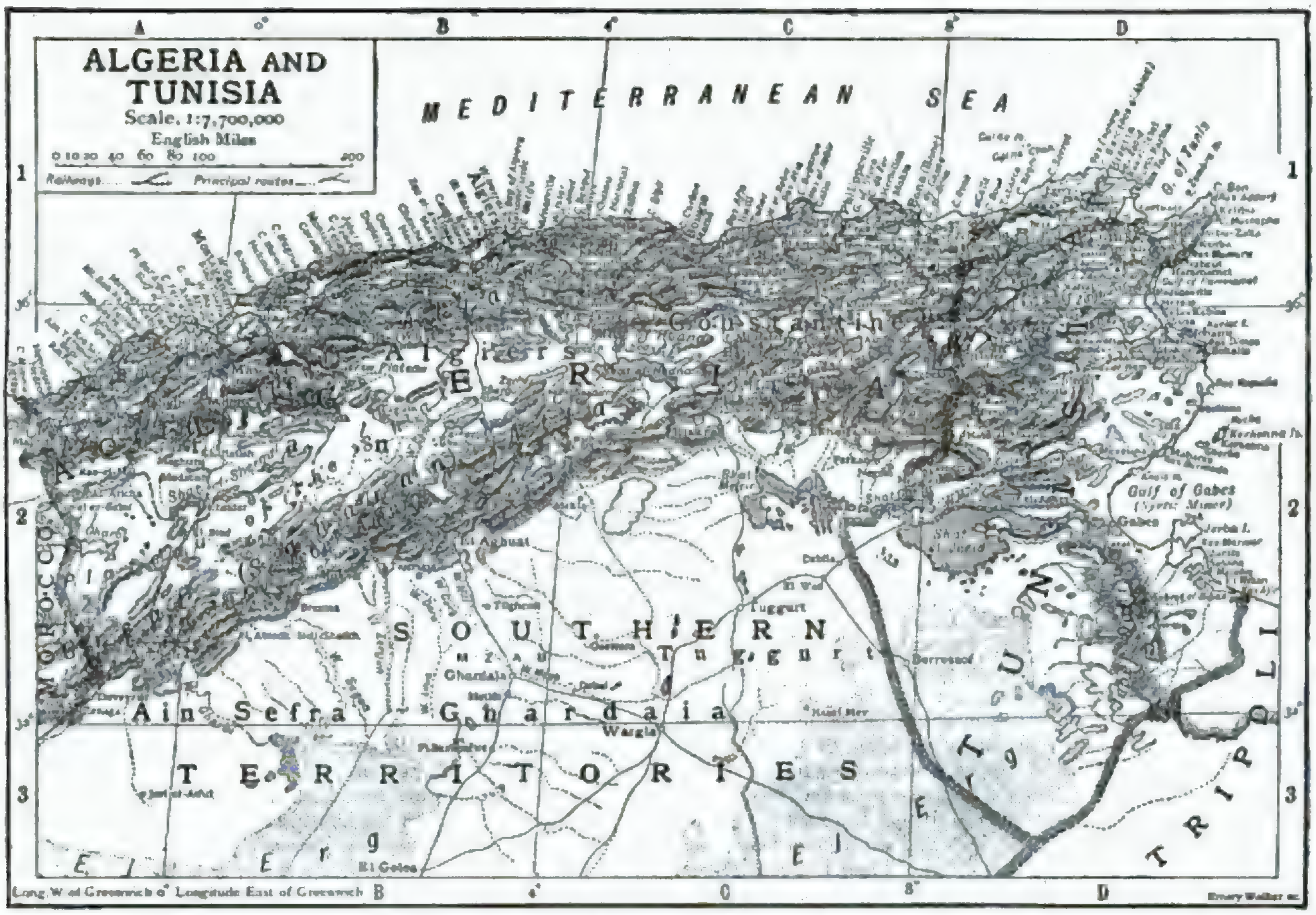
[1] The name "Great" Atlas is more correctly applied to the main range in Morocco.



of them rise in the mountains near the coast, and rush down through deep and rocky channels. During the rainy season they render communication between different parts of the country extremely difficult. The most important river, both from its length and volume, is the Shelif. It rises on the northern slopes of the Amur mountains and flows N.E. across the high plateau, piercing the little Atlas between the Warsenis and Titeri ranges. It then turns W. and reaches the Mediterranean at the eastern end of the Gulf of Arzeu. The Shelif, which has many tributaries, is about 430 m. long. The Seybuse (about 150 m. long), formed by the union of several small streams in the department of Constantine, runs through a fertile valley and reaches the Mediterranean near Bona. The Sahel (about 100 m. long), which contains the greatest body of water after the Shelif, rises in the department of Algiers near Aumâle, and flows for the most part N.E. to its mouth near Bougie. The Kebir or Rummel—the river is known by both names—is formed by the union of several small streams south of Constantine, and flows past that town N.W. 140 m. to the sea. Among the less important rivers which empty into the Mediterranean are the Macta, the Tafna, the Harrach and the Mazafran. The Macta, but 3 m. long, enters the sea in the Gulf of Arzeu, some 25 m. W. of the mouth of the Shelif. It is formed by the Habra (140 m.) and the Sig (130 m.), which rise in the Amur mountains and flowing north unite in a marshy plain, whence issues the Macta. On the lower courses of the Habra and the Sig, barrages have been built for irrigation purposes. The Habra barrage holds 38,000,000 cubic metres; that on the Sig 18,000,000. The Tafna (about 100 m.) rises in a large cavern in the mountains south of Tlemçen and flows N.E. to the sea at Rachgun. It has many affluents; the largest, the Isser (70 m.), joins it on the east bank about 30 m. above its mouth. The Harrach (40 m.), a picturesque stream, enters the Mediterranean in the Bay of Algiers. The Mazafran (50 m.) crosses the plains S.W of Algiers, reaching the sea N. of Kolea. The Mejerda and its affluent the Mellegue, rivers of Tunisia (*q.v.*), have their rise in Algeria, in the mountainous country east of Constantine. None of these rivers is navigable. Besides these there are a number of streams in the interior, but they are usually dry except in the rainy season.

Algeria abounds in extensive salt lakes and marshes. Of the lakes in the northern part of the country near the coast the principal are,—the Fezara, 14 m. S.W. of Bona; Sebkha and El Melah, south of Oran; and three small lakes in the immediate vicinity of La Calle. In the high plateaus are the Shat-el-Gharbi or Western Shat, the Shat-el-Shergui or Eastern Shat, the Zarhez-Gharbi and the Zarhez-Shergui, the Shat-el-Hodna and a number of others. South of the Jebel Aures is another series of salt lakes closely connected with the Shat-el-Jerid (of Tunisia). The chief of these is the Shat Melrir. There are a number of warm mineral springs, containing principally salts of lime, used with success by both Arabs and Europeans in several kinds of disease.

One of the most remarkable groups of springs is near Guelma, in the department of Constantine. There are two principal sources. Their waters unite in one stream whose course is marked by gigantic limestone cones, some of which are 36 ft. high. The water, which is at boiling point, falls into natural basins of a creamy white colour, formed by the deposit of carbonate of lime. The springs are known to the Arabs as Hammam Meskutin (the "accursed baths"). The name and the cones are accounted for by a legend which represents that at this spot lived a sheikh who, finding his sister too beautiful to be married to anyone else, determined to espouse her himself. Whilst the marriage festivities were being celebrated the judgment of Heaven descended on the guilty pair; fire came from below; the water became hot and the sheikh and his sister were turned into stone. Within a mile of Hammam Meskutin are ferruginous and sulphureous springs.

[*Geology.*—The geology of Algeria has been worked out in considerable detail by French geologists. Rocks of Archean and Palaeozoic ages contribute only a small share, but there is a very complete sequence of formations from the Lias to those of recent date. An interesting and orderly petrological sequence of Tertiary igneous rocks has been determined.

Archean rocks form the cores of the ancient crystalline masses within the littoral zone from Algiers to Bona. They consist of gneiss, mica-schist, quartzites, crystalline limestones and conglomerates. Primary deposits are doubtfully represented by the detached fragments of unfossiliferous strata of Traras, Blida and east of Orleansville. Carboniferous and Permian strata are possibly represented by some black and grey micaceous shales with beds of coal in the Jurjura. At Jebel-kahar and west of Traras, Pomel attributes certain conglomerates, red sandstones and purple and green shales to the Permian. The rocks of Secondary and Tertiary ages have been profoundly affected by the Alpine movements, and are thrown into a series of complex folds, so that in numerous instances their stratigraphy is imperfectly understood. The gypsiferous and saliferous marls of Shellata, Suk Ahras and Ain Nussi have yielded Triassic fossils. Triassic rocks are considered to be present in Constantine and in the Jurjura. Rhaetic beds (Infra Lias), consisting of dolomites and siliceous limestones, have been recognized at Saida. The lower and middle divisions of the Jurassic, composed of massive limestones more or less siliceous and overlain by the marls amd highly fossiliferous limestones of the Upper Lias, play an important part in the constitution of the chief mountains of the Tell. In south Oran they determine the principal axes of the mountain ranges. The Inferior Cretaceous rocks include the Neocomian and Gault (Albian and Aptian) subdivisions, and form the flanks of the mountains in the Tell. In the south the Albian subdivision of the Gault is alone represented. Rocks of Upper Cretaceous age are represented in all their stages. The Cenomanian presents two distinct facies. North of the Atlas it belongs to the European type, in the south it contains a fauna of oysters and sea-urchins belonging to the facies "africano-syrian" of Zittel. There is a continuous transition between the Senonian and Danian, proving that the Algerian region did not participate in the immersion which occurred in Provence and in the Corbières of southern France during the Danian epoch. The Lower Eocene rocks contain the chief phosphatic deposits of Algeria, those of the Tebessa region being the best known. Certain species of nummulites, which are very common, distinguish the various subdivisions of the Eocene. The highest beds, consisting of quartzites, shales, marls and sandstones with the remains of fucoids, are found in the Jurjura and Shellata. The Oligocene period consists of a marine phase confined to the littoral zone of Kabylia, and of a continental phase occupying vast areas composed of lacustrine, alluvial, gypsiferous marls, sandstones and conglomerates. The Miocene formation obtains its greatest development in Oran and is much expanded in the Tell. At the close of the Lower Miocene period (beds with *Ostrea crassissima*) great modifications in the relief and limits of the Algerian formations took place. Hitherto marine conditions were confined to the littoral; in Middle Miocene times (Helvetian) the sea broke in and spread in a south-east direction in the form of long ramified fjords but did not extend as far as the Sahara. To the Pliocene period the marine deposits of the Sahel of Algiers and of the Sahel Jijelli must be attributed; also the lacustrine marls and limestone of the basin of Constantine, and the ancient alluviums of the basins and depressions which bear no relation to the existing valleys. Among the Tertiary volcanic rocks those of acid types (granites, granulites) were the first to appear and are developed latitudinally; rocks of intermediate type (dacites, andesites) characterize the Miocene and early Pliocene periods; while the basic rocks (ophites, elaeolite syenites and basalts) attained their maximum in later Pliocene and Quaternary times. Their development, feeble as compared with the acid rocks, is meridional. The Quaternary period includes an older stage containing fragments of fossils from the underlying formations; a later stage containing the bones of *Hippopotamus*, *Elephas*, *Rhinoceros*, *Camelus*, *Equus*; and finally the vast accumulations of sand which began to be formed in prehistoric times. The broad platforms of the hamada are covered with Quaternary deposits. (W. G.*)]

Climate.—Although Algeria enjoys a warm climate, the temperature varies considerably in different parts, according to the elevation and configuration of the country. Along the coast the weather is very mild, the thermometer rarely falling to freezing-point even in winter. The coldest month is January, the hottest August. The mean annual temperature in the coast plains is 66° F. Heavy rains prevail from December to March, and rain is not uncommon during other months also, excepting June, July, August and September, which are very hot and rainless. The average annual fall is 29 in. On the mountains and the high plateaus the winter is often very severe; snow lies for six months on the higher peaks of the Kabyle mountains. On the plateaus the temperature passes from one extreme to the other, and rain seldom falls. (For the climate of the Saharan region see SAHARA.) Throughout Algeria, especially in the summer, there is a great difference between day and night temperature, notably in the inland districts. Between May and September the sirocco, or hot wind of the desert, sweeps at intervals over the country, impregnating the air with fine sand; but in general, with the exception of the vicinity of the marshes, the climate is healthy. Its salubrity has been increased by the draining of many marshes in the neighbourhood of the larger towns.

Fauna and Flora.—The fauna of Algeria resembles that of the Mediterranean system generally, though many animals once common to South Europe and North Africa—such as the lion, panther, hyena and jackal—are now extinct in Europe. Lions, formerly plentiful, have disappeared, and leopards and panthers are rare; but jackals, hyenas and Algerian apes are not uncommon. Wild boars are found in the oak forests, and brown bears in the uplands. In the south are various species of antelope and wild goat. Red deer (*Cervus elaphus barbarus*), which differ from the typical European species only in the fact that the second tine is absent from their antlers, a peculiarity which they share with the red deer of Spain and Corsica, are still found in the forest of Beni Saleh in the department of Constantine, but are being exterminated by forest fires and poaching Arabs. Of domestic animals the camel and sheep are the most important. The chief wealth of the Arab tribes of the plateaus consists in their immense flocks of sheep. The horses and mules of Algeria are noted; and the native cattle are an excellent stock on which to graft the better European varieties. Of birds, eagles, vultures, hawks, owls and quails are common; snipe, curlews, plovers, storks and herons frequent the marshy parts; and the ostrich the desert. Partridges and woodcocks are fairly common. Among the reptiles are various species of serpents, tortoises, turtles, lizards, &c. Locusts are common and sometimes do great damage. Scorpions are numerous in the arid regions. Algerian prawns, especially those of Bona, are large and of a delicate flavour. Of the twenty-one species of freshwater fish, five are peculiar to the country, but none is of much economic value save the barbel and eel. A species of trout is found in the streams near Collo, but in none of the other rivers.

The flora of Algeria consists of about 3000 species, of which some 450 are indigenous to the country, 100 being peculiar to the Sahara. The flora of the Tell is South European in character. The agave and prickly pear, the myrtle, the olive and the dwarf palm grow luxuriantly; and the fields are covered with narcissus, iris and other flowers of every hue. Roses, geraniums, and the like, bloom throughout the winter. The flora of the high plateaus consists chiefly of grasses, notably various kinds of alfa or esparto, and aromatic herbs. In the Saharan oases the characteristic tree is the date palm—"the king of the desert." Over 11,000 sq. m. of the mountainous country near the coast are covered with forests of various species of oak, pine, fir, cedar, elm, ash, maple, olive, many of them of gigantic size, and other trees; and on the slopes of the mountains up to 3800 ft. above the sea the fig is common. Its fruit forms one of the staple articles of food among the Kabyles. Cork and carob trees are also very common. A magnificent conifer, the Atlantic pinsapo (*Abies Pinsapo*), is found on the heights round Bougie. The forests suffer great damage from fires, occasioned in part by the custom of burning up the grass every autumn, and in part by incendiarism. In 1902 alone, according to the British consular report, "at a moderate estimate the number of trees damaged or destroyed might be put down at 6,000,000." Forestry is a state-protected industry, the government owning over 500,000 acres of forest. The chief tree which has commercial value is the cork, and the stripping of the bark is under official supervision. The first cork harvest was gathered in 1890, when 1474 cwt. were sold for £1361. Since that date the yield has been very great. Another tree of great commercial value is the soap tree (*Sapindus utilis*), introduced into the country in 1845 and grown extensively in low-lying lands near the coast.

Inhabitants.—Algeria had in 1906 a population of 5,231,850, consisting of a medley of European, Eastern and African races. The census showed that in addition to French settlers and their descendants (278,976) there were 117,475 Spaniards (most of whom are found in the department of Oran), 33,153 Italians (chiefly in the department of Constantine), 64,645 Jews, 6217 Maltese, and smaller communities of British, Germans, Levantines and Greeks. There were, moreover, 170,444 naturalized French citizens, mainly of Spanish and Italian origin. (These figures are exclusive of 73,799 persons counted apart, as not enjoying municipal rights. In the 73,799 the troops, French and native, are included). The total European population, in which category are reckoned the Jews, other than those of Mzab, was 680,263. Compared with the census of 1901 the figures of 1906 showed a decrease of 14,000 French, 36,000 Spaniards and 5000 Italians, but an increase of nearly 100,000 in the foreigners naturalized. Of other races: (1) The Berbers (*q.v.*) constitute 75% of the entire population. The Kabyles (*q.v.*), a division of the Berbers, occupy chiefly the more mountainous parts of the Tell, but some live in the plains and valleys. (2) Arabs, a numerous class, are found principally in the south. (3) The so-called "Moors," generally of mixed blood, inhabit the towns and villages near the sea-coast. (4) Negroes, originally brought from the interior and sold as slaves, are now found chiefly in the towns, where they serve as labourers and domestic servants. (5) Mzabites (*q.v.*) or Beni-Mzab, a distinct branch of the Berber race, are for the most part engaged in petty trade, and are distinguished by their sleeveless coats of many colours. (6) A few Tuareg (*q.v.*), another division of the Berbers, are among the nomads found in the Algerian Sahara. The Kabyles, Mzabites, Tuareg, Arabs and Moors all profess Mahommedanism, though it is only among the Arabs that its tenets are held in any purity. The census of 1906 gave the number of the native population at 4,447,149. There were also 28,639 non-European foreigners in the country.

The Turks, though for a considerable period the dominant race, were never very numerous in Algeria. The majority of them were repatriated by the French. The Kuluglis, descendants of Turks by native women—once a distinct race noted for their energy, bravery and pride—have almost ceased to exist as a separate people, being merged in the Moors. Jews have long been settled in Algeria. Some are supposed to have fled thither when expelled from Cyrenaica in the reign of the emperor Hadrian, and others on their banishment from Italy in 1342. The purely "African" Jew is now found only in the oases in the extreme south of the country. In the towns the "native" Jews have intermarried with later arrivals from Europe. A remarkable feast is kept annually by the Algerian Jews to commemorate the defeat by the Turks of the emperor Charles V.'s attempt to capture Algiers (1541). The Jews, who enjoyed religious freedom under the Mahommedans, believed that the success of the Spaniards would but lead to their own persecution.

Chief Towns.—The chief towns are Algiers, the capital and principal seaport, with a population (1906), including Mustapha and other suburbs, of 154,049; Oran (100,499),[1] a western seaport and capital of the department of the same name, and Constantine (46,806), an inland town, capital of the department of Constantine. Besides Algiers and Oran the principal seaports are Bona (36,004), Mostaganem (19,528), Philippeville (16,539), Bougie (10,419), Cherchel (4733) and La Calle (2774). Inland, besides Constantine, are the important towns of Tlemçen (24,060), Sidi-bel-Abbes (24,494), Mascara (18,989) and Blida (16,866). In the Sahara are Biskra (4218), El Wad (7586), Tuggurt (2073) and Wargla (3579). All these places are separately noticed.

Nemours (1229) is a seaport near the Moroccan frontier, which formerly bore an Arabic name pregnant with its history —Jamaa-el-Ghazuat ("rendezvous of the pirates"). The surrounding country is rich in mineral wealth. Arzeu (3085) occupies a site on the western side of the gulf of the same name. It has a good harbour, is the outlet for the produce of several fertile valleys, and the starting-point of a railway which penetrates into the Sahara. This railway passes Saida (6256), 106 m. south of Arzeu, one of the capitals of Abd-el-Kader, and serves to bring down from the high plateaus their rich crops of esparto grass. Four miles S.E. of Arzeu is a Berber village, where are interesting ruins of a Roman settlement, identified by some authorities as the Portus Magnus of Pliny; other authorities claim Oran as occupying the site of Portus Magnus. In the vicinity are the famous quarries of Numidian marbles. Tenes (3176) is a seaport situated about 100 m. east of Arzeu on the site of the Phoenician town, afterwards the Roman colony, of Cartenna. Outside the town to the west is a public garden in which are several Roman tombs with inscriptions. Between Tenes and Algiers are Tipasa (*q.v.*) and Castiglione (1634), formerly called Bu-Ismail, both pleasant watering-places. Five miles inland west of Castiglione is Kolea (2932), a town dating from 1550 and originally peopled by Moslem refugees from Spain. It was destroyed by earthquake in 1825 and has been rebuilt largely in European style. It contains the *kubba* of a celebrated marabout, Sidi Embarek, who lived in the 17th century. Dellys (3275), 50 m. by sea E. of Algiers, has a small harbour sheltered from the W. and N.W. winds only. It is a walled town regularly laid out, built by the French on the site of the Roman Ruscurium, the western ramparts of which may still be seen. Jijelli (4878), on the eastern side of the Gulf of Bougie, occupies the site of the Roman colony of Igilgilis. The old town, built on a rocky peninsula, was completely destroyed by earthquake in 1856. A new town arose eastward of the former site, which is now restored as a citadel. Twenty miles by sea west of Philippeville is Collo (2258), a city of considerable importance during the Roman occupation. It was the Kollops Magnus of Ptolemy.

Twenty-three miles S.W. by rail from Algiers is Bufarik (the "hanging well"); pop. 5980. A thoroughly French town, it dates from 1835, when General Drouet d'Erlon established there an entrenched camp on a hillock in the midst of a pestilential swamp. Soon afterwards Marshal Clausel began to build a regular city, which was at first called Medina Clausel in his honour. The draining of the site and neighbourhood was a costly undertaking, and was only accomplished by the sacrifice of many lives. The town, surrounded by vast orchards and farms, is now one of the most flourishing in the country; and the most important market in the colony for the sale of cattle and agricultural produce is held there. Sixty-three miles S.W. of Algiers is Medea (4030)—supposed to stand on the site of a Roman town—finely situated on a plateau 3000 ft. above the sea. It is surrounded by a wall pierced by five gates. An ancient aqueduct is built into the eastern side of the wall. The town, which was chosen by the Turks as capital of the beylik of Titeri, is now French in character. Miliana (3991), which occupies the site of the Roman Milliana, lies about midway between Blida and Orleansville, is 2400 ft. above the sea, and is built on a plateau of the Zakkar mountains, commanding magnificent views of the valley of the Shelif. It possesses few remains of antiquity. An old Moorish minaret has been turned into a clock tower. The town, which is walled, has been rebuilt by the French. The chief streets are bordered by trees and have streams of water.

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[1] The figures given are not those of the communes, but of the towns proper, certain classes of persons (such as troops, lunatics, convicts) excluded from the municipal franchise not being counted.

running down either side. Hammam R'Irha to the N.E. of Miliana, noted from the time of the Romans for its thermal springs, occupies a picturesque position 1800 ft. above the sea. Being the only place within easy distance of western Europe where patients can take with safety a course of baths during the winter months, it has become a resort of invalids. Orleansville (3510), on the extensive plain of the Shelif, 130 m. S.W. by rail from Algiers, and 132 m. N.E. from Oran, is an important military station. The basilica of St Reparatus, discovered in 1843, was allowed to be used as a public stable and has been completely destroyed. There was in it a beautiful mosaic of which, fortunately, drawings exist. From this it appears that the church was built in A.D. 324, and that St Reparatus, bishop of the diocese, was buried in it in 475. Orleansville occupies the site of the Roman Castellum Tingitanum.

Ninety miles S.W. of Bougie is Aumâle (2350), a town and military post established by the French in 1846 on the site of the ancient Auzia. The Roman town was founded in the reign of Augustus, and it flourished for two centuries before it disappeared from history. Out of the materials of the ancient city the Turks built a fort, which at the time of the French occupation was itself a heap of ruins. Setif (12,261), the Sitifis Colonia of the Romans, is 50 m. S.E. of Bougie and 97 m. by rail W. of Constantine. It stands 3573 ft. above the sea, and is the junction of several great lines of communication. Its market is attended by Kabyles, Arabs of the plateaus and people from the Sahara. The town has been entirely rebuilt in the French style. Most of the Roman ruins, even those existing at the time of the French occupation (1839), have disappeared. The walls of the Roman city, restored probably by the Byzantines, have been incorporated in the French walls, which are pierced by four gates. Batna (5279), a walled town 3350 ft. above the sea, 50 m. S. of Constantine by the railway to Biskra, commands the passage of the Aures mountains by which the nomads of the Sahara were wont to enter the Tell. Its importance rests on its strategic position. On the railway between Constantine and Bona and 76 m. from the latter, is Guelma (6584), the Roman Kalama, finely situated on the right bank of the Seybuse. The French occupied the place in 1836 and built their town out of the Roman ruins. Thirty miles S.E. of Guelma is Suk Ahras (7602), a station on the railway to Tunis, identified with the Roman city Tagaste, the birthplace of St Augustine.

Towns in the Sahara.—On the southern slopes of the Great Atlas, 2437 ft. above the sea, looking out on the Saharan desert, and 200 m. in a straight line S.W. of Algiers, is the ancient town of El Aghuat (erroneously written Laghouat); pop. 5660. It formerly belonged to Morocco, by whom it was ceded to the Turks towards the close of the 17th century. It was stormed on the 4th of December 1852 by the French, who almost entirely destroyed the Arab town. The modern town contains little of interest, but is an important military station. One hundred and twelve miles S. of El Aghuat, and 36 m. W.N.W. of Wargla, is Ghardaia (pop. 7868), the capital of the Mzab country, annexed by France in 1882. This country consists of seven oases, five in close proximity and two isolated. The town of Ghardaia (in the local documents Taghardeit) is situated on a mosque-crowned hill in the middle of the Wadi Mzab, 1755 ft. above the sea. Ghardaia, which is divided by walls into three quarters, is built of limestone and the houses are in terraces one above the other. The central quarter is the home of the ruling tribe, the Beni-Mzab. The eastern quarter belongs to the Jews, of whom there are about 300 families; the western is occupied by the Medabia, Arabs from the Jebel Amur. The gardens belong exclusively to the Beni-Mzab. According to native accounts the town was founded about the middle of the 16th century. Aghrem Baba Saad, a small ruined town to the west of Ghardaia, is the fortified post in which the Beni-Mzab took refuge when the Turks under Salah Rais (about 1555) attempted unsuccessfully to subjugate the country. Next to Ghardaia the most important Mzabite town is Beni-Isguen (pop. 4016), an active trading centre. Guerrara, one of the two isolated oases, 37 m. N.E. of Ghardaia, contains a flourishing commercial town with 1912 inhabitants.

The caravan route south from Ghardaia brings the traveller, after a journey of 130 m., to the oasis and town of El Golea (pop. about 2500). The town consists of three portions—the citadel on a limestone hill, the upper and the lower town—separated by irregular plantations of date trees. The place is an important station for the caravan trade between Algeria and the countries to the south. It was occupied by the French under General Gallifet in 1873. El Golea was originally a settlement of the Zenata Berbers, by whom it was known as Taorert, and there is still a considerable Berber element in its population. The full Arab name is El Golea'a el Menia'a, or the "little fortress well defended."

Archaeology.—Algeria is rich in prehistoric memorials of man, especially in megalithic remains, of which nearly every known kind has been found in the country. Numerous flints of palaeolithic type have been discovered, notably at Tlemçen and Kolea. Near Jelfa, in the Great Atlas, and at Mechera-Sfa ("ford of the flat stones"), a peninsula in the valley of the river Mina not far from Tiaret in the department of Oran, are vast numbers of megalithic monuments. In the Kubr-er-Rumía—"grave of the Roman lady" (*Roman* being used by the Arabs to designate strangers of Christian origin)—the Medrassen and the Jedars, Algeria possesses a remarkable series of sepulchral monuments. The Kubr-er-Rumia—best known by its French name, *Tombeau de la Chrétienne*, tradition making it the burial-place of the beautiful and unfortunate daughter of Count Julian—is near Kolea, and is known to be the tomb of the Mauretanian king Juba II. and of his wife Cleopatra Selene, daughter of Cleopatra, queen of Egypt, and Mark Antony. It is built on a hill 756 ft. above the sea. Resting on a lower platform, 209 ft. square, is a circular stone building surmounted by a pyramid. Originally the monument was about 130 ft. in height, but it has been wantonly damaged. Its height is now 100 ft. 8 in.: the cylindrical portion 36 ft. 6 in., the pyramid 64 ft. 2 in. The base, 198 ft. in diameter, is ornamented with 60 engaged Ionic columns. The capitals of the columns have disappeared, but their design is preserved among the drawings of James Bruce, the African traveller. In the centre of the tomb are two vaulted chambers, reached by a spiral passage or gallery 6½ ft. broad, about the same height and 489 ft. long. The sepulchral chambers are separated by a short passage, and are cut off from the gallery by stone doors made of a single slab which can be moved up and down by levers, like a portcullis. The larger of the two chambers is 14¾ ft. long by 11 ft. broad and 11 ft. high. The other chamber is somewhat smaller. The tomb was early violated, probably in search of treasure. In 1555 Salah Rais, pasha of Algiers, set men to work to pull it down, but the records say that the attempt was given up because big black wasps came from under the stones and stung them to death. At the end of the 18th century Baba Mahommed tried in vain to batter down the tomb with artillery. In 1866 it was explored by order of the emperor Napoleon III., the work being carried out by Adrian Berbrugger and Oscar MacCarthy.

The Medrassen is a monument similar to the Kubr-er-Rumia, but older. It was built about 150 B.C. as the burial-place of the Numidian kings, and is situated 35 m. S.W. of Constantine. The form is that of a truncated cone, placed on a cylindrical base 106 ft. in diameter. It is 60 ft. high. The columns encircling the cylindrical portion are stunted and much broader at the base than the top; the capitals are Doric. Many of the columns, 60 in number, have been much damaged. When the sepulchral chamber was opened in 1873 by Bauchetet, a French engineer officer, clear evidence was found that at some remote period the tomb had been rifled and an attempt made to destroy it by fire.

The Jedars (Arab. "walls" or "buildings") are in the department of Oran. The name is given to a number of sepulchral monuments placed on hill-tops. A rectangular or square podium is in each case surmounted by a pyramid. The tombs date from the 5th to the 7th century of the Christian era, and lie in two distinct groups between Tiaret and Frenda, a distance of 35 m. Tiaret (pop. 5778), an ancient town modernized by the French, can be reached by railway from Mostaganem. Near

Frenda (2063), which has largely preserved its old Berber character, are numerous dolmens and prehistoric rock sculptures.

Algeria contains many Roman remains besides those mentioned and is also rich in monuments of Saracenic art. For a description of the chief antiquities see the separate town articles, including, besides those already cited, Lambessa, Tebessa, Tipasa and Timgad.

Agriculture.—Ever since the time of the Romans Algeria has been noted for the fertility of its soil. Over two-thirds of the inhabitants are engaged in agricultural pursuits. More than 7,500,000 acres are devoted to the cultivation of cereals. The Tell is the grain-growing land. Under French rule its productiveness has been largely increased by the sinking of artesian wells in districts which only required water to make them fertile. Of the crops raised, wheat, barley and oats are the principal cereals. A great variety of vegetables and of fruits, especially the orange, is exported. A considerable amount of cotton was grown during the American Civil War, but the industry afterwards declined. In the early years of the 20th century efforts to extend the cultivation of the plant were renewed. A small amount of cotton is also grown in the southern oases. Large quantities of *crin végétal* (vegetable horse-hair) an excellent fibre, are made from the leaves of the dwarf palm. The olive (both for its fruit and oil) and tobacco are cultivated with great success. The soil of Algeria everywhere favours the growth of the vine. The country, in the words of an expert sent to report on the subject by the French government, "can produce an infinite variety of wines suitable to every constitution and to every caprice of taste." The culture of the vine was early undertaken by the colonists, but it was not until vineyards in France were attacked by phylloxera that the export of wine from Algeria became considerable. Algerian vineyards were also attacked (1883) despite precautionary measures, but in the meantime the worth of their wines had been proved. In 1850 less than 2000 acres were devoted to the grape, but in 1878 this had increased to over 42,000 acres, which yielded 7,436,000 gallons of wine. Despite bad seasons and ravages of insects, cultivation extended, and in 1895 the vineyards covered 300,000 acres, the produce being 88,000,000 gallons. The area of cultivation in 1905 exceeded 400,000 acres, and in that year the amount of wine produced was 157,000,000 gallons. By that time the limits of profitable production had been reached in many parts of the country. Practically the only foreign market for Algerian wine is France, which in 1905 imported about 110,000,000 gallons.

Fishery is a flourishing but not a large industry. The fish caught are principally sardines, bonito, smelts and sprats. Fresh fish are exported to France, dried and preserved fish to Spain and Italy. Coral fisheries exist along the coast from Bona to Tunis.

Minerals.—Algeria is rich in minerals, found chiefly in the department of Constantine, where iron, lead and zinc, copper, calamine, antimony and mercury mines are worked. The most productive are those of iron and zinc. Lignite is found in the department of Algiers and petroleum in that of Oran. Immense phosphate beds were discovered near Tebessa in 1891. They yielded 313,500 tons in 1905. Phosphate beds are also worked near Setif, Guelma and Ain Beida. There are more than 300 quarries which produce, amongst other stones, onyx and beautiful white and red marbles. Algerian onyx from Ain Tekbalet was used by the Romans, and many ancient quarries have been found near Kleber in the department of Oran, some being certainly those from which the long-lost Numidian marbles were taken. Salt is collected on the margins of the *shats*.

Shipping and Commerce.—The carrying trade between Algeria and France is confined, by a law passed in 1889, to French bottoms. The largest port is Algiers, after which follow Oran, Philippeville and Bona. There is a considerable coasting trade. The average number of vessels entering and clearing Algerian ports each year has been, since 1900, about 4000, with a total tonnage of some 6,500,000. In the coasting trade some 12,000 small vessels are engaged.

Under French administration the commerce of Algeria has greatly developed. The total imports and exports at the time of the French occupation (1830) did not exceed £175,000. In 1850 the figures had reached £5,000,000; in 1868, £12,000,000; in 1880, £17,000,000; and in 1890, £20,000,000. From this point progress was slower and the figures varied considerably year by year. In 1905 the total value of the foreign trade was £24,500,000. About five-sixths of the trade is with or via France, into which country several Algerian goods have been admitted duty-free since 1851, and all since 1867. French goods, except sugar, have been admitted into Algeria without payment of duty since 1835. After the increase, in 1892, of the French minimum tariff, which applied to Algeria also, foreign trade greatly diminished.

The chief exports are sheep and oxen, most of which are raised in Morocco and Tunisia, and horses; animal products, such as wool and skins; wine, cereals (rye, barley, oats), vegetables, fruits (chiefly figs and grapes for the table) and seeds, esparto grass, oils and vegetable extracts (chiefly olive oil), iron ore, zinc, natural phosphates, timber, cork, *crin végétal* and tobacco. Of these France takes fully three-quarters. The import of wool exceeds the export. Sugar, coffee, machinery, metal work of all kinds, clothing and pottery are largely imported. Of these by far the greater part comes from France. The British imports consist chiefly of coal, cotton fabrics and machinery.

Communications.—Algeria possesses a railway system covering over 2000 m. A decree of 1857 granted to the Paris-Lyons Company the right to construct a line linking Algiers with Oran (266 m.) and Constantine (290 m.) and shorter lines joining the seaports to the trunk line, notably Philippeville to Constantine (54 m.). These lines were opened between 1862 and 1871, but it was not until 1879 that a general scheme for railway construction was adopted. A trunk line runs from the frontier of Morocco at Lalla Maghnia, 44 m. W. of Tlemçen, across the Tell to the Tunisian frontier, whence it is continued to the city of Tunis; while traverse railways connect the seaports with the trunk line and with towns to the south, the Philippeville line being continued to Biskra. From Arzeu a line goes south across the plateaus and crossing the Ksur range at a height of 4211 ft. enters the Sahara. Passing Ain Sefra and Figig (372 m. from Arzeu) the line is continued towards Tuat. The normal gauge of the railways is 4 ft. 8½ in.; a few "light lines" have a gauge of 3 ft. 3 in. Algeria is also traversed by a network of roads constructed by the French, of which the *routes nationales* alone are 2000 m. in length. There are complete postal and telegraphic facilities in all parts of the colony save the Saharan Territories, and cable communication with France.

Central Government.—By the Turks the country was divided into four provinces—Algiers and Titeri in the centre and south, Constantine in the east and Mascara or Oran in the west.[1] The last three were governed by beys dependent upon the representative of the Porte resident at Algiers. The Turkish governors were in the 17th century replaced by deys (see below, *History*). The French rule was at first (1830) purely military. In 1834 the post of governor-general was created. Under the direction of the ministry of war that official exercised nearly all the executive power. At the same time a civil administration and consultative council were formed. The principle of unity of authority was set aside by the second republic in 1848, when many of the public services were attached to the corresponding ministries in Paris, and the departments organized on the metropolitan model by division into arrondissements and communes and by placing a prefect at their head. Under Napoleon III. the governor-generalship was abolished, a minister of Algeria and the colonies created (24th of June 1858), and the whole administration conducted from Paris. At the same time the powers of the prefects were augmented and each department given a general council. This arrangement was not of long duration. By decree of the 24th of November 1860, the ministry of Algeria and the colonies was abolished and the office of governor-general re-established with increased powers. This régime, strongly military in its type, ended with the fall of the second empire. After a brief transitional period, a decree of the 29th of March 1871 placed at the head of Algeria a civil governor-general and gave the control in Paris to the ministry of the interior. In 1876, on the initiative of General Chanzy, then governor-general, that official was accorded the right to correspond direct with all the ministers in Paris. This concession led, however, to the diminution of the authority of the governor-general, whose powers were, step by step, absorbed by the various ministries in France. It had its logical end in the system adopted in 1881 and known as the *rattachement*. Under this system the plan of 1848 was carried out more completely, every department of state being placed under one or other of the ministries in Paris, whilst the governor-general became little more than an ornamental personage. After lasting fifteen years the *rattachement* was, with the approval of the legislature, abrogated by decree dated the 31st of December 1896. The opposing principle, that of concentrating power in the hands of the governor-general, was re-affirmed, but in practice was modified by the retention of the direction from Paris of a few of the public services. The decree of 1896, which was of a provisional character, was replaced by another, dated the 23rd of August 1898, defining the powers of the governor-general under the new scheme. By a law of the 19th of December 1900, Algeria was constituted a legal personality, with power to own goods, contract loans, &c., and a decree of 1901 placed the customs department, until then directed from Paris, under the control of the governor-general, whose hands were also strengthened in various minor matters.

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[1] This western beylik corresponded roughly with the former sultanate of Tlemçen (*q.v.*).

It will be seen that the form of government is entirely dependent on the will of France. The French chambers alone possess the legislative power, though in the absence of express legislation decrees of the head of the state have the force of law. To the legislature in Paris Algeria elects three senators and six deputies (one senator and two deputies for each department). The franchise is confined to "citizens," in which category the native Jews are included by decree of the 24th of October 1870. The Mahommedans, who number nearly eight-ninths of the population, are not, however, "citizens" but "subjects," and consequently have not the vote. They can, however, acquire "citizenship" at their own request, by placing themselves absolutely under the civil and political laws of France (decree of 1865, confirmed in 1870). The number of Mahommedans who avail themselves of this rule is very small; naturalizations do not exceed an average of thirty persons a year. For certain specified objects, financial and municipal, Mahommedans are, however, permitted to exercise the franchise.

The actual form of government may be summarized thus:—At the head of the administration in Algeria is a governor-general, who exercises control over all branches, civil and military, of the administration, except the services of justice, public instruction and worship (as far as concerns Europeans) and the treasury. He corresponds directly with the other Barbary states; draws up the budget, and contracts loans on behalf of the colony. The governor-general is assisted by:—

(1) The Council of Government, a purely advisory body, composed entirely of high officials;

(2) A Superior Council, composed partly of elected and partly of nominated members, including representatives of the Mahommedans. Its duty is to deliberate upon all administrative matters, including the budget, and it possesses certain powers over the finances;

(3) The Financial Delegations (created by decree in 1898), an elective body whose duty is to investigate all matters affecting taxation and to vote the budget. The delegations consist of representatives of (*a*) "colonists," *i.e.* the *rural* community; (*b*) taxpayers, being citizens other than "colonists," *i.e.* the *urban* community; (*c*) the Mahommedan population. The last section is partly elective and partly nominated. A proportion of the members of the delegations are elected to the superior council.

Local Government.—The departments, presided over by prefects, are divided into *territoires civils* and *territoires du commandant*. In the regions under civil administration the local organization closely resembles that of France. The country is divided into arrondissements and communes, with most of the apparatus of self-government enjoyed by the corresponding units in France. The canton (in France a judicial area) has, however, no existence in Algeria. In the territoires du commandant, which are the districts farthest from the coast, and in which the European population is small, the prefect is replaced by a high military officer, who exercises all the functions of a prefect.

The prefect of each department is assisted by a general council, consisting of members elected by the citizens and of nominated representatives of the Mahommedan population. The powers of the council correspond to those of the councils in France. Communes are of three kinds: (1) those with full powers, (2) mixed, (3) native. In those of the first kind, modelled on the French communes, the Mahommedans possess the municipal franchise. The "mixed" communes are under an administrator nominated by the governor-general and assisted by a municipal council composed of Europeans and natives. These communes are large areas, each containing several towns or villages. In the territoires du commandant the mixed commune is presided over by a military officer who fulfils the duties of mayor. Native communes are organized on the same plan as those last mentioned. It will be seen that communes do not correspond with any natural unit. The unit among the Mahommedans is the *douar*, a tribal division administered by a cadi. The communes with full powers have each for centre a town with a considerable European population.

By decree of the 14th of August 1905, the frontier between Saharan territory dependent on Algeria and that attached to French West Africa was laid down. The Algerian Sahara was divided into four territories, officially named Tuggurt, Ghardaia, Ain Sefra and the Saharan Oases (Tuat, Gurara and Tidikelt). The governor-general represents the territories in civil affairs; the budget is distinct from that of Algeria and an annual subvention is provided by France.

Finance.—Revenue is derived chiefly from direct taxation, customs and monopolies. The heaviest item of expenditure chargeable on the Algerian budget is on public works, posts and telegraphs and agriculture. Algeria has had a budget distinct from that of France since 1901. This budget includes all the expenses of Algeria save the cost of the army (estimated at £2,000,000 yearly) and the guarantee of interest on the railways open before 1901. Both these items are borne by France. The Algerian budget for 1906 showed revenue and expenditure balancing at £3,820,000. The country has a debt (1905), including capital, annuities and interest, of some £3,400,000.

Defence.—The military force constitutes the XIX. army corps of the French army. There are in addition a territorial army reserve and a special body of troops, largely Arab, for the defence of the Saharan territory. The troops quartered in Algeria exceed 50,000. The defence of the coast is provided by the French navy.

Land Tenure.—The colonization of Algeria by the French has been greatly hampered by the system of land tenure which they found in force. Except among the Kabyles, private property in land was unknown. Amongst the Arabs, lands were either held in common by a whole tribe, under a tenure known as the *arch* or *sabegha*, or sometimes, especially in the towns, under a modified form of freehold (*melk*) by the family. At the same time the boundaries of property were ill defined and difficult to determine. This system made it impossible for French immigrants to obtain land by lawful transfer. The only lands at the outset available for settlement were, in fact, the confiscated domains of the dey. The obvious solution of the difficulty was to encourage the free movement of real estate by substituting private ownership for the traditional system. Before doing this, however, it was necessary to define the limits of tribal properties already existing—a work of great difficulty—with a view to their ultimate division, and at the same time to guard against any premature traffic in the rights of Arabs in the lands about to be divided. A *sénatus-consulte* of 1863 laid the basis for the change in the land system by providing (1) for the delimitation of the territory of each tribe, (2) for the repartition of the territory thus delimited among newly formed tribal divisions (douars or communes), and (3) for the recognition of private ownership by the issue of title deeds for such individual or family property (*melk*) as already existed. The purpose of this excellent law, which would have laid firmly the basis for gradual change, was defeated by the impatience of the French colonists. At the instance of their representatives in the chambers it was abandoned in 1870, and was not revived till seventeen years later. A law was passed in 1873, and amended in 1887, legalizing the immediate conversion of tribal and family property into private freehold. The result has been disappointing. For the most part, the Arab tribes have been reluctant to avail themselves of their new powers, and where they have done so the hasty reversal of the traditions of centuries has proved demoralizing to the natives, without any sufficient equivalent in the way of healthy French colonization. The main profit has been reaped by Jewish usurers.

The state domains were exhausted by 1870, but were again replenished by the large confiscations which followed the Arab revolt of 1871. Government lands were originally given free to applicants, but with a provisional and insecure title, which made it impossible for poor colonists to borrow money on their land. This was modified by a law of 1851. But ultimately, the results not being satisfactory, the precedent of Australia was followed, and by a law of 1860 domain lands were sold publicly at a fixed price. This had the effect of attracting more and a better class of immigrants, but was none the less reversed in 1881.

In September 1904, a new scheme, intended to attract more European settlers, was adopted. The lands of the state—other than woods and forests—but especially the barren lands and brushwoods situated in the plains, were offered for colonization, to be disposed of (1) by sale at a fixed price, (2) by auction, and (3), in certain cases, by agreement. Purchasers were to be Frenchmen, or Europeans naturalized as French citizens, who had never held "colonization lands"; and they were obliged, under pain of forfeiture, either to take up residence themselves on their property within six months and to live on it and exploit it for a period of ten years, or else to place on the land another family fulfilling the same conditions. If the purchaser farmed the land himself and made satisfactory progress, the period of obligatory residence was reduced to five years. When the interests of colonization required it, free gifts of land might be made; in which case the grantee must himself exploit his concession. In no case might land acquired under this scheme be let to natives until after the expiration of ten years.

For the purpose of creating villages, land was put at the disposition of societies or individuals, who undertook to people them with immigrants fulfilling the same conditions as independent settlers. Two-thirds of the villagers were to be French immigrants, the other third Frenchmen or naturalized Frenchmen already settled in Algeria. To favour the establishment of special industries, the governor-general was given power to authorize the introduction of foreign instead of French immigrants. The societies or individuals undertaking village settlements must do so from philanthropic motives, inasmuch as within two years of the founding of a village, the land, under pain of forfeiture to the state, must be transferred gratuitously to the villagers. As will be seen, settlement on the land by Europeans is hampered by official restrictions, especially by the stringent regulations as to residence.

Justice.—Two judicial systems exist in Algeria—native and French. Native courts decide suits between Mahommedans. From the decision of the cadis appeal lies to the French courts. The French system provides, for civil cases, a court of first instance in each of the sixteen arrondissements into which the country is divided. A court of appeal sits at Algiers. There are also tribunals of commerce and justices of the peace with extensive jurisdiction. The criminal courts are organized as in France. Trial by jury has been introduced; but as natives are not allowed to act as jurymen this has often led to serious miscarriages of justice and to excessive severities.

Whilst modifications of the law require special legislation or decree, it has been legally decided that all laws in force in France before the conquest of the country (*i.e.* those anterior to the 22nd of July 1834) are in force in Algeria. In practice the courts allow themselves wide latitude in applying this principle.

Education.—The system of education is complicated by the co-existence of Mahommedan and Christian communities. Before the arrival of the French two kinds of instruction were given, reading and writing being taught in the ordinary schools and higher education—largely theological—in *medressas* (colleges), usually attached to the chief mosques. Attempts by the French to improve the education of the natives were at first marked by hesitation and long periods in which little or nothing was done. The provision for the instruction of the European and Jewish population was also inadequate. In 1883 a law was passed for the reorganization of the systems in force, and primary instruction was made compulsory for Europeans and Jews, whilst in the case of Mahommedans discretion in the establishment of schools was vested in the governor-general.

Attempts are made to assimilate the Mahommedan population by means of Franco-Arab primary and secondary schools, which supplement the purely French and purely Arab establishments of the same character. These attempts meet with little success, owing in part to racial prejudice and in part to the indifference of the Arabs to education. Few Moslems attend the secondary schools. Purely Mahommedan higher schools exist at Algiers, Tlemçen and Constantine. From these establishments the ranks of native officials are recruited. There is one secondary school for Moslem girls. The education provided for Europeans resembles in most respects that given in France. (The *lycées* at Algiers, Oran and Constantine are open to Mahommedans, but few take advantage of them.) Besides the government schools there are establishments conducted by clerics and laymen. The best girls' schools are generally those kept by nuns. At Algiers there is an establishment with faculties of law, medicine and pharmacy, science and letters. At Oran is a college for European girls. The scholars attending primary schools number about 150,000 (over 100,000 being Europeans and some 15,000 Jewish) and those at secondary schools about 6000. (F. R. C.)

HISTORY

Africa Minor.

From a geographical point of view Algeria, together with Morocco and Tunisia, from which it is separated only by artificial and purely political frontiers, forms a distinct country, which it is convenient to designate by the name of *Africa Minor*. Both historically and geographically, Africa Minor belongs much more to the Mediterranean world than to the African. All the foreign invaders who successively established their dominion over this country either crossed the Mediterranean or followed its shores. The Phoenicians, the Romans, the Vandals, the Byzantines, the Arabs, the Turks and the French, all came from the east or from the north. The history of Africa Minor is the history of all those foreigners who have successively endeavoured to exploit this land, the history of their divers civilizations struggling against an ever-renascent barbarism.

The political divisions of Africa Minor have changed many times, for, as the country has no natural centre, many towns have aspired to play the rôle of capital. The rivalry of these towns is intimately connected with the struggles and insurrections which have stained the land with blood. The existing division—viz. Morocco, Algeria and Tunisia—dates back to the time of the Turkish dominion. It is since that time only that the expression Algeria has been in use.

At the beginning of the 16th century the native dynasties

Struggle with Spain.

which divided Africa Minor between them—the Marinides at Fez, the Abd-el-Wahid at Tlemçen, and the Hafsides at Tunis—were without strength and without authority. Two nations, then at the height of their power, Spain and Turkey, disputed the empire of the Mediterranean. The Spaniards took Mers-el-Kebir (1505), Oran (1509), and Bougie and Tripoli (1510). Two Turkish corsairs, Arouj and his brother, Khair-ed-Din (otherwise known as Barbarossa), at first established in the island of Jerba and afterwards at Jijelli, disputed with the Spaniards the dominion of the country. Arouj seized Algiers (1516); Khair-ed-Din, succeeding him in 1518, did homage for his conquest to the sultan at Constantinople, who named him beylerbey and sent him soldiers (1519). Then began the struggle of the Turks with Spain. In 1541 the emperor Charles V. undertook a great expedition against Algiers. He succeeded in landing, and proceeded to attack the town. But during the night of the 26th of October a violent storm destroyed a great part of his fleet. His provisions and his ammunition were lost, his army was compelled to retreat with considerable loss, and the emperor had to re-embark with the remnant of his troops. This check completely discouraged the Spaniards and assured success to the Turks. The Spanish garrisons established in the coast towns, badly paid and left without reinforcements, had difficulty in defending themselves. In the end, the only towns the Spaniards retained on the Algerian coast were Oran and Mers-el-Kebir. These two towns, taken by the Turks in 1708 and retaken by the Spaniards in 1732, were finally abandoned in 1791.

Barbary corsairs.

Under the Turkish dominion Algeria had originally at its head a beylerbey resident at Algiers. He controlled three beys:—the bey of Titeri in the south, the bey of the east at Constantine, and the bey of the west who resided at Mascara and afterwards at Oran. These three beys existed till 1830. The beylerbeys were replaced in 1587 by pashas sent triennially by the Porte. But the authority of these pashas, strangers to the country, was always precarious. They found themselves, in fact, in conflict with two forces, which in principle were in their service, but which in reality held the power—the *taïffe des reis*, otherwise called the corporation of the corsairs (see BARBARY PIRATES), and the janissaries, a kind of military democracy in which each member was promoted according to seniority. In 1669 the corsairs drove out the pasha, and put into his place a dey elected by themselves. After some fruitless attempts Turkey ceased to send pashas to Algiers—where they were not allowed even to land—and thus recognized the *de facto* independence of this singular republic. The authority of the deys, moreover, was scarcely more solid than that of the pashas. They trembled before the janissaries, who from the 18th century elected and deposed them at their pleasure.

The relations which the European powers were able to maintain with northern Africa were at that time difficult and uncertain. Ships trading in the Mediterranean were seized by the corsairs, who pillaged the coasts of Europe, carried off their captives to Algiers, and destroyed the fishing and commercial settlements founded by the Marseillais on the shores of Africa. The Christian governments either uttered useless and impotent complaints at Constantinople, or endeavoured to negotiate directly with Algiers, as in the case of the negotiations of Sanson Napollon during the ministry of Richelieu. More rarely their patience became exhausted, and ships were sent to bombard this nest of pirates. Two naval demonstrations were made by France during the reign of Louis XIV., one by Abraham Duquesne in 1682, and the other by Marshal Jean d'Estrées in 1688, but these repressive measures were too intermittent to produce a durable effect.

In 1815 at the congress of Vienna, and in 1818 at the congress of Aix-la-Chapelle, the powers endeavoured to concert measures to put an end to the Barbary piracy. Nevertheless the naval demonstrations made by Lord Exmouth in 1816, and by a combined English and French squadron in 1819, remained equally fruitless. But the result which the European powers in concert had been unable to achieve, was brought about by the accidental circumstances which led France to undertake alone an expedition against Algiers.

French intervention.

Some difficulties had arisen between France and the dey of Algiers with reference to the debts contracted to Bacri and Busnach, two Algerine Jews who had supplied corn to the French government under the Directory. This question of interest would not have been sufficient in itself to bring about a rupture, but the situation became acute when the dey, Hussein, struck the French consul, Deval, on the face with his fly-flap (April 30, 1827). Thereupon the port of Algiers was blockaded. The minister of war, the duc de Clermont-Tonnerre, would have gone further, but the president of the council, the comte de Villèle, opposed the sending of an expedition, while in the Martignac ministry M. de la Ferronays, minister of foreign affairs, was bent upon negotiating. It needed a second insult—the firing on "La Provence," a vessel carrying a flag of truce, in the harbour of Algiers (August 3, 1829)—to spur the French government to further action than an ineffectual blockade. An expedition against Algiers was then decided upon, and Marshal de Bourmont, the minister of war, himself took the command. On the 14th of June 1830 the French troops landed at Sidi-Ferruch. On the 19th of June they beat the enemy at Staoueli. On the 4th of July the *fort de l'Empereur* was blown up. On the 5th of July Algiers capitulated. Some days later the dey was deported, as well as the greater part of the janissaries. Those who were not married were conveyed immediately to Asia Minor; the rest had permission to remain, but in fact they left the country soon afterwards.

Meanwhile the revolution of July 1830 had broken out in France. The new government found itself very much embarrassed by the situation bequeathed by the Restoration. The more serious section in parliament were frankly opposed to the idea of conquering or of colonizing Algeria; on the other hand, popular sentiment was hostile to evacuation. The French government—fearing to displease the other powers by following up its conquest, and hampered in particular by its engagements towards England, yet conscious that the only means of putting an end to the piracy was to remain—decided provisionally in favour of that intermediate system, called restricted occupation, which consisted in occupying merely the principal seaports and awaiting events. The Algerians extricated the government from its difficulty by attacking the French troops, who were obliged to defend themselves. The natives gained some successes, and it became necessary to avenge the honour of the flag. In this gradual manner were the French led to conquer Algeria.

General Bertrand Clausel, who succeeded Marshal de Bourmont, was one of the few men who at that period dreamed of conquering and colonizing Algeria. His enthusiastic confidence knew no obstacles. If the dey had left, the three beys remained. With the feeble resources at his disposal Clausel undertook an expedition against Bu-Meyrag, the bey of Titeri, took from him Blida and Medea, dismissed him, replaced him by a successor devoted to France, and returned to Algiers after having left a garrison in Medea. Then, not having the means of directly extending the rule of France to the east or west, Clausel devised a system of protectorates. He negotiated directly with the bey of Tunis with a view to installing as beys at Oran and Constantine Tunisian princes who recognized the authority of France. But the events which were taking place in Europe made it imperative to send home a part of the army of Africa, and Medea had to be evacuated. At the same time the negotiations set on foot with the bey of Tunis were censured by the government, and General Clausel was recalled (February 1831).

The period of uncertainty was prolonged under his successors, General Pierre Berthezène (February to December 1831), A. J. M. R. Savary, duc de Rovigo (December 1831 to March 1833), General Avizard (March to April 1833), and General Voirol (April 1833 to September 1834). The French, not yet certain whether or not they would retain Algeria, remained on the defensive. At the time they occupied only the three towns of Algiers, Bona and Oran, with their suburbs, where their situation was moreover singularly precarious. The Arabs would pillage the suburbs and run away. Sometimes they cut off supplies by ceasing to bring provisions to the market, but the French were not to be turned aside by such tactics.

At Algiers the energies of the French were devoted to protecting themselves against the incursions of the Hajutas. This was sufficient to absorb the attention of the general-in-chief, who left the guardianship of the east and west to the initiative of the generals established at Bona and Oran. At Bona, where General Monk d'Uzer was in command till 1836, things went fairly well. At once firm and conciliatory, he had been able to attach to the French cause the natives whom the cruelty of Ahmed, bey of Constantine, had alienated. The occupation of Bougie by General Camille Alphonse Trézel in October 1833 gave the French a footing at another point of this eastern province. But at Oran, where General Desmichels had succeeded General P. F. X. Boyer in the spring of 1833, their situation was much less favourable. There the French had found a redoubtable adversary in the young Abd-el-Kader, who had been proclaimed amir at Mascara in 1832.

Abd-el-Kader.

A man of rare intelligence, a fearless horseman and an eloquent orator, Abd-el-Kader had acquired a great reputation by his piety. He reunited under his sway the tribes that had hitherto been divided, and infused a unique spirit into their resistance. For fifteen years he held the French in check, treating on terms of equality with their government. Moreover, the treaty which General Desmichels had the weakness to sign with him on the 24th of February 1834 greatly improved his position. In pursuance of this treaty, French officers were to represent their country at the court of the amir; while the amir on his part was represented in the three French coast towns, Oran, Arzeu and Mostaganem, by vakils who immediately began to act as masters of the natives. Such was the situation at the period when, the French having at last resolved to keep Algeria, the ordinance of the 22nd of July 1834 laid down the bases of the political and administrative organization of the "French possessions in the north of Africa," at the head of which was placed a governor-general. But this date (July 22, 1834), very important from a judicial point of view, is much less so from a historical point of view. The position of the first governor-general, Jean Baptiste Drouet d'Erlon (1765–1844), remained fully as precarious as that of his predecessor. During this time the power of Abd-el-Kader increased. Master of the province of Oran, he crossed the Shelif at the appeal of the natives, the people flocking to witness his progress as that of an emperor. He entered Miliana and Medea, where he installed beys of his own choice. All the western part of Algeria belonged to him. General Trézel, who had succeeded General Desmichels at Oran, resolved to march against the amir, but was defeated on the banks of the Macta (June 1835). This defeat shook public opinion. Drouet d'Erlon was recalled and replaced by Marshal Clausel.

In short, five years after the capitulation of Algiers, the French dominion extended as yet over only six coast towns. Clausel, who returned with the same colonial ambitions as in 1830, resolved to conquer the interior of the country. He marched against the amir, defeated him and entered Mascara. Then he proceeded to deliver the inhabitants of Tlemçen, who had been attacked by Abd-el-Kader, and there he left a garrison. Turning towards the east, Clausel organized at Bona the first expedition against Constantine. This failed, and the only result of it was the occupation of Guelma. Clausel was recalled and replaced by General C. M. D. Damrémont (February 1837). The task of maintaining the position of France was then divided between Thomas Robert Bugeaud (1784–1849), acting independently in the west, and Damrémont, who directed all his efforts towards the east. By the signature of the celebrated treaty of the Tafna (June 1, 1837), Bugeaud made peace with Abd-el-Kader. In return for a vague recognition of the sovereignty of France in Africa, this treaty gave up to the amir the whole of western Algeria. France reserved to herself only Oran and its environs, Mazagran, Algiers and the Metija; she gave up Tlemçen and the Titeri beylik. This was a triumph for Abd-el-Kader, who regarded the peace as but a truce which would allow him time to gain strength to resume the war under more favourable conditions.

Damrémont, on his part, directed a second expedition on Constantine. The town was taken, but Damrémont was killed (October 1837). Marshal Sylvain Charles Valée (1773–1846), who replaced him, founded Philippeville to serve as a seaport for the region of Constantine, occupied Jijelli, and at the head of the expeditionary column returned from Constantine to Algiers by the interior, passing through Setif and les Portes de fer. Abd-el-Kader maintained that the French had thus violated the treaty of the Tafna, and began the war again. For two years his power had been increasing. A whole hierarchy of khalifas, aghas and caids obeyed him. He had a regular army of 8000 infantry and 2000 cavalry, without counting 50,000 *goums* (bodies of Arab horsemen) brought by the khalifas. He was well furnished with war material, possessing magazines and arsenals in the heart of the Tell. He had attacked and subjugated all who were not willing to recognize his authority. Under his influence old rivalries were effaced; at his voice all the tribes joined in the holy war. On the 18th of November 1839 he sent his declaration of war to Marshal Valée, but the impatient Hajutas had already devastated the Metija. Marshal Valée marched against Abd-el-Kader, and at first gained some successes: the French occupied Cherchel, Medea and Miliana. But at the end of 1840 Valée was recalled and replaced by Bugeaud, who adopted totally different tactics. The system of Marshal Valée had been the defensive: he multiplied the fortified posts in order to draw the enemy to a spot chosen beforehand. Bugeaud resolutely adopted the offensive, reduced the weight carried by the soldiers in order to increase the mobility of his troops, and carried the war into the province of Oran, from which Abd-el-Kader drew his principal resources. One after the other, all the magazines of the amir—those at Takdempt, Boghar, Taza, Saida and Sebdu—were taken and destroyed. In the spring of 1843 the duc d'Aumale had an opportunity of surprising the *smala* (camp) of Abd-el-Kader near Taguin. This was a serious blow for the amir, whose determination to continue the contest was, however, as strong as ever. He took refuge in Morocco, and induced that power to declare war on the French on the pretext that they would not give up the frontier post of Lalla-Maghnia. Morocco was soon vanquished. While François, prince de Joinville, was bombarding Tangier and Mogador, Bugeaud gained the victory of the Isly (August 1844). Morocco signed a treaty of peace at Tangier on the 10th of September 1844.

The struggle, however, was not ended. Islam made a supreme effort in Algeria. The Dahra and the Warsenis rose at the voice of a fanatic called Bu-Maza ("the goat man"), a *Khuan* of the order of the Mouley-Taïeb. Elsewhere other "masters of the hour," false Bu-Mazas, rose. Abd-el-Kader reappeared in Algeria, which he overran with a rapidity which baffled all pursuit. He beat the French at Sidi Brahim, raided the tribes of the Tell Oranais which had abandoned him, penetrated as far as the borders of the Metija, and reached the Jurjura, where he endeavoured to rouse the Kabyles. But his eloquence offended the narrow and cramped particularism of those little democratic cities, deaf to the sentiment of the common interest. From that time he played a losing game. He returned toward the west, penetrating farther and farther to the south. Badly received by the great aristocratic family of the Walid-sidi-Sheikh, he re-entered Morocco, but the emperor of that country, dreading his influence and fearing difficulties with the French, drove him out. This was the end. On the 23rd of December 1847 Abd-el-Kader surrendered to General Lamoricière in the plains of Sidi-Brahim. His adversary, Bugeaud, was there no longer. Having failed to persuade the French government to adopt his plans of military colonization, he had retired in June 1847 and had been replaced by the duc d'Aumale.

The surrender of Abd-el-Kader marks the end of the period of the conquest. It is true that Great Kabylia had to be subdued only ten years later, and that terrible insurrections still had to be quelled. But at the end of the reign of Louis Philippe the essential work was accomplished. All that remained was to complete and to secure it.

French progress.

Under the second republic Algeria was governed successively by Generals L. E. Cavaignac (February to April 1848), N. A. T. Changarnier (April to September 1848), V. Charon (September 1848 to October 1850), and A. H. d'Hautpoul (October 1850 to December 1851). The policy followed at this period consisted in assimilating Algeria to France. Important efforts were made to attract French colonists to the country, the colonization of Algeria appearing as a means towards the extinction of pauperism in the mother-country. This point of view suggested numerous projects, as chimerical as they were generous; two millions sterling (50 million francs) were expended with a view to installing Parisian unemployed workmen as colonists, but this attempt failed miserably. The most remarkable military events of this period were (1) the siege and destruction of the oasis of Zaatcha, where the inhabitants, displeased by an alteration in the tax on palms, rose at the voice of a fanatic named Bu-Zian; (2) the ineffectual campaign of Marshal Saint Arnaud in Little Kabylia, where the tribes rose at the instigation of Bu-Magla ("the mule man") in 1851.

Marshal J. L. C. A. Randon (1795–1871), named governor-general of Algeria after the *coup d'état*, had at first to repress in the south a rising of a new "master of the hour," Mahomet ben Abdallah, the sherif of Wargla. A column seized Laghouat (El Aghuat) in December 1852. Si-Hamza, leader of the Walid-sidi-Sheikh, an ally of France, indignant at the growing influence of a base-born agitator, pursued him and seized Wargla (1853). In 1854 General Desvaux entered Tuggurt. Henceforth matters remained quiet in the region of the Sahara, and Marshal Randon turned his efforts towards Kabylia. Neither the Romans nor the Turks had been able to subdue this square mountainous tract, of which Bougie, Setif, Aumâle and Dellys form the four corners. But in two months (May to June 1857) Marshal Randon made himself master of it, and built in the heart of this country Fort Napoleon (now Fort National), "the thorn in the side of Kabylia," whose batteries commanded all the Kabyle villages of the region.

In 1858 the creation of a "ministry of Algeria and of the colonies" brought about the resignation of Marshal Randon. The administrative headquarters of Algeria was then transferred from Algiers to Paris. The ministry of Algeria was entrusted first to Prince Napoleon, and afterwards to the marquis J. N. S. P. de Chasseloup-Laubat (1805–1873). But this office, created at the least prematurely, soon disappeared without causing any regrets. This ephemeral régime lasted from the 24th of June 1858 to the 24th of November 1860. The decree of the 24th of November 1860 transferred the services from Paris back to Algiers, and re-established the functions of governor-general, which were exercised at the end of the second empire first by Marshal Pélissier, duc de Malakoff (December 1860 to September 1864) and then by Marshal MacMahon, duc de Magenta (September 1864 to July 1870). At this period the conception of the *Arab kingdom* was prevalent. The emperor Napoleon III., in a celebrated letter, wrote that he was as much the emperor of the Arabs as the emperor of the French. Algeria was considered as a kind of great military fief, and the officers who ruled there commonly took the side of the native chieftains against the civil population. European colonization, hampered by the ill-will of the Arab bureaux, then made little progress.

Revolt of 1864-1871.

It was at this period that the great insurrection of the Walid-sidi-Sheikh broke out in the Sud Oranais. This powerful family had lived up to that time on a good understanding with France; Si-Hamza, chief of the elder branch, had remained until his death (1861) a faithful ally of France. Thanks to him, the security of the southern frontier was assured. But after his death his son, Si-Sliman, imbued with anti-French sentiments, revolted in 1864 and massacred the Beauprêtre column. Several years were occupied in quelling the insurrection. Compelled to guard themselves on the south against the Walid-sidi-Sheikh, the French realized how much they lost by not having the support of these great chieftains. They then accepted the services offered to them by Si-Sliman-ben-Kadour, chief of the younger branch of the Walid-sidi-Sheikh, who maintained tranquillity in the Sud Oranais during the great insurrection of Kabylia in 1871.

The causes of this insurrection were manifold, and, moreover, interdependent: the injury done to the military prestige of France by its defeats in Europe; the fall of the imperial government, in which, in the eyes of the natives, the authority of France was incarnate; and the insults offered with impunity in the streets by the civil population to the officers, who were loved and respected by the Arabs, at the same time that the decree of Adolphe Crémieux accorded to the Algerine Jews the rights of French citizens. The great native chiefs, bewildered and disquieted, thought themselves menaced. The insurrection was inevitable. Mokrani, bach-agha of the Mejana, whom the imperial government had loaded with honours, gave the signal. He had an interview with El Haddad, the sheikh of the *Khuans*, the religious confraternity of Sidi-Abd-er-Rahman, whose influence was great, and having secured his support in April 1871, Mokrani proclaimed the holy war. At the bidding of El Haddad the whole of Kabylia rose, and numbers of French colonists were massacred; the columns of Colonel Cérez and General F. G. Saussier had to engage in numerous fights. The death of the bach-agha at the battle of Suflat, the submission of the Sheikh El Haddad, and finally the arrest of Bu-Meyrag, brother of Mokrani, mark the declining stages of the insurrection, which was completely suppressed by August 1871. A heavy war contribution was imposed upon the rebels and their lands were sequestrated. The Beni-Manassir, who rose almost at the same time in the Dahra, were subdued soon after. Subsequently the native population of the Algerine Tell remained quiet, the massacre of the colonists at Margueritte many years later being a local and isolated movement.

Since 1870.

Under the third republic Algeria was governed successively by Admiral L. H. de Gueydon (March 1871 to June 1873), General A. E. A. Chanzy (June 1873 to February 1879), J. P. L. Albert Grévy (March 1879 to November 1881), Tirman (November 1881 to April 1891), Jules Cambon (April 1891 to September 1897), Louis Lépine (September 1897 to August 1898), E. J. Laferrière (August 1898 to October 1900), Charles Jonnart (October 1900 to June 1901), A. J. P. Révoil (June 1901 to April 1903), and again Jonnart. During the first years of the new régime a keen reaction was produced against the political system of the imperial government in Africa. The civil territory was considerably enlarged at the expense of the military. An effort was made to attract French colonists to Algeria by gratuitous concessions of land. Some lands were granted in particular to natives of Alsace-Lorraine, who preferred to retain French nationality after the war. Peasants from the south of France, whose vines had been destroyed by the phylloxera, crossed the Mediterranean and established in Algeria an important vineyard. This double current of immigration notably increased the French population of North Africa. The tendency then was to treat Algeria as a piece of France. This assimilative policy attained its culminating point in the so-called decrees of *rattachement* (1881), in pursuance of which each ministerial department in France was made responsible for Algerine affairs which came by their nature within its jurisdiction.

After a great inquiry held in 1892 by a senatorial committee a reaction was produced in France against this excessive assimilation. The system of *rattachement* was in great part abandoned, and decentralization was obtained by augmenting the powers of the governor-general, and by granting to Algeria legal personality and a special budget (see above, *Central Government*). These reforms appear to have given satisfaction to Algerian opinion. Profoundly troubled as Algeria was in the last years of the 19th century by the anti-Semitic agitation, which occasioned frequent changes of governors, it appears to-day to have turned aside from sterile political struggles to interest itself exclusively in the economic development of the country.

The movement of expansion towards the south was continued under the third republic. In 1873 General G. A. A. Gallifet entered El Golea. In 1882 the oasis of Mzab was annexed. In the Sud Oranais an insurrection, fomented by a marabout named Bu-Amama, broke out in 1881, and the insurgents massacred the European labourers engaged in the collection of alfa (or esparto) grass. But soon the French columns re-established peace, and Bu-Amama had to take refuge in Morocco. In 1883 Si-Hamza, chief of the elder branch of the Walid-sidi-Sheikh, made his submission, and since then that family has remained devoted to France.

The attempts at penetration into the extreme south, abandoned after the massacre by Tuareg of a mission sent in 1881, under Colonel Paul Flatters, to study the question of railway communication with Senegal, were begun again in 1890, in which year the British government recognized the western Sahara as within the French sphere. Since then military stations and scientific and commercial exploration have increased. But the results of these efforts remained inconsiderable until the spring of 1900, when the French authorities decided to occupy the oases of Gurara, Tuat and Tidikelt. This being accomplished by March 1901, the conquest of the Algerine Sahara was from that time completed, and nothing any longer hindered the attempts to join Algeria and the Sudan across the Sahara. (A. GIR.)

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The best general maps are those of the *Carte de l'Algérie*, in numerous sheets, on the scale of 1 : 50,000 (published by the *Service géographique de l'Armée*, Paris). (F. R. C.)

ALGHERO, a seaport and episcopal see on the W. coast of Sardinia, in the province of Sassari, 21 m. S.S.W. by rail from the town of Sassari. Pop. (1901) 10,779. The see was founded in 1503, but the cathedral itself dates from the 12th century, though it has been reconstructed. The town was strongly fortified by medieval walls, which have to some extent been demolished. It was originally founded by the Doria family of Genoa about 1102, but was occupied by the house of Aragon in 1354, who held it successfully against various attacks until it fell to the house of Savoy with the rest of Sardinia in 1720. Catalonian is still spoken here. Charles V. visited Alghero on his way to Africa in 1541. The coral and fishing industries are the most important in Alghero, but agriculture has made some progress in the district, which produces good wine. There is a large penal establishment containing over 700 convicts. Seven miles to the W.N.W. is the fine natural harbour of Porto Conte, secure in all weather, and on the W. of this harbour is the Capo Caccia, with two stalactite grottos, the finest of which, the Grotta di Nettuno, is accessible only from the sea. The important prehistoric necropolis of Anghelu Ruju was excavated in 1904 6½ m. N. of Alghero (*Notizie degli Scavi*, 1904, 301 seq.).

ALGIDUS MONS, a portion of the ridge forming the rim of the larger crater of the Alban volcano (see ALBANUS MONS) and more especially the eastern portion, traversed by a narrow opening (now called the Cava d'Aglio) of which the Via Latina took advantage, and which frequently appears in the early military history of Rome. That a distinct town existed (Dion. Halic. x. 21, xi. 3) on the mountain is improbable; there must have been a fortified post, but the extensive castle on the hill (Maschio d'Ariano) to the south of the Via Latina is entirely medieval, a fact which has not been recognized by some topographers.

ALGIERS (Fr. *Alger*, Arab. *Jezair*, *i.e.* The Islands), capital and largest city of Algeria, North Africa, seat of the governor-general, of a court of appeal, and of an archbishop, and station of the French XIX. *corps d'armée*. It is situated on the west side of a bay of the Mediterranean, to which it gives its name in 36° 47′ N., 3° 4′ E., and is built on the slopes of the Sahel, a chain of hills parallel to the coast. The view of the city from the sea is one of great beauty. Seen from a distance it appears like a succession of dazzling white terraces rising from the water's edge. The houses being seemingly embowered in the luxuriant verdure of the Sahel, the effect is imposing and picturesque, and has given rise to the Arab comparison of the town to a diamond set in an emerald frame. The city consists of two parts; the modern French town, built on the level ground by the seashore, and the ancient city of the deys, which climbs the steep hill behind the modern town and is crowned by the *kasbah* or citadel, 400 ft. above the sea. The kasbah forms the apex of a triangle of which the quays form the base.

Extending along the front of the town is the boulevard de la République, a fine road built by Sir Morton Peto on a series of arches, with a frontage of 3700 ft., and bordered on one side by handsome buildings, whilst a wide promenade overlooking the harbour runs along the other. Two inclined roads lead from the centre of the boulevard to the quay 40 ft. below. On the quay are the landing-stages, the custom-house and the railway station. At the southern end of the boulevard de la République is the square de la République, formerly the place Bresson, in which is the municipal theatre; at the other extremity of the boulevard is the place du Gouvernement, which is planted on three sides with a double row of plane trees and is the fashionable resort for evening promenade. The principal streets of the city meet in the place du Gouvernement: the rue Bab Azoun (Gate of Grief) which runs parallel to the boulevard de la République; the rue Bab-el-Oued (River Gate) which goes north to the site of the old arsenal demolished in 1900; the rue de la Marine which leads to the ancient harbour, and in which are the two principal mosques. A large part of the modern town lies south of the square de la République; in this quarter are the law courts, hôtel de ville, post office and other public buildings. The streets in the modern town are regularly laid out; several are arcaded on both sides.

The old town presents a strong contrast to the new town. The streets are narrow, tortuous and inaccessible to carriages. They often end in a *cul-de-sac*. The principal street is the rue de la Kasbah, which leads up to the citadel by 497 steps. The streets are joined by alleys just wide enough to pass through. The houses, built of stone and whitewashed, are square, substantial, flat-topped buildings, presenting to the street bare walls, with a few slits protected by iron gratings in place of windows. Each house has a quadrangle in the centre, into which it looks, and which is entered by a low, narrow doorway. Shops in the native quarter are simply chambers in the walls of the houses, and open at the front. In these shops the few Moorish industries are carried on, such as embroidery in gold and silver thread, the making of kid slippers of every kind and colour, the manufacture of gold and silver ornaments. To European eyes the native city, with its motley throng of Moors, Arabs, Jews and negroes, is the most interesting sight in Algiers. Various squares are set apart for markets, and here are to be witnessed scenes of the greatest animation.

The public buildings of chief interest are the kasbah, the government offices (formerly the British consulate), the palaces of the governor-general and the archbishop—all these are fine Moorish houses; the "Grand" and the "New" Mosques, the Roman Catholic cathedral of St Philippe, the church of the Holy Trinity (Church of England), and the Bibliothèque Nationale d'Alger—a Turkish palace built in 1799–1800. The kasbah was begun in 1516 on the site of an older building, and served as the palace of the deys until the French conquest. A road has been cut through the centre of the building, the mosque turned into barracks, and the hall of audience allowed to fall into ruin. There still remain a minaret and some marble arches and columns. Traces exist of the vaults in which were stored the treasures of the dey. The Grand Mosque (Jamaa-el-Kebir) is traditionally said to be the oldest mosque in Algiers. The pulpit (*mimbar*) bears an inscription showing that the building existed in 1018. The minaret was built by Abu Tachfin, sultan of Tlemçen, in 1324. The interior of the mosque is square and is divided into aisles by columns joined by Moorish arches. The principal façade, in the rue de la Marine, consists of a row of white marble columns supporting an arcade. The New Mosque (Jamaa-el-Jedid), dating from the 17th century, is in the form of a Greek cross, surmounted by a large white cupola, with four small cupolas at the corners. The minaret is 90 ft. high. The interior resembles that of the Grand Mosque. The church of the Holy Trinity (built in 1870) stands at the southern end of the rue d'Isly near the site of the demolished Fort Bab Azoun. The interior is richly decorated with various coloured marbles. Many of these marbles contain memorial inscriptions relating to the English residents (voluntary and involuntary) of Algiers from the time of John Tipton, British consul in 1580. One tablet records that in 1631 two Algerine pirate crews landed in Ireland, sacked Baltimore, and carried off its inhabitants to slavery; another recalls the romantic escape of Ida M'Donnell, daughter of Admiral Ulric, consul-general of Denmark, and wife of the British consul. When Lord Exmouth was about to bombard the city in 1816, the British consul was thrown into prison and loaded with chains. Mrs. M'Donnell—who was but sixteen—escaped to the British fleet disguised as a midshipman, carrying a basket of vegetables in which her baby was hidden. (Mrs. M'Donnell subsequently married the duc de Talleyrand-Perigord and died at Florence in 1880). Among later residents commemorated is Edward Lloyd, who was the first person to show the value of esparto grass for the manufacture of paper, and thus started an industry which is one of the most important in Algeria.

The cathedral of St Philippe, built on the site of a mosque, is in the place Malakoff, next to the governor-general's palace. In its construction an attempt has been made to produce a building suitable for Christian worship whilst the architecture is Moorish in style. The principal entrance, reached by a flight of 23 steps, is ornamented with a portico supported by four black-veined marble columns. The roof of the nave is of Moorish plaster work. It rests on a series of arcades supported by white marble columns. Several of these columns belonged to the former mosque. In one of the chapels is a tomb containing the bones of San Geronimo. The finding of the remains of the saint in 1853 afforded striking confirmation of an incident recorded by a Spanish Benedictine named Haedo, who published a topography of Algeria in 1612. Haedo sets forth that a young Arab who had embraced Christianity and had been baptized with the name of Geronimo was captured by a Moorish corsair in 1569 and taken to Algiers. The Arabs endeavoured to induce Geronimo to renounce Christianity, but as he steadfastly refused to do so he was condemned to death. Bound hand and foot he was thrown alive into a mould in which a block of concrete was about to be made. The block containing his body was built into an angle of the Fort of the Twenty-four Hours, then under construction. In 1853 the Fort of the Twenty-four Hours was demolished, and in the angle specified by Haedo the skeleton of Geronimo was found. The bones were interred at St Philippe. Into the mould left by the saint's body liquid plaster of Paris was run, and a perfect model obtained, showing the features of the youth, the cords which bound him, and even the texture of his clothing. This model is now in the museum at Mustapha (see below).

Algiers possesses a college with schools of law, medicine, science and letters. The college buildings are large and handsome. There is also a lycée in which the instruction is similar to that given in France, and in which Christians, Jews and Mahommedans are educated together. The museum (a state institution), formerly housed in the same building as the library, was transferred in 1897 to a new building in the suburb of Mustapha Supérieur. In the museum are some of the ancient sculptures and mosaics discovered in Algeria, together with medals and Algerian money. New buildings, to contain specimens of Moslem art, were added in 1903.

The port of Algiers is sheltered from all winds. There are two harbours, both artificial—the old or northern harbour and the southern or Agha harbour. The northern harbour covers an area of 235 acres. The depth at the entrance is 72 to 108 ft., and in port from 36 to 66 ft. Two government dry docks are available for merchant vessels. The quays cover 18,000 sq. yds. There are three jetties, north, east and south. Within this harbour is the small harbour of the deys, now transformed into a wet dock. An opening in the south jetty affords an entrance into Agha harbour, constructed in Agha Bay. This harbour is formed by the projection of a mole, 2500 ft. in length, from the eastern jetty of the old harbour. It provides extensive quayage with a minimum depth of water of 28 ft. Agha harbour has also an independent entrance on its southern side. Algiers is the chief coaling station in the Mediterranean, having become so largely at the expense of Gibraltar. In other respects the trade resembles that of other Algerian ports. (For trade statistics see ALGERIA.) The inner harbour was begun in 1518 by Khair-ed-Din (see *History*, below), who, to accommodate his pirate vessels, caused the island on which was Fort Penon to be connected with the mainland by a mole. The lighthouse which occupies the site of Fort Penon was built in 1544. Work on the northern harbour was begun in 1836, on the southern in 1904. Algiers maintains communication with Marseilles by a quick service of steamers, which run the 497 miles across the Mediterranean in twenty-eight to thirty hours. The journey between Algiers and Paris, from which it is distant 1031 miles, is accomplished in about forty-five hours.

Algiers was a walled city from the time of the deys until the close of the 19th century. The French, after their occupation of the city (1830), built a rampart, parapet and ditch, with two terminal forts, Bab Azoun to the south and Bab-el-Oued to the north. The forts and part of the ramparts were demolished at the beginning of the 20th century, when a line of forts occupying the heights of Bu Zarea (at an elevation of 1300 ft. above the sea) took their place.

Owing to the mildness of its climate Algiers has become a favourite resort for those seeking to escape the rigours of a European winter. The city is well supplied with water and its sanitary state is good. The mistral of the Riviera is entirely absent from Algiers, but in summer the city occasionally suffers from the sirocco or desert wind. The environs of Algiers are noted for their beauty and healthiness. Of the suburbs the most picturesque is Mustapha Supérieur, about 2 m. from the centre of the city on the slopes of the hills to the south. Here are the summer palace of the governor-general, many fine Moorish and French villas and luxurious hotels, all surrounded by beautiful gardens. A numerous British colony resides at Mustapha, where there is an English club. Mustapha Inférieur is built on the lower slopes of the hills. Farther to the south is the large Jardin d'Essai, containing five avenues of palms, planes, bamboos and magnolias. Notre-Dame d'Afrique, a church built (1858–1872) in a mixture of the Roman and Byzantine styles, is conspicuously situated, overlooking the sea, on the shoulder of the Bu Zarea hills, 2 m. to the north of the city. Above the altar is a statue of the Virgin depicted as a black woman. The church also contains a solid silver statue of the archangel Michael, belonging to the confraternity of Neapolitan fishermen. Beyond Notre-Dame d'Afrique is the beautiful Valley of the Consuls, very little changed since the time of the deys. (The valley was in those days the favourite residence of the consuls.) At the Petit Séminaire, on the site of the old French consulate, Cardinal Lavigerie died (1892).

In 1906 the population of the commune of Algiers was 154,049; the *population municipale*, which excludes the garrison, prisoners, &c., was 145,280. Of this total 138,240 were living in the city proper or in Mustapha. Of the inhabitants 105,908 were Europeans. French residents numbered 50,996, naturalized Frenchmen 23,305, Spaniards 12,354, Italians 7368, Maltese 865, and other Europeans (chiefly British and Germans) 1652, besides 12,490 Jews. The remainder of the population—all Mahommedans—are Moors, Arabs, Berbers, Negroes, with a few Turks. The vast majority of the Europeans are Roman Catholics. Most of the naturalized French citizens are of Spanish or Italian origin.

History.—In Roman times a small town called Icosium existed on what is now the marine quarter of the city. The rue de la Marine follows the lines of a Roman street. Roman cemeteries existed near the rues Bab-el-Oued and Bab Azoun. Bishops of Icosium—which was created a Latin city by Vespasian—are mentioned as late as the 5th century. The present city was founded in 944 by Bulukkin b. Zeiri, the founder of the Zeirid-Sanhaja dynasty, which was overthrown by Roger II. of Sicily in 1148 (see FATIMITES). The Zeirids had before that date lost Algiers, which in 1159 was occupied by the Almohades, and in the 13th century came under the dominion of the Abd-el-Wahid, sultans of Tlemçen. Nominally part of the sultanate of Tlemçen, Algiers had a large measure of independence under amirs of its own, Oran being the chief seaport of the Abd-el-Wahid. The islet in front of the harbour, subsequently known as the Penon, had been occupied by the Spaniards as early as 1302. Thereafter a considerable trade grew up between Algiers and Spain. Algiers, however, continued of comparatively little importance until after the expulsion from Spain of the Moors, many of whom sought an asylum in the city. In 1510, following their occupation of Oran and other towns on the coast of Africa, the Spaniards fortified the Penon. In 1516 the amir of Algiers, Selim b. Teumi, invited the brothers Arouj and Khair-ed-Din (Barbarossa) to expel the Spaniards. Arouj came to Algiers, caused Selim to be assassinated, and seized the town. Khair-ed-Din, succeeding Arouj, drove the Spaniards from the Penon (1530) and was the founder of the pashalik, afterwards deylik, of Algeria. Algiers from this time became the chief seat of the Barbary pirates. In October 1541 the emperor Charles V. sought to capture the city, but a storm destroyed a great number of his ships, and his army of some 30,000, chiefly Spaniards, was defeated by the Algerians under their pasha, Hassan. Repeated attempts were made by various European nations to subdue the pirates, and in 1816 the city was bombarded by a British squadron under Lord Exmouth, assisted by Dutch men-of-war, and the corsair fleet burned. The piracy of the Algerians was renewed and continued until 1830. On the 4th of July in that year a French army under General de Bourmont attacked the city, which capitulated on the following day (see ALGERIA, *History*).

ALGOA BAY, a wide, shallow bay of South Africa, 436 m. E. from the Cape of Good Hope, bounded W. by Cape Recife, E. by Cape Padrone. St Croix Island in the bay is in 33° 47′ S. 25° 46′ E. On this island Bartholomew Diaz made his second landing in South Africa some time after the 3rd of February 1488, and from the cross which he is thought to have erected on it the island gets its name. Algoa Bay was the first landing-place of the British emigrants to the eastern province of Cape Colony in 1820. At a spot 6 m. N.E. of Cape Recife these emigrants founded a town, Port Elizabeth (*q.v.*), its harbour being sheltered from all winds save the S.E. By seafarers "Algoa Bay" is used as synonymous with Port Elizabeth.

ALGOL, the Arabic name (signifying "the Demon") of β Persei, a star of the second magnitude, noticed by G. Montanari in 1669 to fluctuate in brightness. John Goodricke established in 1782 the periodicity of its change in about $2^d\ 21^h$, and suggested their cause in recurring eclipses by a large dark satellite. Their intermittent character prompted the supposition. The light of Algol remains constant during close upon 56 hours; then declines in 6½ hours (approximately) to nearly one-fourth its normal amount, and is restored by sensibly the same gradations. The amplitude of the phase is 1·1 magnitude; and the absence of any stationary interval at minimum proves the eclipse to be partial, not annular. Its conditions were investigated from photometric data, by Professor E. C. Pickering in 1880;[1] and their realization was finally demonstrated by Dr H. C. Vogel's spectroscopic measures in 1889.[2] Previously to each obscuration, the star was found to be moving rapidly away from the earth; its velocity then diminished to zero *pari passu* with the loss of light, and reversed its direction during the process of recovery. Algol, in fact, travels at the rate of 26·3 miles a second round the centre of gravity of the system which it forms with an invisible companion, while the two together approach the sun with an unvarying speed of 2·3 miles per second. The elements of this disparate pair, calculated by Dr Vogel on the somewhat precarious assumption that its dark and bright members are of equal mean density, are as follows:—

Diameter of Algol	1,061,000 English miles.
" Satellite . . .	834,300 " "
Distance from centre to centre .	3,230,000 " "
Mass of Algol	$\frac{4}{9}$ solar mass.
" Satellite	$\frac{2}{9}$ " "
Mean density	about $\frac{1}{5}$ solar.

The plane of the joint orbit, in which no deviation from circularity has yet been detected, nearly coincides with the line of sight. The period of Algol, as measured by its eclipses, is subject to complex irregularities. It shortened fitfully by eight seconds between 1790 and 1879; soon afterwards, restoration set in, and its exact length in 1903 was $2^d\ 20^h\ 48^m\ 56^s$, being only two seconds short of its original value. By an exhaustive discussion, Dr S. Chandler ascertained in 1888 the compensatory nature of these disturbances;[3] and he afterwards found the most important among several which probably conspire to produce the observed effects, to be comprised in a period of 15,000 light-cycles, equivalent to 118 years.[4] An explanatory hypothesis, propounded by him in 1892,[5] is still on its trial. The system of Algol, according to this view, is triple; it includes a large, obscure primary, round which the eclipsing pair revolves in an orbit somewhat smaller than that of Uranus, very slightly elliptical, and inclined 20° to the line of sight, the periodic time being 118 years. The alternate delay and acceleration of the eclipses are then merely apparent; they represent the changes in the length of the light-journey as the stars perform their wide circuit. If these suppositions have a basis of reality, the proper motion of Algol should be disturbed by a small, but measurable undulation, corresponding to the projection of its orbit upon the sky; and although certainty on the point cannot be attained for some years to come, Lewis Boss regarded the evidence available in 1895 as tending to confirm Dr Chandler's theory.[6]

[1] *Proceedings Amer. Acad.* vol. xvi. p. 27.

[2] *Astr. Nach.* No. 2947.

[3] *Astr. Journal*, No. 165.

[4] *Ibid.* No. 509.

[5] *Ibid.* Nos. 255–256.

[6] *Ibid.* No. 343.

A rival interpretation of the phenomena it dealt with was put forward by F. Tisserand in 1895.[1] It involved the action of no third mass, but depended solely upon the progression of the line of apsides in a moderately elliptical orbit due to the spheroidal shape of the globes traversing it. Inequalities of the required sort in the returns of the eclipses would ensue; moreover, their duration should concomitantly vary with the varying distance from periastron at the times of their occurrence. It is a moot question whether changes of the latter kind actually occur. When they are proved to do so, Tisserand's hypothesis will hold the field.

Algol gives a helium-spectrum which undergoes no alteration at minimum. Hence the light from the marginal and central portions of the disc is identical in quality, and the limb can be little, if at all, darkened by the "smoke-veil" absorption conspicuous in the sun. The rays of this star spend close upon a century in travelling hither. Dr Chase's measures with the Yale heliometer indicated for it, in 1894, a parallax of about 0″·035;[2] and it must, accordingly, be of nearly four times the total brightness of Sirius, while its aerial lustre exceeds seventy-fold that of the solar photosphere. Variables of the Algol class are rendered difficult to discover by the incidental character of their fluctuations. At the end of 1905, however, about 37 had been certainly recognized, besides some outlying cases of indeterminate type, in which continuous occultations by two bright stars, revolving in virtual contact, are doubtfully supposed to be in progress. (A. M. C.)

ALGONQUIN, or ALGONKIN (a word formerly regarded as a French contraction of *Algomequin*, "those on the other side" of the river, viz. the St Lawrence, but now believed to be from the Micmac *algoomaking*—"at the place of spearing fish"), a collective term for a number of tribes of North American Indians dwelling in the valley of the Ottawa river and around the northern tributaries of the St Lawrence. The Algonquins allied themselves with the French against the Iroquois. Many were driven west by the latter and later became known as Ottawa. The French missionaries at work among the Algonquins early in the 17th century found their language to be the key to the many Indian dialects now included by philologists under the general term "Algonquian stock." The chief tribes included in this stock were the Algonquin, Malecite, Micmac, Nascapi, Pennacook, Fox, Kickapoo, Delaware, Cheyenne, Conoy, Cree, Mohican, Massachuset, Menominee, Miami, Misisaga, Mohegan, Nanticoke, Narraganset, Nipmuc, Ojibway, Ottawa, Pequot, Potawatami, Sac, Shawnee and Wampanoag. The Indians of Algonquian stock number between 80,000 and 90,000, of whom rather more than half are in the United States, the rest being in Canada. Of the Algonquins proper there remain about 1500 settled in the provinces of Quebec and Ontario.

For details see *Handbook of American Indians*, ed. F. W. Hodge, Washington, 1907.

ALGUAZIL, a Spanish title often to be met in stories and plays, derived from the Arabic "*vizir*" and the article "*al*." The alguazil among the early Spaniards was a judge, and sometimes the governor of a town or fortress. In later times he has gradually sunk down to the rank of an officer of the court, who is trusted with the service of writs and certain police duties, but he is still of higher rank than the mere *corchete* or catch-poll. The title has also been given to inspectors of weights and measures in market-places, and similar officials.

ALGUM, or ALMUG TREE. The Hebrew words *Algummim* or *Almuggim* are translated Algum or Almug trees in the authorized version of the Bible (see 1 Kings x. 11, 12; 2 Chron. ii. 8, and ix. 10, 11); *almug* is an erroneous form (see Max Müller, *Science of Language*, vol. i.). The wood of the tree was very precious, and was brought from Ophir (probably some part of India), along with gold and precious stones, by Hiram, and was used in the formation of pillars for the temple at Jerusalem, and for the king's house; also for the inlaying of stairs, as well as for harps and psalteries. It is probably the red sanders or red sandal-wood of India (*Pterocarpus santalinus*). This tree belongs to the natural order Leguminosae, sub-order Papilionaceae. The wood is hard, heavy, close-grained and of a fine red colour. It is different from the white fragrant sandal-wood, which is the produce of *Santalum album*, a tree belonging to a distinct natural order Santalaceae.

ALHAMA DE GRANADA, a town of southern Spain, in the province of Granada, 24 m. S.W. of Granada. Pop. (1900) 7679. Alhama is finely situated on a ledge of rock which overlooks a deep gorge traversed by the river Marchan or Alhama; while the rugged peaks of the Sierra de Alhama rise behind it to a height of 6800 ft. The town is largely modern; for over one thousand of its picturesque old Moorish houses, which formerly rose in terraces up the mountain side, were destroyed, together with five churches, the hospital, the theatre, the prison, and 800 of the inhabitants, in an earthquake which took place in 1884. Subscriptions were received from all parts of Spain, and the present town was built at a little distance from its predecessor. Few vestiges of antiquity survived, except the baths from which Alhama (in Arabic "the Bath") derives its name. These are situated near the river, and appear to have been used continuously since Roman times (*c.* 19 B.C.—A.D. 409). The temperature of the hot sulphurous springs is about 112° F.; and, as the waters are considered beneficial in cases of rheumatism and dyspepsia, many visitors come to Alhama in spring and autumn, attracted also by the fine scenery of the district. In the 15th century Alhama, and the neighbouring fortress of Loja (*q.v.*), were generally regarded as the keys of the kingdom of Granada, and their capture went far to insure the overthrow of the Moorish power. Alhama was taken by the Spanish marquis of Cadiz in 1482; and its fall is celebrated in an ancient ballad, *Ay de mi, Alhama*, which Byron translated into English.

ALHAMBRA, THE, an ancient palace and fortress of the Moorish monarchs of Granada, in southern Spain, occupying a hilly terrace on the south-eastern border of the city of Granada. This terrace or plateau, which measures about 2430 ft. in length by 674 ft. at its greatest width, extends from W.N.W. to E.S.E., and covers an area of about 35 acres. It is enclosed by a strongly fortified wall, which is flanked by thirteen towers. The river Darro, which foams through a deep ravine on the north, divides the plateau from the Albaicin district of Granada; the Assabica valley, containing the Alhambra Park, on the west and south, and beyond this valley the almost parallel ridge of Monte Mauror, separate it from the Antequeruela district.

The name *Alhambra*, signifying in Arabic "the red," is probably derived from the colour of the sun-dried *tapia*, or bricks made of fine gravel and clay, of which the outer walls are built. Some authorities, however, hold that it commemorates the red flare of the torches by whose light the work of construction was carried on nightly for many years; others associate it with the name of the founder, Mahomet Ibn Al Ahmar; and others derive it from the Arabic *Dar al Amra*, "House of the Master." (For an account of the period to which the Alhambra belongs, see GRANADA (city).) The palace was built chiefly between 1248 and 1354, in the reigns of Al Ahmar and his successors; but even the names of the principal artists employed are either unknown or doubtful. The splendid decorations of the interior are ascribed to Yusef I., who died in 1354. Immediately after the expulsion of the Moors in 1492, their conquerors began, by successive acts of vandalism, to spoil the marvellous beauty of the Alhambra. The open work was filled up with whitewash, the painting and gilding effaced, the furniture soiled, torn or removed. Charles V. (1516–1556) rebuilt portions in the modern style of the period, and destroyed the greater part of the winter palace to make room for a modern structure which has never been completed. Philip V. (1700–1746) Italianised the rooms, and completed the degradation by running up partitions which blocked up whole apartments, gems of taste and patient ingenuity. In subsequent centuries the carelessness of the Spanish authorities permitted this masterpiece of Moorish art to be still further defaced; and in 1812 some of the towers were blown up by the French under Count Sebastiani, while the whole buildings narrowly escaped the same fate. In

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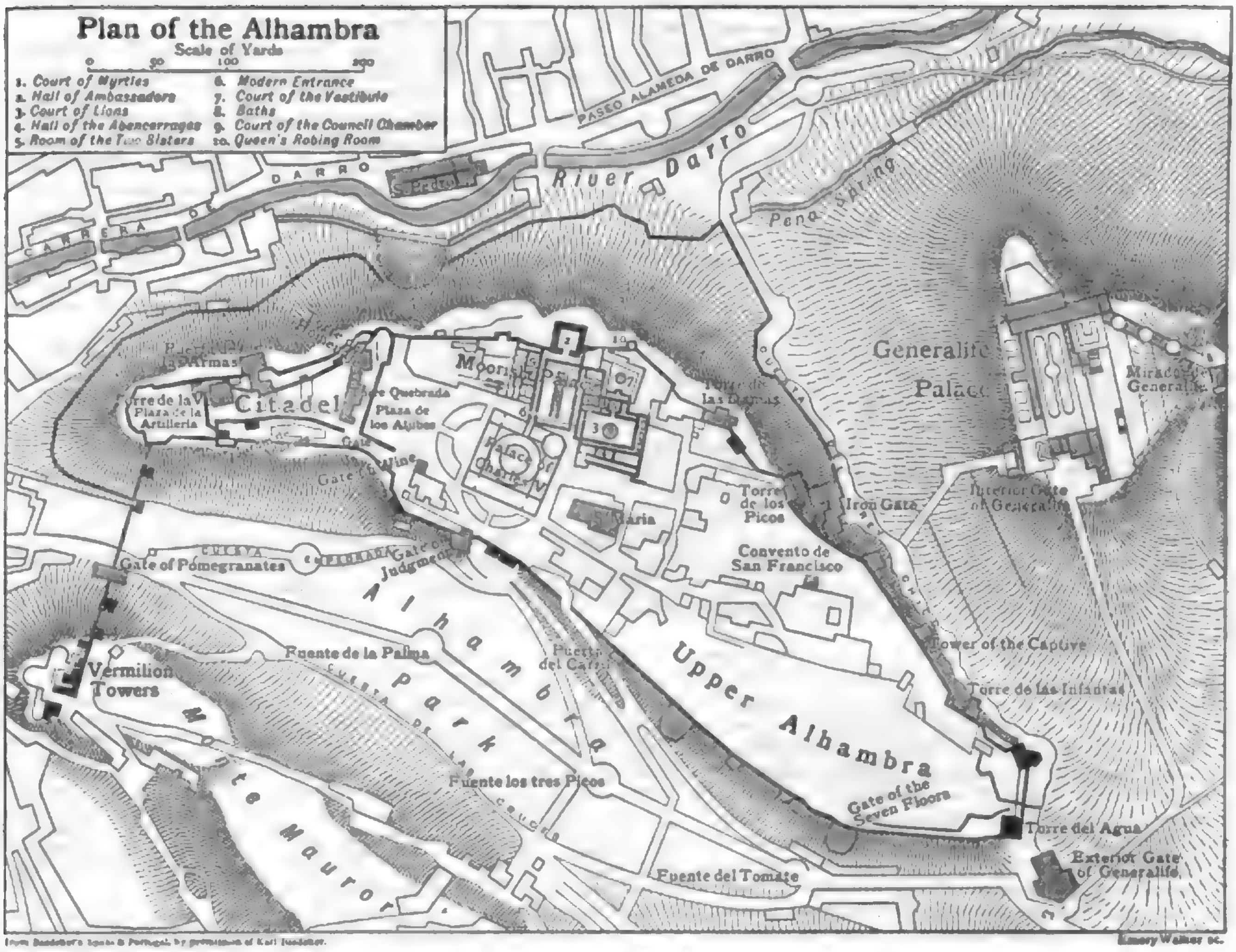
[1] *Comptes Rendus*, t. cxx. p. 125.

[2] *Astr. Jour.* No. 318.


Plan of the Alhambra
Scale of Yards
0
50
100
200
1. Court of Myrtles
2. Hall of Ambassadors
3. Court of Lions
4. Hall of the Abencerrages
5. Room of the Two Sisters
6. Modern Entrance
7. Court of the Vestibule
8. Baths
9. Court of the Council Chamber
10. Queen's Robing Room
Paseo Alameda de Darro
Darro
Carrera
S. Pedro
River Darro
Peña Partida
Generalife Palace
Mirador de Generalife
Plaza de Armas
Torre de la Vela
Plaza de la Artilleria
Citadel
Torre Quebrada
Plaza de los Aljibes
Gate of Wine
Moorish Palace
Palace of Charles V
Torre de las Damas
Torre de los Picos
Iron Gate
Interior Gate of Generalife
S. Maria
Convento de San Francisco
Gate of Pomegranates
Gate of Judgment
Alhambra Park
Fuente de la Palma
Puerta del Carril
Vermilion Towers
Monte Mauror
Upper Alhambra
Tower of the Captive
Torre de las Infantas
Gate of the Seven Floors
Fuente los tres Picos
Torre del Agua
Exterior Gate of Generalife
Fuente del Tomate

From Baedeker's Spain & Portugal, by permission of Karl Baedeker. Emery Walker sc.

1821 an earthquake caused further damage. The work of restoration undertaken in 1828 by the architect José Contreras was endowed in 1830 by Ferdinand VII.; and after the death of Contreras in 1847, it was continued with fair success by his son Rafael (d. 1890), and his grandson Mariano.

The situation of the Alhambra is one of rare natural beauty; the plateau commands a wide view of the city and plain of Granada, towards the west and north, and of the heights of the Sierra Nevada, towards the east and south. Moorish poets describe it as "a pearl set in emeralds," in allusion to the brilliant colour of its buildings, and the luxuriant woods round them. The park (Alameda de la Alhambra), which in spring is overgrown with wild-flowers and grass, was planted by the Moors with roses, oranges and myrtles; its most characteristic feature, however, is the dense wood of English elms brought hither in 1812 by the duke of Wellington. The park is celebrated for the multitude of its nightingales, and is usually filled with the sound of running water from several fountains and cascades. These are supplied through a conduit 5 m. long, which is connected with the Darro at the monastery of Jesus del Valle, above Granada.

The Moorish portion of the Alhambra resembles many medieval Christian strongholds in its threefold arrangement as a castle, a palace and a residential annexe for subordinates. The Alcazába or citadel, its oldest part, is built on the isolated and precipitous foreland which terminates the plateau on the north-west. Only its massive outer walls, towers and ramparts are left. On its watch-tower, the Torre de la Vela, 85 ft. high, the flag of Ferdinand and Isabella was first raised, in token of the Spanish conquest of Granada, on the 2nd of January 1492. A turret containing a huge bell was added in the 18th century, and restored after being injured by lightning in 1881. Beyond the Alcazába is the palace of the Moorish kings, or Alhambra properly so-called; and beyond this, again, is the Alhambra Alta (Upper Alhambra), originally tenanted by officials and courtiers.

In spite of the long neglect, wilful vandalism and ill-judged restoration which the Alhambra has endured, it remains the most perfect example of Moorish art in its final European development,—freed from the direct Byzantine influences which can be traced in the cathedral of Cordova, more elaborate and fantastic than the Giralda at Seville. The majority of the palace buildings are, in ground-plan, quadrangular, with all the rooms opening on to a central court; and the whole reached its present size simply by the gradual addition of new quadrangles, designed on the same principle, though varying in dimensions, and connected with each other by smaller rooms and passages. In every case the exterior is left plain and austere, as if the architect intended thus to heighten by contrast the splendour of the interior. Within, the palace is unsurpassed for the exquisite detail of its marble pillars and arches, its fretted ceilings and the veil-like transparency of its filigree work in stucco. Sun and wind are freely admitted, and the whole effect is one of the most airy lightness and grace. Blue, red, and a golden yellow, all somewhat faded through lapse of time and exposure, are the colours chiefly employed. The decoration consists, as a rule, of stiff, conventional foliage, Arabic inscriptions, and geometrical patterns wrought into arabesques of almost incredible intricacy and ingenuity. Painted tiles are largely used as panelling for the walls.

Access from the city to the Alhambra Park is afforded by the Puerta de las Granadas (Gate of Pomegranates), a massive triumphal arch dating from the 15th century. A steep ascent leads past the Pillar of Charles V., a fountain erected in 1554, to the main entrance of the Alhambra. This is the Puerta Judiciaria

(Gate of Judgment), a massive horseshoe archway, surmounted by a square tower, and used by the Moors as an informal court of justice. A hand, with fingers outstretched as a talisman against the evil eye, is carved above this gate on the exterior; a key, the symbol of authority, occupies the corresponding place on the interior. A narrow passage leads inward to the Plaza de los Aljibes (Place of the Cisterns), a broad open space which divides the Alcazába from the Moorish palace. To the left of the passage rises the Torre del Vino (Wine Tower), built in 1345, and used in the 16th century as a cellar. On the right is the palace of Charles V., a cold-looking but majestic Renaissance building, out of harmony with its surroundings, which it tends somewhat to dwarf by its superior size. Its construction, begun in 1526, was abandoned about 1650.

The present entrance to the Palacio Arabe, or Casa Real (Moorish palace), is by a small door from which a corridor conducts to the Patio de los Arrayanes (Court of the Myrtles), also called the Patio de la Alberca (Court of the Blessing or Court of the Pond), from the Moorish *birka*, "pond," or *berka*, "blessing." This court is 140 ft. long by 74 ft. broad; and in the centre there is a large pond set in the marble pavement, full of goldfish, and with myrtles growing along its sides. There are galleries on the north and south sides; that on the south 27 ft. high, and supported by a marble colonnade. Underneath it, to the right, was the principal entrance, and over it are three elegant windows with arches and miniature pillars. From this court the walls of the Torre de Comares are seen rising over the roof to the north, and reflected in the pond.

The Sala de los Ambajadores (Hall of the Ambassadors) is the largest in the Alhambra, and occupies all the Torre de Comares. It is a square room, the sides being 37 ft. in length, while the centre of the dome is 75 ft. high. This was the grand reception room, and the throne of the sultan was placed opposite the entrance. The tiles are nearly 4 ft. high all round, and the colours vary at intervals. Over them is a series of oval medallions with inscriptions, interwoven with flowers and leaves. There are nine windows, three on each façade, and the ceiling is admirably diversified with inlaid-work of white, blue and gold, in the shape of circles, crowns and stars—a kind of imitation of the vault of heaven. The walls are covered with varied stucco-work of most delicate pattern, surrounding many ancient escutcheons.

The celebrated Patio de los Leones (Court of the Lions) is an oblong court, 116 ft. in length by 66 ft. in breadth, surrounded by a low gallery supported on 124 white marble columns. A pavilion projects into the court at each extremity, with filigree walls and light domed roof, elaborately ornamented. The square is paved with coloured tiles, and the colonnade with white marble; while the walls are covered 5 ft. up from the ground with blue and yellow tiles, with a border above and below enamelled blue and gold. The columns supporting the roof and gallery are irregularly placed, with a view to artistic effect; and the general form of the piers, arches and pillars is most graceful. They are adorned by varieties of foliage, &c.; about each arch there is a large square of arabesques; and over the pillars is another square of exquisite filigree work. In the centre of the court is the celebrated Fountain of Lions, a magnificent alabaster basin supported by the figures of twelve lions in white marble, not designed with sculptural accuracy, but as emblems of strength and courage.

The Sala de los Abencerrajes (Hall of the Abencerrages) derives its name from a legend according to which Boabdil, the last king of Granada, having invited the chiefs of that illustrious line to a banquet, massacred them here. This room is a perfect square, with a lofty dome and trellised windows at its base. The roof is exquisitely decorated in blue, brown, red and gold, and the columns supporting it spring out into the arch form in a remarkably beautiful manner. Opposite to this hall is the Sala de las dos Hermanas (Hall of the two Sisters), so-called from two very beautiful white marble slabs laid as part of the pavement. These slabs measure 15 ft. by 7½ ft., and are without flaw or stain. There is a fountain in the middle of this hall, and the roof—a dome honeycombed with tiny cells, all different, and said to number 5000—is a magnificent example of the so-called "stalactite vaulting" of the Moors.

Among the other wonders of the Alhambra are the Sala de la Justicia (Hall of Justice), the Patio del Mexuar (Court of the Council Chamber), the Patio de Daraxa (Court of the Vestibule), and the Peinador de la Reina (Queen's Robing Room), in which are to be seen the same delicate and beautiful architecture, the same costly and elegant decorations. The palace and the Upper Alhambra also contain baths, ranges of bedrooms and summer-rooms, a whispering gallery and labyrinth, and vaulted sepulchres.

The original furniture of the palace is represented by the celebrated vase of the Alhambra, a splendid specimen of Moorish ceramic art, dating from 1320, and belonging to the first period of Moorish porcelain. It is 4 ft. 3 in. high; the ground is white, and the enamelling is blue, white and gold.

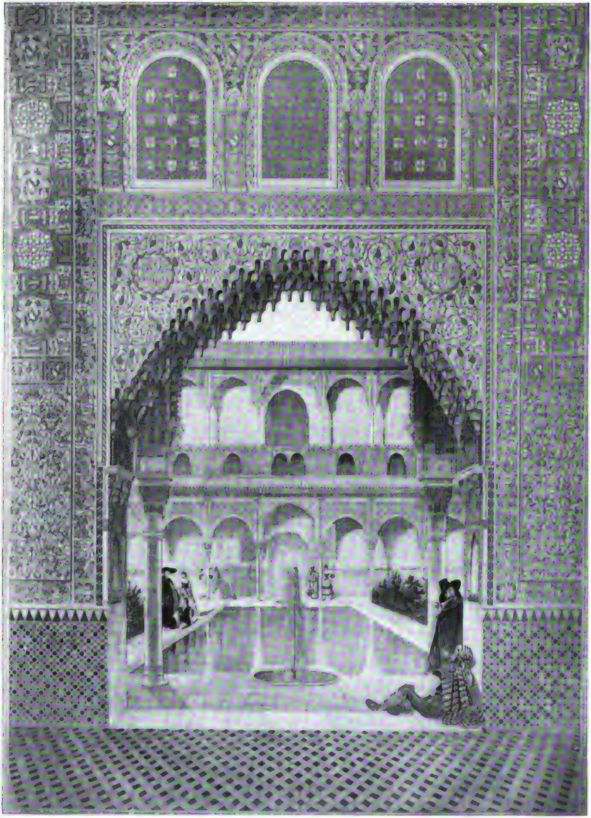
Of the outlying buildings in connexion with the Alhambra, the foremost in interest is the Palacio de Generalife or Gineralife (the Moorish *Jennat al Arif*, "Garden of Arif," or "Garden of the Architect"). This villa probably dates from the end of the 13th century, but has been several times restored. Its gardens, however, with their clipped hedges, grottos, fountains, and cypress avenues, are said to retain their original Moorish character. The Villa de los Martires (Martyrs' Villa), on the summit of Monte Mauror, commemorates by its name the Christian slaves who were employed to build the Alhambra, and confined here in subterranean cells. The Torres Bermejas (Vermilion Towers), also on Monte Mauror, are a well-preserved Moorish fortification, with underground cisterns, stables, and accommodation for a garrison of 200 men. Several Roman tombs were discovered in 1829 and 1857 at the base of Monte Mauror.

See *Plans, Elevations, Sections and Details of the Alhambra; from drawings taken on the spot by J. Goury and Owen Jones; with a complete translation of the Arabic inscriptions and a historical notice of the Kings of Granada, by P. de Gayangos*. These two magnificent folios, though first published in London between 1842 and 1845, give the best pictorial representation of the Alhambra. See also Rafael Contreras, *La Alhambra, El Alcázar, y la gran Mezquita de Occidente* (Madrid, 1885); *The Alhambra*, by Washington Irving, was written in 1832, and rewritten in 1857, when it had already become widely celebrated for its picturesque and humorous descriptions. A well-illustrated edition was published in London in 1896.

ALHAZEN (ABU ALI AL-HASAN IBN ALHASAN), Arabian mathematician of the 11th century, was born at Basra and died at Cairo in 1038. He is to be distinguished from another Alhazen who translated Ptolemy's *Almagest* in the 10th century. Having boasted that he could construct a machine for regulating the inundations of the Nile, he was summoned to Egypt by the caliph Hakim; but, aware of the impracticability of his scheme, and fearing the caliph's anger, he feigned madness until Hakim's death in 1021. Alhazen was, nevertheless, a diligent and successful student, being the first great discoverer in optics after the time of Ptolemy. According to Giovanni Battista della Porta, he first explained the apparent increase of heavenly bodies near the horizon, although Bacon gives the credit of this discovery to Ptolemy. He taught, previous to the Polish physicist Witelo, that vision does not result from the emission of rays from the eye, and wrote also on the refraction of light, especially on atmospheric refraction, showing, *e.g.* the cause of morning and evening twilight. He solved the problem of finding the point in a convex mirror at which a ray coming from one given point shall be reflected to another given point. His treatise on optics was translated into Latin by Witelo (1270), and afterwards published by F. Risner in 1572, with the title *Opticae thesaurus Alhazeni libri VII., cum ejusdem libro de crepusculis et nubium ascensionibus*. This work enjoyed a great reputation during the middle ages. Works on geometrical subjects were found in the *Bibliothèque nationale de Paris* in 1834 by E. A. Sédillot; other manuscripts are preserved in the Bodleian library at Oxford and in the library of Leiden.

See Casiri, *Bibl. Arab. Hisp. Escur.*; J. E. Montucla, *Histoire des mathématiques* (1758); and E. A. Sédillot, *Matériaux pour l'histoire des sciences mathématiques*.

ALI, in full, 'ALI BEN ABŪ TALIB (*c.* 600–661), the fourth of the caliphs or successors of Mahomet, was born at Mecca about



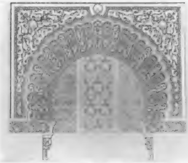
THE COURT OF THE MYRTLES.

From Gayangos and Owen Jones, *The Alhambra.*

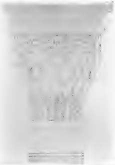
PLATE II.

ALHAMBRA

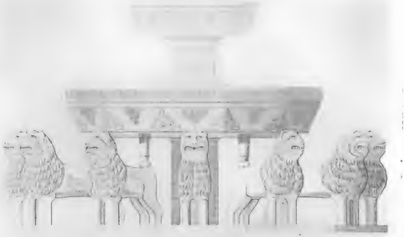
CAPITAL IN THE COURT OF THE LIONS.



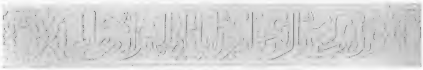
PRAYER NICHE.



CAPITAL IN THE COURT OF THE MYRTLES.



FOUNTAIN IN THE COURT OF THE LIONS.



DETAIL FROM THE FOUNTAIN (QUARTER-SIZE).

From Gayangos and Owen Jones, *The Alhambra.*

the year A.D. 600. His father, Abū Talib, was an uncle of the prophet, and Ali himself was adopted by Mahomet and educated under his care. As a mere boy he distinguished himself by being one of the first to declare his adhesion to the cause of Mahomet, who some years afterwards gave him his daughter Fatima in marriage. Ali proved himself to be a brave and faithful soldier, and when Mahomet died without male issue, a few emigrants thought him to have the best claim to succeed him. Abu Bekr, Omar and Othman, however, occupied this position before him, and it was not until 656, after the murder of Othman, that he assumed the title of caliph. The fact that he took no steps to prevent this murder is, perhaps, the only real blot upon his character. Almost the first act of his reign was the suppression of a rebellion under Talha and Zobair, who were instigated by Ayesha, Mahomet's widow, a bitter enemy of Ali, and one of the chief hindrances to his advancement to the caliphate. The rebel army was defeated at the "Battle of the Camel," near Bassorah (Basra), the two generals being killed, and Ayesha taken prisoner. Ali soon afterwards made Kufa his capital. His next care was to get rid of the opposition of Moawiya, who had established himself in Syria at the head of a numerous army. A prolonged battle took place in July 657 in the plain of Siffin (Suffein), near the Euphrates; the fighting was at first, it is said, in favour of Ali, when suddenly a number of the enemy, fixing copies of the Koran to the points of their spears, exclaimed that "the matter ought to be settled by reference to this book, which forbids Moslems to shed each other's blood." The superstitious soldiers of Ali refused to fight any longer, and demanded that the issue be referred to arbitration (see further Caliphate, section B. 1). Abu Musa was appointed umpire on the part of Ali, and 'Amr-ibn-el-Ass, a veteran diplomatist, on the part of Moawiya. It is said that 'Amr persuaded Abu Musa that it would be for the advantage of Islam that neither candidate should reign, and asked him to give his decision first. Abu Musa having proclaimed that he deposed both Ali and Moawiya, 'Amr declared that he also deposed Ali, and announced further that he invested Moawiya with the caliphate. This treacherous decision (but see Caliphate, *ib.*) greatly injured the cause of Ali, which was still further weakened by the loss of Egypt. After much indecisive fighting, Ali found his position so unsatisfactory that according to some historians he made an agreement with Moawiya by which each retained his own dominions unmolested. It chanced, however—according to a legend, the details of which are quite uncertain—that three of the fanatic sect of the Kharijites had made an agreement to assassinate Ali, Moawiya and 'Amr, as the authors of disastrous feuds among the faithful. The only victim of this plot was Ali, who died at Kufa in 661, of the wound inflicted by a poisoned weapon. A splendid mosque called Meshed Ali was afterwards erected near the city, but the place of his burial is unknown. He had eight wives after Fatima's death, and in all, it is said, thirty-three children, one of whom, Hassan, a son of Fatima, succeeded him in the caliphate. His descendants by Fatima are known as the Fatimites (*q.v.*; see also Egypt: *History*, Mahommedan period). The question of Ali's right to succeed to the caliphate is an article of faith which divided the Mahommedan world into two great sects, the Sunnites and the Shiites, the former denying, and the latter affirming, his right. The Turks, consequently, hold his memory in abhorrence; whereas the Persians, who are generally Shi'as, venerate him as second only to the prophet, call him the "Lion of God" (*Sher-i-Khudā*), and celebrate the anniversary of his martyrdom. Ali is described as a bold, noble and generous man, "the last and worthiest of the primitive Moslems, who imbibed his religious enthusiasm from companionship with the prophet himself, and who followed to the last the simplicity of his example." It is maintained, on the other hand, that his motives were throughout those of ambition rather than piety, and that, apart from the tragedy of his death, he would have been an insignificant figure in history. (See further Caliphate.)

In the eyes of the later Moslems he was remarkable for learning and wisdom, and there are extant collections (almost all certainly spurious) of proverbs and verses which bear his name: the *Sentences of Ali* (Eng. trans., William Yule, Edinburgh, 1832); H. L. Fleischer, *Alis hundert Sprüche* (Leipz. 1837); the *Divan*, by G. Kuypert (Leiden, 1745, and at Bulak, 1835); C. Brockelmann, *Gesch. d. arabisch. Lit.* (vol. i., Weimar, 1899).

ALI, known as Ali Bey (1766-1818), the assumed name of Domingo Badia y Leblich, a Spanish traveller, born in 1766. After receiving a liberal education he devoted particular attention to the Arabic language, and made a special study of the manners and customs of the East. Pretending to be a descendant of the Abbasids, Badia in 1803 set out on his travels. Under the name of Ali Bey el Abbassi, and in Mussulman costume, he visited Morocco, Tripoli, Egypt, Arabia and Syria, and was received as a person of high rank wherever he appeared. He made the pilgrimage to Mecca, at that time in the possession of the Wahabites. On his return to Spain in 1807 he declared himself a Bonapartist, and was made intendant first of Segovia and afterwards of Cordova. When the French were driven from Spain, Badia was compelled to take refuge in France, and there in 1814, published an account of his travels under the title of *Voyage d'Ali Bey en Asie et en Afrique, &c.* A few years later he set out again for Syria, under the assumed name of Ali Othman, and, it is said, accredited as a political agent by the French government. He reached Aleppo, and there died on the 30th of August 1818, not without suspicion of having been poisoned.

An account of his Eastern adventures was published in London in 1816, in two volumes, entitled *Travels in Morocco, Tripoli, Cyprus, Egypt, Arabia, Syria and Turkey, between the years 1803 and 1807.*

ALI, known as Ali Pasha (1741–1822), Turkish pasha of Iannina, surnamed *Arslan*, "the Lion," was born at Tepeleni, a village in Albania at the foot of the Klissura mountains. He was one of the Toske tribe, and his ancestors had for some time held the hereditary office of bey of Tepeleni. His father, a man of mild and peaceful disposition, was killed when Ali was fourteen years old by neighbouring chiefs who seized his territories. His mother Khamko, a woman of extraordinary character, thereupon herself formed and led a brigand band, and studied to inspire the boy with her own fierce and indomitable temper, with a view to revenge and the recovery of the lost property. In this wild school Ali proved an apt pupil. A hundred tales, for the most part probably mythical, are told of his powers and cunning during the years he spent among the mountains as a brigand leader. At last, by a picturesque stratagem, he gained possession of Tepeleni and took vengeance on his enemies. To secure himself from rivals in his own family, he is said to have murdered his brother and imprisoned his mother on a charge of attempting to poison him. With a view to establishing his authority he now made overtures to the Porte and was commissioned to chastise the rebellious pasha of Scutari, whom he defeated and killed. He also, on pretext of his disloyalty, put to death Selim, pasha of Delvinon. Ali was now confirmed in the possession of all his father's territory and was also appointed lieutenant to the derwend-pasha of Rumelia, whose duty it was to suppress brigandage and highway robbery. This gave him an opportunity for amassing wealth by sharing the booty of the robbers in return for leaving them alone. The disgrace that fell in consequence on his superior, Ali escaped by the use of lavish bribes at Constantinople. In 1787 he took part in the war with Russia, and was rewarded by being made pasha of Trikala in Thessaly and derwend-pasha of Rumelia. It now suited his policy to suppress the brigands, which he did by enlisting most of them under his own banner. His power was now already considerable; and in 1788 he added to it by securing his nomination to the pashalik of Iannina by a characteristic trick.

The illiterate brigand, whose boyish ambition had not looked beyond the recovery of his father's beylick, was now established as one of the most powerful viziers under the Ottoman government. Success only stimulated his insatiable ambition. He earned the confidence of the Porte by the cruel discipline he maintained in his own sanjak, and the regular flow of tribute and bribes which he directed to Constantinople; while he bent all his energies to extending his territories at the expense of his neighbours. The methods he adopted would have done credit to

Cesare Borgia; they may be studied in detail in the lurid pages of Pouqueville. Soon, by one means or another, his power was supreme in all central Albania. Two main barriers still obstructed the realization of his ambition, which now embraced Greece and Thessaly, as well as Albania, and the establishment in the Mediterranean of a sea-power which should rival that of the dey of Algiers. The first of these was the resistance of the little Christian hill community of Suli; the second the Venetian occupation of the coast, within a mile of which—by convention with the Porte—no Ottoman soldier might penetrate. It needed three several attacks before, in 1803, Ali conquered the Suliot stronghold. Events in western Europe gave him an earlier opportunity of becoming master of most of the coast towns. Ali had watched with interest the career of Bonaparte in Italy, and the treaty of Campo Formio (1797), which blotted the Venetian republic from the map of Europe, gave him the opportunity he desired. In response to his advances commissaries of the French republic visited him at Iannina and, affecting a sudden zeal for republican principles, he easily obtained permission to suppress the "aristocratic" tribes on the coast. His plans in Albania were interrupted by the war against Pasvan Oglu, the rebellious pasha of Widdin, in which Ali once more did good service. Meanwhile international politics had developed in a way that necessitated a change in Ali's attitude. Napoleon's occupation of the Ionian Islands and his relations with Ali had alarmed Russia, which feared that French influence would be substituted for her own in the Balkan peninsula; and on the 5th of September 1798 a formal alliance, to which Great Britain soon after acceded, was signed on behalf of the emperor Paul and the sultan. Once more Ali turned Turk and fought against his recent friends with such success that in the end he remained in possession of Butrinto, Prevesa and Vonitza on the coast, was created pasha "of three tails" by the sultan, and received the congratulations of Nelson. But the campaign of Austerlitz followed, then the peace of Pressburg which guaranteed to Napoleon the former dominions of Venice, and finally the treaty of Tilsit, which involved, among other things, the withdrawal of the Russians from the Ionian Islands and the Albanian coast.

Amid all the momentous changes the part of Ali was a difficult one. He had, moreover, to contend with domestic enemies, and with difficulty defeated a league formed against him by some Mussulman tribes, under Ibrahim of Berat and Mustapha of Delvinon, and the Suliots. He knew, however, how to retain the confidence of the sultan, who not only confirmed him in the possession of the whole of Albania from Epirus to Montenegro, but even in 1799 appointed him vali of Rumelia, an office which he held just long enough to enable him to return to Iannina laden with the spoils of Thessaly. He was now at the height of his power. In 1803 the Suliot stronghold fell; and he was undisputed master of Epirus, Albania and Thessaly, while the pashalik of the Morea was held by his son Veli, and that of Lepanto by his son Mukhtar. Only the little town of Parga held out against him on the coast; and in order to obtain this he once more in 1807 entered into an alliance with Napoleon. The French emperor, however, preferred to keep Parga, as a convenient gate into the Balkan peninsula, and it remained in French occupation until March 1814, when the Pargiots rose against the garrison and handed the fortress over to the British to save it from falling into the hands of Ali, who had bought the town from the French commander, Cozi Nikolo, and was closely investing it. The cordial relations between Napoleon and the pasha of Iannina had not long continued. Ali was angered by the refusal to surrender Parga and justly suspicious of the ambitions which this refusal implied; he could not feel himself secure with the Ionian Islands and the Dalmatian coast in the hands of a power whose plans in the East were notorious, and he was glad enough to avail himself of Napoleon's reverses in 1812 to help to rid himself of so dangerous a neighbor. His services to the allies received their reward. Still bent on obtaining Parga, he sent a special mission to London, backed by a letter from Sir Robert Liston, the British ambassador at Constantinople, calling the attention of the government to the pasha's supereminent qualities" and his services against the French. After some hesitation it was decided to evacuate Parga and hand it over to the Ottoman government, *i.e.* Ali Pasha. The convention by which this was effected was ultimately signed on the 17th of May 1817, being ratified by the sultan on the 24th of April 1819. By its terms the Pargiots were to receive an asylum in the islands, the Ottoman government undertaking to pay compensation for their property. Ali had no difficulty in finding the money; the garrison, as soon as it was received, marched out with the bulk of the inhabitants; and the last citadel of freedom in the Balkans fell to the tyrant of Iannina.[1]

Ali's authority in the great part of the peninsula subject to him now overshadowed that of the sultan; and Mahmud II., whose whole policy had been directed to destroying the overgrown power of the provincial pashas, began to seek a pretext for overthrowing the Lion of Iannina, whose all-devouring ambition seemed to threaten his own throne. The occasion came in 1820 when Ali, emboldened by impunity, violated the sanctity of Stamboul itself by attempting to procure the murder of his enemy Pacho Bey in the very precincts of the palace. A decree of disposition was now issued against the sacrilegious vali, who had dared "to fire shots in Constantinople, the residence of the caliph, and the centre of security." Its execution was entrusted to Khurshid Pasha, with the bulk of the Ottoman forces.

For two years Ali, now over eighty years of age, held his own, in spite of the defection of his vassals and even of his sons. At last, in the spring of 1822, after a prolonged siege in his island fortress at Iannina, which even the outbreak of the Greek revolt had not served to raise, the intrepid old man was forced to sue for terms. He asked and received an interview with Khurshid, was received courteously and dismissed with the most friendly assurances. As he turned to leave the grand vizier's tent he was stabbed in the back; his head was cut off and sent to Constantinople. Notwithstanding their treason to their father, his sons met with the same fate.

In spite of the ferocious characteristics which have been suggested in the above sketch, Ali Pasha is undoubtedly one of the most remarkable, as he is one of the most picturesque, figures in modern history; and as such he was recognized in his own day. His court at Iannina was the centre of a sort of barbarous culture, in which astrologers, alchemists and Greek poets played their part, and was often visited by travellers. Amongst others, Byron came, and has left a record of his impressions in "Childe Harold's Pilgrimage," less interesting and vivid than the prose accounts of Pouqueville, T. S. Hughes and William M. Leake. Leake (iii. 259) reports a reproof addressed by Ali to the French renegade Ibrahim Effendi, who had ventured to remonstrate against some particular act of ferocity: "At present you are too young at my court to know how to comport yourself. . . . You are not yet acquainted with the Greeks and Albanians: when I hang up one of these wretches on the plane-tree, brother robs brother under the very branches: if I burn one of them alive, the son is ready to steal his father's ashes to sell them for money. They are destined to be ruled by me; and no one but Ali is able to restrain their evil propensities." This is perhaps as good an apology as could be made for his character and methods. To the wild people over whom he ruled none was needed. He had their respect, if not their love; he is the hero of a thousand ballads; and his portrait still hangs among the *ikons* in the cottages of the Greek mountaineers. All accounts agree in describing him in later life as a man of handsome presence, with a venerable white beard, piercing black eyes and a benevolent cast of countenance, the effect of which was heightened in conversation by a voice of singular sweetness.

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[1] In his report on the Ionian Treaty presented to Lord Castlereagh at the congress of Vienna in December 1814, Sir Richard Church strongly advocated, not only the retention of Parga, but that Vonitza, Prevesa and Butrinto also should be taken from Ali Pasha and placed under British protection, a measure he considered necessary for the safety of the Ionian Islands. "Ali Pasha," he wrote, "is now busy building forts along his coast and strengthening his castles in the interior. In January 1814 he had 14,000 peasants at work on the castle of Argiro Castro, and about 1500 erecting a fort at Porto Palermo, nearly opposite Corfu." In 1810 he had erected a fort directly opposite Santa Maura commanding the harbour.

The fate of Parga created intense feeling at the time in England, and was cited by Liberals as a crowning instance of the perfidy of the government and of Castlereagh's subservience to reactionary tendencies abroad. The step, however, was not lightly taken. In occupying the town the British general had expressly refrained from pledging Great Britain to remain there; and the government held that any permanent occupation of a post on the mainland carried with it risks of complications out of all proportion to any possible benefit.

AUTHORITIES.—Apart from the scattered references in the published and unpublished diplomatic correspondence of the period, contemporary journals and books of travel contain much interesting material for the life of Ali. Of these may especially be mentioned François C. H. L. Pouqueville, *Voyage en Morée, à Constantinople, en Albanie, &c.* (3 vols., Paris, 1805), of which an English version by A. Plumptre was published in 1815; ib. *Voyage dans la Grèce* (5 vols., Paris, 1820, 1821). Pouqueville, who spent some time as French resident at Iannina, had special facilities for obtaining first-hand information, though his emotionalism makes his observations and deductions at times somewhat suspect. Very interesting also are Thomas Smart Hughes, *Travels in Greece and Albania* (2 vols., 2nd ed., Lond. 1830); John Cam Hobhouse (Lord Broughton), *A Journey through Albania, &c. . . . during the years 1809 and 1810* (Lond., 4to, 1813, a new ed., 2 vols., 1855); William Martin Leake, *Travels in Northern Greece* (4 vols., Lond. 1845). See also Pouqueville's *Hist. de la régénération de la Grèce*, 1740–1824 (4 vols., Paris, 1824, 3rd ed., Brussels, 1825); R. A. Davenport, *Life of Ali Pasha, vizier of Epirus* (1861). (W. A. P.)

ALIAGA, a town of the province of Nueva Ecija, Luzon, Philippine Islands, about 70 m. N. by W. of Manila. Pop. (1903) 11,950. It has a comparatively cool and healthful climate, and is pleasantly situated about midway between the Pampanga Grande and the Pampanga Chico rivers, and in a large and fertile valley of which the principal products are Indian corn, rice, sugar and tobacco. Tagalog is the most important language; Ilocano, Pampango and Pangasinan are also used.

ALIAS (Lat. for "at another time"), a term used to connect the different names of a person who has passed under more than one, in order to conceal his identity, or for other reasons; or, compendiously, to describe the adopted name. The expression *alias dictus* was formerly used in legal indictments, and pleadings where absolute precision was necessary in identifying the person to be charged, as "John Jones, *alias dictus* James Smith." The adoption of a name other than a man's baptismal or surname need not necessarily be for the purpose of deception or fraud; pseudonyms or nicknames fall thus under the description of an *alias*. Where a person is married under an *alias*, the marriage is void when both parties have knowingly and wilfully connived at the adoption of the *alias*, with a fraudulent intention. But if one of the parties to a marriage has acquired a new name by use and reputation, or if the true name of any one of the parties is not known to the other, the use of an *alias* in these cases will not affect the validity of the marriage.

ALIBI (Lat. for "elsewhere"), in law, the defence resorted to in criminal prosecutions, where the person charged alleges that he was so far distant at the time from the place where the crime was committed that he could not have been guilty. An alibi, if substantiated, is the most conclusive proof of innocence.

ALICANTE, a province of south-eastern Spain; bounded on the N. by Valencia, W. by Albacete and Murcia, S. by Murcia, and S.E. and E. by the Mediterranean Sea. Pop. (1900) 470,149; area, 2096 sq. m. Alicante was formed in 1833 of districts taken from the ancient provinces of Valencia and Murcia, Valencia contributing by far the larger portion. The surface of the province is extremely diversified. In the north and west there are extensive mountain ranges of calcareous formation, intersected by deep ravines; while farther south the land is more level, and there are many fertile valleys. On the Mediterranean coast, unhealthy salt marshes alternate with rich plains of pleasant and productive *huertas* or gardens, such as those of Alicante and Dénia. Apart from Segura, which flows from the highlands of Albacete through Murcia and Orihuela to the sea, there is no considerable river, but a few rivulets flow east into the Mediterranean. The climate is temperate, and the rainfall very slight. Despite the want of rivers and of rain, agriculture is in a flourishing condition. Many tracts, originally rocky and sterile, have been irrigated and converted into vineyards and plantations. Cereals are grown, but the inhabitants prefer to raise such articles of produce as are in demand for export, and consequently part of the grain supply has to be imported. Esparto grass, rice, olives, the sugar-cane, and tropical fruits and vegetables are largely produced. Great attention is given to the rearing of bees and silk-worms; and the wine of the province is held in high repute throughout Spain, while some inferior kinds are sent to France to be mixed with claret. There are iron and lignite mines, but the output is small. Mineral springs are found at various places. The manufactures consist of fine cloths, silk, cotton, woollen and linen fabrics, girdles and lace, paper, hats, leather, earthenware and soap. There are numerous oil mills and brandy distilleries. Many of the inhabitants are engaged in the carrying trade, while the fisheries on the coast are also actively prosecuted, tunny and anchovies being caught in great numbers. Barilla is obtained from the sea-weed on the shores, and some of the saline marshes, notably those near Torrevieja, yield large supplies of salt. The principal towns, which are separately described, include Alicante, the capital (pop. 1900, 50,142), Crevillente (10,726), Dénia (12,431), Elche (27,308), Novelda (11,388), Orihuela (28,530), and Villena (14,099). Other towns, of less importance, are Aspe (7927), Cocentaina (7093), Monóvar (10,601), Pinoso (7946), and Villajoyosa (8902).

ALICANTE, the capital of the Spanish province described above, and one of the principal seaports of the country. Pop. (1900) 50,142. It is situated in 38° 21′ N. and 0° 26′ W., on the Bay of Alicante, an inlet of the Mediterranean Sea. It is the termini of railways from Madrid and Murcia. From its harbour, the town presents a striking picture. Along the shore extends the Paseo de los Martires, a double avenue of palms; behind this, the white flat-roofed houses rise in the form of a crescent towards the low hills which surround the city, and terminate, on the right, in a bare rock, 400 ft. high, surmounted by an ancient citadel. Its dry and equable climate renders Alicante a popular health-resort. The city is an episcopal see, and contains a modern cathedral.

The bay affords good anchorage, but only small vessels can come up to the two moles. The harbour is fortified, and there is a small lighthouse on the eastern mole; important engineering works, subsidized by the state, were undertaken in 1902 to provide better accomodation. In the same year 1737 vessels of 939,789 tons entered the port. The trade of Alicante consists chiefly in the manufacture of cotton, linen and woollen goods, cigars and confectionery; the importation of coal, iron, machinery, manures, timber, oak staves and fish; and the exportation of lead, fruit, farm produce and red wines, which are sent to France for blending with better vintages. Fine marble is procured in the island of Plana near the coast.

Alicante was the Roman *Lucentum*; but, despite its antiquity, it has few Roman or Moorish remains. In 718, it was occupied by the Moors, who were only expelled in 1304, and made an unsuccessful attempt to recapture the city in 1331. Alicante was besieged by the French in 1709, and by the Federalists of Cartagena in 1873. For an account of the events which led up to these two sieges, see SPAIN.

For further details of the local history, see J. Pastor de la Roca, *Historia general de la ciudad y castillo de Alicante, &c.* (Alicante, 1854); and the *Ensayo biográfico bibliográfico de escritores de Alicante y de su provincia*, by M. R. Garcia and A. Montero y Perez (Alicante, 1890).

ALICE MAUD MARY, GRAND-DUCHESS OF HESSE-DARMSTADT (1843–1878), second daughter and third child of Queen Victoria, was born at Buckingham Palace, on the 25th of April 1843. A pretty, delicate-featured child—"cheerful, merry, full of fun and mischief," as her elder sister described her—fond of gymnastics, a good skater and an excellent horsewoman, she was a general favourite from her earliest days. Her first years were passed without particular incident in the home circle, where the training of their children was a matter of the greatest concern to the queen and the prince consort. Among other things, the royal children were encouraged to visit the poor, and the effect of this training was very noticeable in the later life of Princess Alice. After the marriage of the Princess Royal in 1858, the new responsibilities devolving upon Princess Alice, as the eldest daughter at home, called forth the higher traits of her character, and brought her into still closer relationship with her parents, and especially with her father. In the summer of 1860, at Windsor Castle, Princess Alice first met her future husband, Prince Louis of Hesse. An attachment quickly sprang up, and on the prince's second visit in November they were formally engaged. In the following year, on the announcement of the contemplated marriage, the House of Commons unanimously voted a dowry of £30,000 and an annuity of £6000 to the princess. In December 1861, while preparations were being made for the marriage, the prince consort was struck down with typhoid fever, and died on the 14th. Princess Alice nursed her father during his short illness with the utmost care, and after his death devoted herself to comforting her mother under this terrible blow. Her marriage took place at Osborne, on the 1st of July 1862. The princess unconsciously wrote her own biography from this period in her constant letters to Queen Victoria, a selection of which, edited by Dr. Carl Sell, were allowed to be printed in 1883. These letters give a complete picture of the daily life of the duke and duchess, and they also show the intense love of the latter for her husband, her mother and her native land. She managed to visit England every year, and it was at her special request that when she died her husband laid an English flag upon her coffin.

In the war between Austria and Prussia in 1866, Hesse-Darmstadt was upon the side of the Austrians; Prince Louis accompanied his troops to the front, and was duly appointed by the grand-duke to the command of the Hessian division. This was a time of intense trial to the princess, whose husband and brother-in-law, the crown prince of Prussia, were necessarily fighting upon opposite sides. The duke of Hesse also took part in the principal battles of the Franco-Prussian war, while the duchess was actively engaged in organizing hospitals for the relief of the sick and wounded. The death of the duke's father, Prince Charles of Hesse, on the 20th of March 1877, was followed by that of the grand-duke on the 13th of June, and Prince Louis succeeded to the throne as Grand Duke Louis IV. In the summer of 1878 the grand-duke and duchess, with their family, came again to England, and went to Eastbourne, where the duchess remained for some time. She returned to Darmstadt in the autumn, and on the 8th of November 1878 her daughter, Princess Victoria, was attacked by diphtheria. Three more of her children, as well as her husband, quickly caught the disease, and the youngest, "May," succumbed on the 16th. On the 7th of December the princess was herself attacked, and, being weakened by nursing and anxiety, had not strength to resist the disease, which proved fatal on the 14th of December, the seventeenth anniversary of her father's death. She left one son and four daughters.

See Carl Sell, *Alice: Mittheilungen aus ihrem Leben und Briefen, &c.* (Darmstadt, 1883), with English translation by the Princess Christian, *Alice: biographical sketch and letters* (1884). (G. F. B.)

ALIDADE (from the Arab.), the movable index of a graduated arc, used in the measurement of angles. The word is used also to designate the supporting frame or arms carrying the microscopes or verniers of a graduated circle.

ALIEN (Lat. *alienus*), the technical term applied by British constitutional law to anyone who does not enjoy the character of a British subject; in general, a foreigner who for the purposes of any state comes into certain domestic relations with it, other than those applying to native-born or naturalized citizens, but owns allegiance to a foreign sovereign.

English law, save with the special exceptions mentioned, admits to the character of subjects all who are born within the king's allegiance, that is, speaking generally, within the British dominions. In the celebrated question of the *post-nati* in the reign of James I. of England, it was found, after solemn trial, that natives of Scotland born before the union of the crowns were aliens in England, but that, since allegiance is to the person of the king, those born subsequently were English subjects. A child born abroad, whose father or whose grandfather on the father's side was a British subject, may claim the same character unless at the time of his birth his father was an attainted traitor, or in the service of a state engaged in war against the British empire (4th Geo. II. c. 21). Owing to this exceptional provision some sons of Jacobite refugees born abroad, who joined in the rebellion of 1745, were admitted to the privilege of prisoners of war.

It has been enacted in the United Kingdom with regard to the national status of women and children that a married woman is to be deemed a subject of the state of which her husband is for the time being a subject; that a natural-born British woman, having become an alien by marriage, and thereafter being a widow, may be rehabilitated under conditions slightly more favourable than are required for naturalization; that where a father or a widow becomes an alien, the children in infancy becoming resident in the country where the parent is naturalized, and being naturalized by the local law, are held to be subjects of that country; that those of a father or of a widow readmitted to British nationality or who obtains a certificate of naturalization, becoming during infancy resident with such parent in the British dominions in the former case or in the United Kingdom in the latter, become readmitted or naturalized (Naturalization Act 1870, s. 10). The nationality of children not covered by these enactments is not affected by the change of their parents' nationality. The same statute provides that a declaration of alienage before a justice of peace or other competent judge, having the effect of divesting the declarant of the character of a British subject, may be made by a naturalized British subject desiring to resume the nationality of the country to which he originally belonged, if there be a convention to that effect with that country; by natural-born subjects who were also born subjects of another state according to its law; or by persons born abroad having British fathers.

Naturalization, which means conferring the character of a subject, may now, under the act of 1870, be obtained by applying to the home secretary and producing evidence of having resided for not less than five years in the United Kingdom, or of having been in the service of the crown for not less than five years, and of intention to reside in the United Kingdom or serve under the crown. Such a certificate may be granted by the secretary of state to one naturalized previously to the passing of the act, or to a British subject as to whose nationality a doubt exists, or to a statutory alien, *i.e.* one who has become an alien by declaration in pursuance of the act of 1870.

In the United States the separate state laws largely determine the status of an alien, but subject to Federal treaties. (For further particulars see ALLEGIANCE and NATURALIZATION.)

Many of the disabilities to which aliens were subject in the United Kingdom, either by the common law or under various acts of parliament, have been repealed by the Naturalization Act 1870. It enables aliens to take, acquire, hold and dispose of real and personal property of every description, and to transmit a title to it, in all respects as natural-born British subjects. But the act expressly declares that this relaxation of the law does not qualify aliens for any office or any municipal, parliamentary or other franchise, or confer any right of a British subject other than those above expressed in regard to property, nor does it affect interests vested in possession or expectancy under dispositions made before the act, or by devolution of law on the death of any one dying before the act. A ship, any share in which is owned by an alien, shall not be deemed a British ship (Merchant Shipping Act 1894, s. i). By the Juries Act 1870, s. 8, aliens who have been domiciled for ten years in England or Wales, if in other respects duly qualified, are liable to serve on juries or inquests in England or Wales; and by the Naturalization Act 1870, s. 5, the aliens' old privilege of being tried by a jury *de medietate linguae* (that is, of which half were foreigners), was abolished.

It seems to be a rule of general public law that an alien can be sent out of the realm by exercise of the crown's prerogative; but in modern English practice, whenever it seems necessary to expel foreigners (see EXPULSION), a special act of parliament has to be obtained for the purpose, unless the case falls within the extradition acts or the Aliens Act 1905. The latter prohibits the landing in the United Kingdom of undesirable alien steerage passengers, called in the act "immigrants," from ships carrying more than twenty alien steerage passengers, called in the act "immigrant ships"; nor can alien immigrants be landed except at certain ports at which there is an "immigrant officer," to whom power of prohibiting the landing is given, subject to a right of appeal to the immigration board of the port. The act contains a number of qualifications, and among these empowers the secretary of state to exempt any immigrant ship from its provisions if he is satisfied that a proper system is maintained to prevent the immigration of undesirable persons. The principal test of undesirableness is not having or being in a position to obtain the means of supporting one's self and one's dependents, or appearing likely from disease or infirmity to become a charge on the rates, provided that the immigrant is not seeking to avoid prosecution or punishment on religious or political grounds, or persecution, involving danger of imprisonment or danger to life or limb, on account of religious belief. Lunatics, idiots, persons who from disease or infirmity appear likely to become a detriment to the public otherwise than through the rates, and persons sentenced in a foreign country for crimes for which they could be surrendered to that country, are also enumerated as undesirable. Power is also given to the secretary of state to expel persons sentenced as just mentioned, or, if recommended by the court in which they have been convicted, persons convicted of felony or some offence for which the court has power to impose imprisonment without the option of a fine, or of certain offences against the police laws; and persons in receipt of any such parochial relief as disqualifies for the parliamentary franchise, or wandering without ostensible means of subsistence, or living under insanitary conditions due to overcrowding. (Jno. W.)

ALIENATION (from Lat. *alienus*, belonging to another), the act or fact of being estranged, set apart or separated. In law the word is used for the act of transfer of property by voluntary deed and not by inheritance. In regard to church property the word has come to mean, since the Reformation, a transfer from religious to secular ownership. "Alienation" is also used to denote a state of insanity (*q.v.*).

ALIEN-HOUSES, religious houses in England belonging to foreign ecclesiastics, or under their control. They generally were built where property had been left by the donors to foreign orders to pray for their souls. They were frequently regular "priories," but sometimes only "cells," and even "granges," with small chapels attached. Some, particularly in cities, seem to have been a sort of mission-houses. There were more than 100 in England. Many alien-houses were suppressed by Henry V. and the rest by Henry VIII.

ALIENIST (Lat. *alienus*, that which belongs to another, *i.e.* is external to one's self), one who specializes in the study of mental diseases, which are often included in the generic name "Alienation." (See Insanity.)

ALIGARH, a city and district of British India in the Meerut division of the United Provinces. The city, also known as Koil, was a station on the East Indian railway, 876 m. from Calcutta. Sir Sayad Ahmad Khan, K.C.S.I., who died in 1898, founded in 1864 the Aligarh Institute and Scientific Society for the translation into the vernacular of western literature; and afterwards the Mahommedan Anglo-Oriental college, under English professors, with an English school attached. The college meets with strong support from the enlightened portion of the Mussulman community, whose aim is to raise it to the status of a university, with the power of conferring degrees. The population (1901) 70,434, showed an increase of 14% in the decade. There are several flour-mills, cotton-presses and a dairy farm. Aligarh Fort, situated on the Grand Trunk road, consists of a regular polygon, surrounded by a very broad and deep ditch. It became a fortress of great importance under Sindhia in 1759, and was the depot where he drilled and organized his battalions in the European fashion with the aid of De Boigne. It was captured from the Mahrtatas under the leadership of Perron, another French officer, by Lord Lake's army, in September 1803, since which time it has been much strengthened and improved. In the rebellion of 1857 the troops stationed at Aligarh mutinied, but abstained from murdering their officers, who, with the other residents and ladies and children, succeeded in reaching Hathras.

The district of Aligarh has an area of 1957 sq. m. It is nearly a level plain, but with a slight elevation in the centre, between the two great rivers the Ganges and Jumna. The only other important river is the Kali Nadi, which traverses the entire length of the district from north-east to south-west. The district is traversed by several railways and also by the Ganges canal, which is navigable. The chief trading centre is Hathras. In 1901 the population was 1,200,822, showing an increase of 15% in the decade, due to the extension of irrigation. There are several factories for ginning and pressing cotton.

ALIGNMENT (from Fr. *à* and *ligne*, the Lat. *linea*, a line), a setting in line, generally straight, or the way in which the line runs; an expression used in surveying, drawing, and in military arrangements, the alignment of a regiment or a camp meaning the situation when drawn up in line or the relative position of the tents. The alignment of a rifle has reference to the way of getting the sights into line with the object, so as to aim correctly.

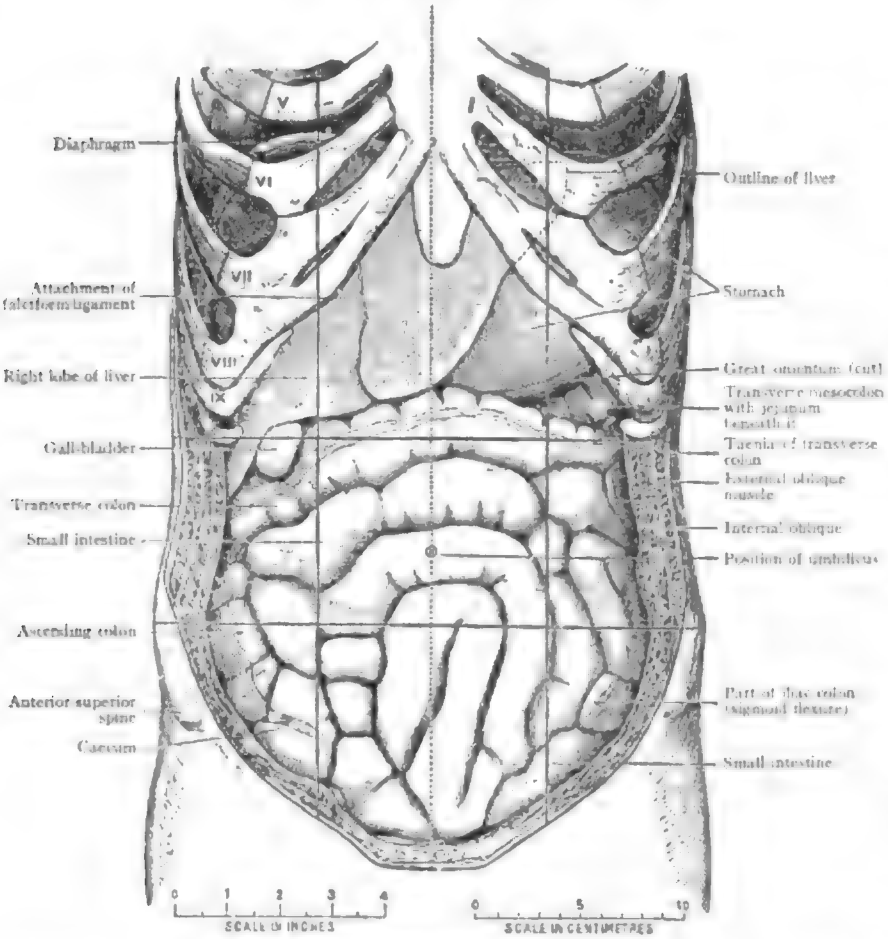
ALIMENT (from Lat. *aliment-um*, from *alere* to nourish), a synonym for "food," literally or metaphorically. The word has also been used in the same legal sense as Alimony (*q.v.*). Aliment, in Scots law, is the sum paid or allowance given in respect of the reciprocal obligation of parents and children, husband and wife, grandparents and grandchildren, to contribute to each other's maintenance. The term is also used in regard to a similar obligation of other parties, as of creditors to imprisoned debtors, the payments by parishes to paupers, &c. Alimentary funds, whether of the kind above mentioned, or set apart as such by the deed of a testator, are intended for the mere support of the recipient, and are not attachable by creditors.

ALIMENTARY CANAL, in anatomy. The alimentary canal, strictly speaking, is the whole digestive tract from the mouth to the anus. From the one orifice to the other the tube is some 25 to 30 ft. long, and the food, in its passage, passes through the following parts one after the other:—mouth, pharynx, oesophagus, stomach, small intestines, caecum, large intestines, rectum and anus. Into this tube at various points the salivary glands, liver and pancreas pour their secretions by special ducts. As the mouth (*q.v.*) and pharynx (*q.v.*) are separately described, the detailed description will here begin with the oesophagus or gullet.

The *oesophagus* (Gr. οἴσω, I will carry, and φαγεῖν, to eat), a muscular tube lined with mucous membrane, stretches from the lower limit of the pharynx, at the level of the cricoid cartilage, to the cardiac orifice of the stomach. It is about 10 in. long (25 cm.) and half to one inch in diameter. At first it lies in the lower part of the neck, then in the thorax, and lastly, for about an inch, in the abdomen. As far as the level of the fourth or fifth thoracic vertebra it lies behind the trachea, but when that tube ends, it is in close contact with the pericardium, and, at the level of the tenth thoracic vertebra, passes through the oesophageal opening of the diaphragm (*q.v.*), accompanied by the two vagi nerves, the left being in front of it and the right behind. In the abdomen it lies just behind the left lobe of the liver. Both in the upper and lower parts of its course it lies a little to the left of the mid line. Its mucous membrane is thrown into a number of longitudinal pleats to allow stretching.

The *stomach* (Gr. στόμαχος) is an irregularly pear-shaped bag, situated in the upper and left part of the abdomen. It is somewhat flattened from before backward and so has an anterior and posterior surface and an upper and lower border. When moderately distended the thick end of the pear or *fundus* bulges upward and to the left, while the narrow end is constricted to form the *pylorus*, by means of which the stomach communicates with the small intestine. The *cardiac orifice*, where the oesophagus enters, is placed about a third of the way along the upper border from the left end of the fundus, and, between it and the pylorus, the upper border is concave and is known as the *lesser curvature.* From the cardiac to the pyloric orifice, round the lower border, is the *greater curvature.* The stomach has in front of it the liver (see fig. 1), the diaphragm and the anterior abdominal wall, while behind it are the pancreas, left kidney, left adrenal, spleen, colon and mesocolon. These structures form what is known as the *stomach chamber.* When the stomach is empty it contracts into a tubular organ which is frequently sharply bent, and the transverse colon ascends to occupy the vacant part of the stomach chamber.

The last inch of the stomach before reaching the pylorus is usually tubular and is known as the *pyloric canal.* Before reaching this there is a bulging known as the *pyloric vestibule* (see D. J. Cunningham, *Tr. R. Soc. of Edinb.* vol. xlv. pt. 1, No. 2). The *pylorus* is an oval opening, averaging half an inch in its long axis but capable of considerable distension; it is formed by a special development of the circular muscle layer of the stomach, and during life is probably tightly closed. The mucous membrane of the stomach is thrown into pleats or rugae when the organ is not fully distended, while between these it has a mammillated appearance.



From A. Birmingham; Cunningham's *Text-Book of Anatomy.*

FIG. 1.—The Abdominal Viscera *in situ*, as seen when the abdomen is laid open and the great omentum removed (drawn to scale from a photograph of a male body aged 56, hardened by formalin injections).

The ribs on the right side are indicated by Roman numerals; it will be observed that the eighth costal cartilage articulated with the sternum on both sides. The subcostal, intertubercular, and right and left Poupart lines are drawn in black, and the mesial plane is indicated by a dotted line. The intercostal muscles and part of the diaphragm have been removed, to show the liver and stomach extending up beneath the ribs. The stomach is moderately distended, and the intestines are particularly regular in their arrangement.

Superficial to the mucous coat is a sub-mucous, consisting of loose connective tissue, while superficial to this are three coats of unstriped muscle, the inner oblique, the middle circular and the outer longitudinal. The peritoneal coat is described in the article on the coelom and serous membranes.

The *small intestine* is a tube, from 22 to 25 ft. long, beginning at the pylorus and ending at the *ileo-caecal valve*; it is divided into duodenum, jejunum and ileum.

The *duodenum* is from 9 to 11 in. long and forms a horseshoe or C-shaped curve, encircling the head of the pancreas. It differs from the rest of the gut in being retroperitoneal. Its first part is horizontal and lies behind the fundus of the gall-bladder, passing backward and to the right from the pylorus. The second part runs vertically downward in front of the hilum of the right kidney, and into this part the pancreatic and bile ducts open. The third part runs horizontally to the left in front of the aorta and vena cava, while the fourth part ascends to the left side of the second lumbar vertebra, after which it bends sharply downward and forward to form the *duodeno-jejunal* flexure.

The *jejunum* forms the upper two-fifths of the rest of the small intestine; it, like the ileum, is thrown into numerous convolutions and is attached by the mesentery to the posterior abdominal wall. (See COELOM AND SEROUS MEMBRANES.)

The *ileum* is the remaining three-fifths of the small intestine, though there is no absolute point at which the one ends and the other begins. Speaking broadly, the jejunum occupies the upper and left part of the abdomen below the subcostal plane (see ANATOMY: *Superficial and Artistic*), the ileum the lower and right part. About 3 ft. from its termination a small pouch, known as *Meckel's diverticulum*, is very occasionally found. At its termination the ileum opens into the large intestine at the ileo-caecal valve.

The *caecum* is a blind sac occupying the right iliac fossa and extending down some two or three inches below the ileo-caecal junction. From its posterior and left surface the *vermiform appendix* protrudes, and usually is directed upward and to the left, though it not infrequently hangs down into the true pelvis. This worm-like tube is blind at its end and is usually 3 or 4 in. long, though it has been seen as long as 10. in. Its internal opening into the caecum is about 1 in. below that of the ileum. On transverse section it is seen to be composed of (1) an external muscular coat, (2) a submucous coat, (3) a mass of lymphoid tissue, which appears after birth, and (4) mucous membrane. In many cases its lumen is wholly or partly obliterated, though this is probably due to disease (see R. Berry and L. Lack, *Journ. Anat. & Phys.* vol. xl. p. 247). Guarding the opening of the ileum into the caecum is the *ileo-caecal valve*, which consists of two cusps projecting into the caecum; of these the upper forms a horizontal shelf, while the lower slopes up to it obliquely. Complete absence of the valve has been noticed, and in one such case the writer found that no abdominal inconvenience had been recorded during life. The caecum is usually completely covered by peritoneum, three special pouches of which are often found in its neighbourhood; of these the ileo-colic is just above the point of junction of the ileum and caecum, the ileo-caecal just below that point, while the retro-caecal is behind the caecum. At birth the caecum is a cone, the apex of which is the appendix; it is bent upon itself to form a U, and sometimes this arrangement persists throughout life (see C. Toldt, "Die Formbildung d. menschl. Blinddarmes," *Sitz. der Wiener Akad.* Bd. ciii. Abteil. 3, p. 41).

The *ascending colon* runs up from the caecum at the level of the ileo-caecal valve to the hepatic flexure beneath and behind the right lobe of the liver; it is about 8 in. long and posteriorly is in contact with the abdominal wall and right kidney. It is covered by peritoneum except on its posterior surface (see fig. 1).

The *transverse colon* is variable in position, depending largely on the distension of the stomach, but usually corresponding to the subcostal plane (see ANATOMY: *Superficial and Artistic*). On the left side of the abdomen it ascends to the splenic flexure, which may make an impression on the spleen (see DUCTLESS GLANDS), and is bound to the diaphragm opposite the eleventh rib by a fold of peritoneum called the *phrenico-colic ligament*. The peritoneal relations of this part are discussed in the article on the coelom and serous membranes.

The *descending colon* passes down in front of the left kidney and left side of the posterior abdominal wall to the crest of the ilium; it is about 6 in. long and is usually empty and contracted while the rest of the colon is distended with gas; its peritoneal relations are the same as those of the ascending colon, but it is more likely to be completely surrounded.

The *iliac colon* stretches from the crest of the ilium to the inner border of the psoas muscle, lying in the left iliac fossa, just above and parallel to Poupart's ligament. Like the descending, it is usually uncovered by peritoneum on its posterior surface. It is about 6 in. in length.

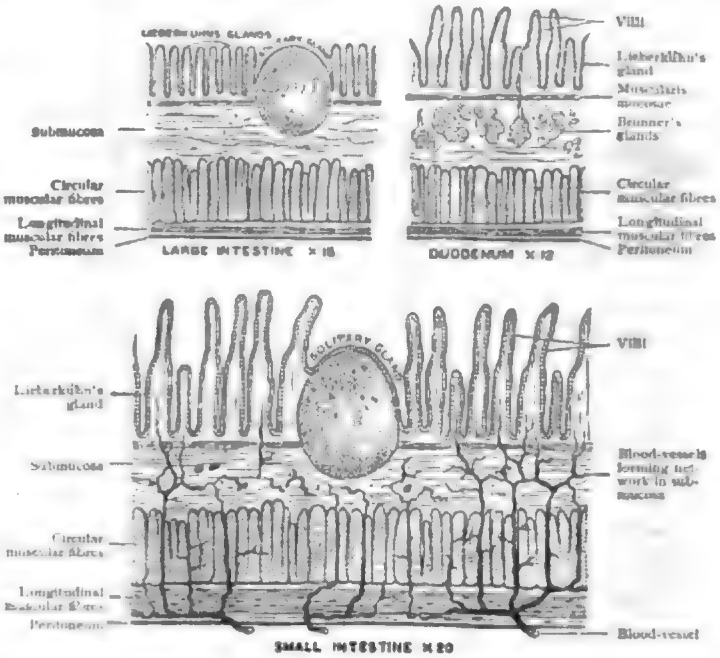
The *pelvic colon* lies in the true pelvis and forms a loop, the two limbs of which are superior and inferior while the convexity reaches across to the right side of the pelvis. In the foetus this loop occupies the right iliac fossa, but, as the caecum descends and enlarges and the pelvis widens, it is usually driven out of this region. The distal end of the loop turns sharply downward to reach the third piece of the sacrum, where it becomes the rectum. To this pelvic colon Sir F. Treves (*Anatomy of the Intestinal Canal*, London, 1885) has given the name of the *omega loop*. Formerly the iliac and pelvic colons were spoken of as the *sigmoid flexure*, but Treves and T. Jonnesco (*Le Colon pelvien pendant la vie intra-utérine*, Paris, 1892) have pointed out the inapplicability of the term, and to the latter author the modern description is due.

The *rectum*, according to modern ideas, begins in front of the third piece of the sacrum; formerly the last part of the Ω (or omega) loop was described as its first part. It ends in a dilatation or *rectal ampulla*, which is in contact with the back of the prostate in the male and of the vagina in the female and is in front of the tip of the coccyx. The rectum is not straight, as its name would imply, but has a concavity forward corresponding to that of the sacrum and coccyx.

When viewed from in front three bends are usually seen, the upper and lower of which are sharply concave to the left, the middle one to the right. At the end of the pelvic colon the mesocolon ceases, and the rectum is then only covered by peritoneum at its sides and in front; lower down the lateral covering is gradually reflected off and then only the front is covered. About the junction of the middle and lower thirds of the tube the anterior peritoneal covering is also reflected off on to the bladder or vagina, forming the *recto-vesical* pouch in the male and the *pouch of Douglas* in the female. This reflexion is usually about 3 in. above the anal aperture, but may be a good deal lower.

The *anal canal* is the termination of the alimentary tract, and runs downward and backward from the lower surface of the rectal ampulla between the levatores ani muscles. It is about an inch long and its lateral walls are in contact, so that in section it appears as an antero-posterior slit (see J. Symington, *Journ. Anat. and Phys.* vol. 23, 1888).

Structure of the Intestine.—The intestine has four coats: serous, muscular, submucous and mucous. The serous or peritoneal coat has already been described wherever it is present. The muscular coat consists of unstriped fibres arranged in two layers, the outer longitudinal and the inner circular (see fig. 2). In the large intestine the longitudinal fibres, instead of being arranged evenly round the tube as they are in the small, are gathered into three longitudinal bands called *taeniae* (see fig. 1); by the contraction of these the large intestine is thrown into a series of *sacculi* or slight pouches. The taeniae in the caecum all lead to the vermiform appendix, and form a useful guide to this structure. In the rectum the three taeniae once more become evenly arranged over the whole surface of the bowel, but more thickly on the anterior and posterior parts. The circular layer is always thicker than the longitudinal; in the small intestine it decreases in thickness from the duodenum to the ileum, but in the large it gradually increases again, so that it is thickest in the duodenum and rectum.



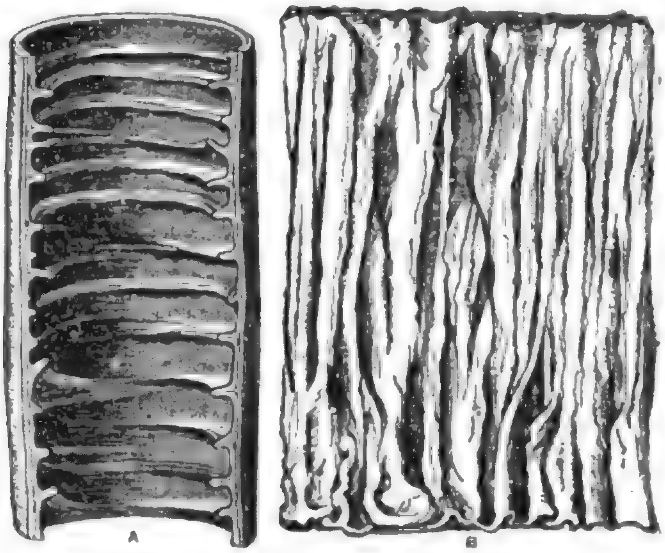
From A. Birmingham: Cunningham's *Text-Book of Anatomy*.

FIG. 2.—Diagram to show the structure of the small and large intestine and the duodenum.

The submucous coat is very strong and consists of loose areolar tissue in which the vessels break up.

The mucous coat is thick and vascular (see fig. 2); it consists of an epithelial layer most internally which forms the intestinal glands (see EPITHELIAL, ENDOTHELIAL AND GLANDULAR TISSUES). External to this is the *basement membrane*, outside which is a layer of retiform tissue, and this is separated from the submucous coat by a very thin layer of unstriped muscle called the *muscularis mucosae*. In the duodenum and jejunum the mucous membrane is thrown into a series of transverse pleats called *valvulae conniventes* (see fig. 3); these begin about an inch from the pylorus and gradually fade away as the ileum is reached. About 4 in. from the pylorus the common bile and pancreatic ducts form a papilla, above which one of the valvulae conniventes makes a hood and below which a vertical fold, the *frenulum*, runs downward. The surface of the mucous membrane of the whole of the small intestine has a velvety appearance, due to the presence of closely-set, minute, thread-like elevations called *villi* (see fig. 2). Throughout the whole length of the intestinal tract are minute masses of lymphoid tissue called *solitary glands* (see fig. 2); these are especially numerous in the caecum and appendix, while in the ileum they are collected into large oval patches, known as *agminated glands* or *Peyer's patches*, the long axes of which, from half an inch to 4 in. long, lie in the long axis of the bowel. They are always found in that part of the intestine which is farthest from the mesenteric attachment. In the interior of the rectum three shelf-like folds, one above the other, project into the cavity and correspond to the lateral concavities or kinks of the tube. They are not in the same line and the largest is usually on the right side. They are known as the *plicae recti* or *valves of Houston*. In the anal canal are four or five longitudinal folds called the *columns of Morgagni*. (For further details, see Quain's *Anatomy*, London, 1896; Gray's *Anatomy*, London, 1905; Cunningham's *Anatomy*, Edinburgh, 1906.)

Embryology.—The greater part of the alimentary canal is formed by the closing-in of the entoderm to make a longitudinal tube, ventral and parallel to the notochord. This tube is blind in front and behind (cephalad and caudad), but the middle part of its ventral wall is for some distance continuous with the wall of the yolk-sac, and this part of the canal, which at first opens into the yolk-sac by a very wide aperture, is called the *mid gut*. The part in front of it, which lies dorsal to the heart, is the *fore gut*, while the part behind the aperture of the yolk-sac is the *hind gut*.



From A. Birmingham; Cunningham's *Text-Book of Anatomy*.

FIG. 3.—*Valvulae Conniventes* (natural size).

A, As seen in a bit of jejunum which has been filled with alcohol and hardened.

B, A portion of fresh intestine spread out under water.

The pharynx, oesophagus, stomach and part of the duodenum are developed from the fore gut, a good deal of the colon and the rectum from the hind gut, while the mid gut is responsible for the rest. The cephalic part of the fore gut forms the pharynx (*q.v.*), and about the fourth week the stomach appears as a fusiform dilatation in the straight tube. Between the two the oesophagus gradually forms as the embryo elongates. The opening into the yolk-sac, which at first is very wide, gradually narrows, as the ventral abdominal walls close in, until in the adult the only indication of the connexion between the gut and the yolk-sac is the very rare presence (about 2%) of Meckel's diverticulum already referred to. The stomach soon shows signs of the greater and lesser curvatures, the latter being ventral, but maintains its straight position. About the sixth week the caecum appears as a lateral diverticulum, and, until the third month, is of uniform calibre; after this period the terminal part ceases to grow at the same rate as the proximal, and so the vermiform appendix is formed. The mid gut forms a loop with its convexity toward the diminishing *vitelline duct*, or remains of the yolk-sac, and until the third month it protrudes into the umbilical cord. The greater curvature of the stomach grows more rapidly than the lesser, and the whole stomach turns over and becomes bent at right angles, so that what was its left surface becomes ventral. This turning over of the stomach throws the succeeding part of the intestine into a *duodenal loop*, which at first has a dorsal and ventral mesentery (see COELOM AND SEROUS MEMBRANES). The intestine now grows very rapidly and is thrown into a series of coils; the caecum ascends and passes to the right ventral to the duodenum, and presses it against the dorsal wall of the abdomen; then it descends toward its permanent position in the right iliac fossa.

From the ventral surface on the hinder (caudal) closed end of the intestinal tube the *allantois* grows to form the placenta and bladder (see URINARY SYSTEM, REPRODUCTIVE SYSTEM and PLACENTA), and this region is the *cloaca* into which the alimentary, urinary and generative canals or ducts all open, but later two lateral folds appear which, by their union, divide the cloaca into a ventral and a dorsal part, the former being genito-urinary and the latter alimentary or intestinal. In this way the rectum or dorsal compartment is shut off from the genito-urinary. Later an ectodermal invagination at the hind end of the embryo develops and forms the anal canal; this is the *proctodaeum*, and for some time it is separated from the hind (caudal) end of the rectal part of the *mesodaeum* (or part of the intestinal canal formed from the mesoderm) by a membrane called the *anal membrane*. This is eventually absorbed and the digestive tract now communicates with the surface by the anus.

F. Wood Jones (*British Medical Journal*, 17th of December 1904) has given a somewhat different description of the development of the cloaca and anus, which better explains the various abnormalities met with in this region but requires further confirmation before it is generally accepted. For the development of the mouth, pharynx, lungs, liver and pancreas from the primitive alimentary canal, the reader is referred to the special articles on those structures. (For further details, see W. His, *Anatomie menschlicher Embryonen* (Leipzig, 1880–1885); C. S. Minot's *Embryology* (New York, 1897); and J. P. M'Murrich, *Development of the Human Body* (London, 1906). (F. G. P.)

Comparative Anatomy.—The primitive condition of the vertebrate alimentary canal may be described as a straight, simple tube, consisting of an anterior portion, the *stomodaeum*, formed by an ectodermal invagination, the *mesenteron*, a long median portion lined by endoderm, and a short posterior portion, the *proctodaeum*, formed by ectodermal invagination. In the lower vertebrates the primitive tube subserved also the purpose of respiration, and traces of the double function remain in the adult structure of all vertebrates (see MOUTH, PHARYNX). In fish, the pharynx, or branchial region, suddenly becomes narrower, posterior to the gill-slits, to form the oesophagus; in higher animals the oesophagus, in the adult, is separated from the primitive pharyngeal region and lies dorsal to it. Probably, in the primitive vertebrata, the entire alimentary canal was lined with ciliated cells. Traces of this ciliation persist in many living forms. In the *Ammocoete*, the larval form of *Petromyzon* (see CYCLOSTOMATA), the whole canal is ciliated except the pharynx and the rectum; in the *Dipnoi* the epithelium of the stomach and the intestines is ciliated; in *Selachii* that of the posterior part of the gullet, and the spiral valve, is ciliated; extensive ciliation may occur in almost any region of the gut of the lower teleostomes, but in the higher forms (*Teleostei*) it is generally absent. In the latter, however, and in higher groups of vertebrates, a peculiar striated border on the columnar cells lining the intestinal tract has been held to be a final trace of ancestral ciliation.

The alimentary canal may be conveniently described in three divisions, the *oesophagus* or gullet, the passage by which food reaches the stomach, the *stomach*, typically an expanded region in which the food remains for a considerable time and is mechanically pulped, mixed with mucus and certain digestive juices (see NUTRITION) and partly macerated, the *intestinal tract* or gut, extending from the distal end of the stomach to the cloaca or anus, in which the food is subjected to further digestive action, but which is above all the region in which absorption of the products of digestion takes place, the refuse material together with quantities of waste matter entering the gut from the blood and liver being gradually passed towards the anus for discharge from the body.

The *oesophagus* is essentially merely a passage, as straight as may be, from the pharynx to the stomach, varying in length with the length of the neck and thoracic regions in different animals, and in calibre with the nature of the food. It is almost invariably lined with a many-layered epithelium, forming a tough coating, readily repaired and not easily damaged by hard food masses. It is occasionally separated from the stomach by a slight constriction which may be capable of contraction so as to prevent regurgitation. There are few exceptions to this structural and functional simplicity. In fishes (see ICHTHYOLOGY, *Anatomy*) the swim-bladder is developed as a dorsal outgrowth of the oesophagus and may remain in open connexion with it. In certain *Teleosteis* (*e.g. Lutodeira*) it is longer than the length it has to traverse and is thrown into convolutions. In many other fish, particularly *Selachiis*, a set of processes of the lining wall project into the cavity near the stomach and have been supposed to aid in preventing food particles, or living creatures swallowed without injury, escaping backwards into the mouth. In some egg-eating snakes the sharp tips of the ventral spines (hypapophyses) of the posterior cervical vertebrae penetrate the wall of the oesophagus and are used for breaking the shells of the eggs taken as food. In some aquatic *Chelonians*, the food of which consists chiefly of seaweeds, the lining membrane is produced into pointed processes backwardly directed. In birds this region frequently presents peculiarities. In *Opisthocomus* it forms an enormously wide double loop, hanging down over the breast-bone, which is peculiarly flattened and devoid of a keel in the anterior portion. In many birds part of the oesophagus may be temporarily dilated, forming a "crop," as for instance in birds of prey and humming birds. In the flamingo, many ducks, storks, and the cormorant the crop is a permanent although not a highly specialized enlargement. Finally, in the vast majority of seed-eating birds, in gallinaceous birds, pigeons, sandgrouse, parrots and many *Passeres*, particularly the finches, the crop is a permanent globular dilatation, in which the food is retained for a considerable time, mixed with a slight mucous secretion, and softened and partly macerated by the heat of the body. Many birds feed their young from the soft contents of the crop, and in pigeons, at the breeding season, the cells lining the crop proliferate rapidly and are discharged as a soft cheesy mass into the cavity, forming the substance known as pigeon's milk. Amongst *Mammalia*, in *Rodentia*, *Carnivora*, elephants and ruminants, the wall of the oesophagus contains a layer of voluntary muscle, by the contraction of which these animals induce antiperistaltic movements and can so regurgitate food into the mouth.

Stomach.—Where the oesophagus passes into the stomach, the lining wall of the alimentary tract changes from a many-layered epithelium to a mucous epithelium, consisting of a single layer of endodermal cells, frequently thrown into pits or projecting as processes; from being chiefly protective, it has become secretory and absorbing, and maintains this character to the distal extremity where it passes into the epiblast of the proctodaeum. In most cases the course of the alimentary canal from the distal end of the oesophagus to the cloaca or anus is longer than the corresponding region of the body, and the canal is therefore thrown into folds. The fundamental form of the stomach is a sac-like enlargement of the canal, the proximal portion of which is continuous with the line of the oesophagus, but the distal portion of which is bent in the proximal portion, the whole forming an enlarged bent tube. At the distal end of the tube the intestinal tract proper begins, and the two regions are separated by a muscular constriction. In fishes the stomach is generally in one of two forms; it may be a simple bent tube, the proximal limb of which is almost invariably much wider than the distal, anteriorly directed limb; or the oesophagus may pass directly into an expanded, globular or elongated sac, from the anterior lateral wall of which, not far from the oesophageal opening, the duodenum arises. In *Batrachia* and *Reptilia* the stomach is in most cases a simple sac, marked off from the oesophagus only by increased calibre. In the *Crocodilia*, however, the anterior portion of the stomach is much enlarged and very highly muscular, the muscles radiating from a central tendinous area on each of the flattened sides. The cavity is lined by a hardened secretion and contains a quantity of pebbles and gravel which are used in the mechanical trituration of the food, so that the resemblance to the gizzard of birds is well marked. This muscular chamber leads by a small aperture into a distal, smaller and more glandular chamber. In birds the stomach exhibits two regions, an anterior glandular region, the proventriculus, the walls of which are relatively soft and contain enlarged digestive glands aggregated in patches (*e.g.* some *Steganopodes*), in rows (*e.g.* most birds of prey) or in a more or less regular band. The distal region is larger and is lined in most cases by a more or less permanent lining which is thick and tough in birds with a muscular gizzard, very slight in the others. In many birds, specially those feeding on fish, the two regions of the stomach are of equal width, and are indistinguishable until, on opening the cavity, the difference in the character of the lining membrane becomes visible. In other birds the proventriculus is separated by a well-marked constriction from the posterior and larger region. In graminiferous forms the latter becomes a thick-walled muscular gizzard, the muscles radiating from tendinous areas and the cavity containing pebbles or gravel.

In mammals, the primitive form of the stomach consists of a more or less globular or elongated expansion of the oesophageal region, forming the cardiac portion, and a forwardly curved, narrower pyloric portion, from which the duodenum arises. The whole wall is muscular, and the lining membrane is richly glandular. In the *Insectivora*, *Carnivora*, *Perissodactyla*, and in most *Edentata*, *Chiroptera*, *Rodentia* and *Primates*, this primitive disposition is retained, the difference consisting chiefly in the degrees of elongation of the stomach and the sharpness of the distal curvature. In other cases the cardiac portion may be prolonged into a caecal sac, a condition most highly differentiated in the blood-sucking bat, *Desmodeus*, where it is longer than the entire length of the body. There are two cardiac extensions in the hippopotamus and in the peccary. In many other mammals one, two or three protrusions of the cardiac region occur, whilst in the manatee and in some rodents the cardiac region is constricted off from the pyloric portion. In the *Artiodactyla* the stomach is always complex, the complexity reaching a maximum in ruminating forms. In the *Suidae* a cardiac diverticulum is partly constricted from the general cavity, forming an incipient condition of the rumen of true ruminants; the general cavity of the stomach shows an approach to the ruminant condition by the different characters of the lining wall in different areas. In the chevrotains, which in many other respects show conditions intermediate between non-ruminant artiodactyles and true ruminants, the oesophagus opens into a wide cardiac portion, incompletely divided into four chambers. Three of these, towards the cardiac extremity, are lined with villi and correspond to the *rumen* or paunch; the fourth, which lies between the opening of the oesophagus and the pyloric portion of the stomach, is the ruminant *reticulum* and its wall is lined with very shallow "cells." A groove runs along its dorsal wall from the oesophageal aperture to a very small cavity lined with low, longitudinally disposed folds, and forming a narrow passage between the cardiac and pyloric divisions; this is an early stage in the development of the *omasum*, *psalterium* or manyplies of the ruminant stomach. The fourth or true pyloric chamber is an elongated sac with smooth glandular walls and is the *abomasum*, or rennet sack. In the camel the rumen forms an enormous globular paunch with villous walls and internally showing a trace of division into two regions. It is well marked off from the reticulum, the "cells" of which are extremely deep, forming the well-known water-chambers. The psalterium is sharply constricted off from the reticulum and is an elongated chamber showing little trace of the longitudinal ridges characteristic of this region; it opens directly into the relatively small abomasum. In the true ruminants, the rumen forms capacious, villous reservoir, nearly always partly sacculated, into which the food is passed rapidly as the animal grazes. The food is subjected to a rotary movement in the paunch; and is thus repeatedly subjected to moistening with the fluids secreted by the reticulum, as it is passed over the aperture of that cavity, and is formed into a rounded bolus. Most ruminants swallow masses of hairs, and these, by the rotary action of the paunch, are aggregated into peculiar dense, rounded balls which are occasionally discharged from the mouth and are known as "hair-balls" or "bezoars." The food bolus, when the animal is lying down after grazing, is passed into the oesophagus and reaches the mouth by anti-peristaltic contractions of the oesophagus. After prolonged mastication and mixing with saliva, it is again swallowed, but is now passed into the psalterium, which, in true ruminants, is a small chamber with conspicuous longitudinal folds. Finally it reaches the large abomasum where the last stages of gastric digestion occur.

In the *Cetacea* the stomach is different from that found in any other group of mammals. The oesophagus opens directly into a very large cardiac sac the distal extremity of which forms a long caecal pouch. At nearly the first third of its length this communicates by a narrow aperture into the elongated, relatively narrow pyloric portion. The latter is convoluted and constricted into a series of chambers that differ in different groups of *Cetacea*. In the *Sirenia* the stomach is divided by a constriction into a cardiac and a pyloric portion, and the latter has a pair of caeca. In most of the *Marsupialia* the stomach is relatively simple, forming a globular sac with the oesophageal and pyloric apertures closely approximated; in the kangaroos, on the other hand, the stomach is divided into a relatively small, caecal cardiac portion and an enormously long sacculated and convoluted pyloric region, the general arrangement of which closely recalls the large caecum of many mammals.

Intestinal Tract.—It is not yet possible to discuss the general morphology of this region in vertebrates as a group, as, whilst the modifications displayed in birds and mammals have been compared and studied in detail, those in the lower groups have not yet been systematically co-ordinated.

Fishes.—In the *Cyclostomata*, *Holocephali* and a few *Teleostei* the course of the gut is practically straight from the pyloric end of the stomach to the exterior, and there is no marked differentiation into regions. In the *Dipnoi*, a contracted sigmoid curve between the stomach and the dilated intestine is a simple beginning of the complexity found in other groups. In very many of the more specialized teleosteans, the gut is much convoluted, exhibiting a series of watchspring-like coils. In a number of different groups, increased surface for absorption is given, not by increase in length of the whole gut, but by the development of an internal fold known as the spiral valve. This was probably originally a longitudinal fold similar to the typhlosole of chaetopods. It forms a simple fold in the larval *Ammocoete*, and in its anterior region remains straight in some adult fish, *e.g. Polypterus*, but in the majority of cases it forms a complex spiral, wound round the inner wall of the expanded large intestine, the internal edge of the fold sometimes meeting to form a central column. It occurs in *Cyclostomata*, *Selachii*, *Holocephali*, *Chondrostei*, *Crossopterygii*, *Amiidae*, *Lepidosteidae* and *Dipnoi*. A set of organs peculiar to fish and known as the *pyloric caeca* are absent in *Cyclostomata* and *Dipnoi*, in most *Selachii* and in *Amia*, but present, in numbers ranging from one to nearly two hundred, in the vast majority of fish. These are outgrowths of the intestinal tract near the pyloric extremity of the stomach, and their function is partly glandular, partly absorbing. In a few *Teleostei* there is a single caecal diverticulum at the beginning of the "rectum," and in the same region a solid rectal gland occurs in most elasmobranchs, whilst, again, in the *Dipnoi* a similar structure opens into the cloaca. These caeca have been compared with the colic caeca of higher vertebrates, but there is yet no exact evidence for the homology.

In the *Batrachia* the course of the intestinal tract is nearly straight from the pyloric end of the stomach to the cloaca, in the case of the perennibranchiates there being no more than a few simple loops between the expanded "rectum" and the straight portion that leaves the stomach. In the *Caducibranchiata* the anterior end of the enlarged rectum lies very close to the distal extremity of the stomach, and the gut, between these two regions, is greatly lengthened, forming a loop with many minor loops borne at the periphery of an expanse of mesentery, recalling the Meckelian tract of birds and mammals. In the tadpole this region is spirally coiled and is still longer relatively to the length of the whole tract. In *Hyla* and *Pipa* there is a small caecum comparable with the colic caecum of birds and mammals.

In *Reptilia* the configuration of the intestinal tract does not differ much from that in *Batrachia*, the length and complexity of the minor coils apparently varying with the general configuration of the body, that is to say, in reptiles with a long, narrow, and snake-like body the minor loops of the gut are relatively short and unimportant, whilst in those with a more spacious cavity, such as chelonians, many lizards and crocodiles, the gut may be relatively long and disposed in many minor coils. There is comparatively little differentiation between the mid-gut and the gut in cases where the whole gut is long; in the others the hind-gut is generally marked by an increase of calibre. A short caecal diverticulum, comparable with the colic caecum of birds and mammals, is present in many snakes and lizards and in some chelonians.

In fishes, batrachians and reptiles the intestinal tract is swung from the dorsal wall of the abdominal cavity by a mesentery which is incomplete on account of secondary absorption in places, and which grows out with the minor loops of the gut. There are also traces, more abundant in the lower forms, of the still more primitive ventral mesentery.

Intestinal Tract in Birds and Mammals.—There is no doubt but that the similarity of the modes of disposition of the alimentary tract in birds and mammals points to the probability of the chief morphological features of this region in these animals having been laid down in some common ancestor, although we have not yet sufficient exact knowledge of the gut in *Pisces*, *Batrachia* and *Reptilia* to find amongst these with any certainty the most probable survival from the ancestral condition. The primitive gut must be supposed to have run backwards from the stomach to the cloaca suspended from the dorsal wall of the body-cavity by a dorsal mesentery. This tract, in the course of phylogeny of the common ancestors of birds and mammals, became longer than the straight length between its extreme points and, consequently, was thrown into a series of folds. The

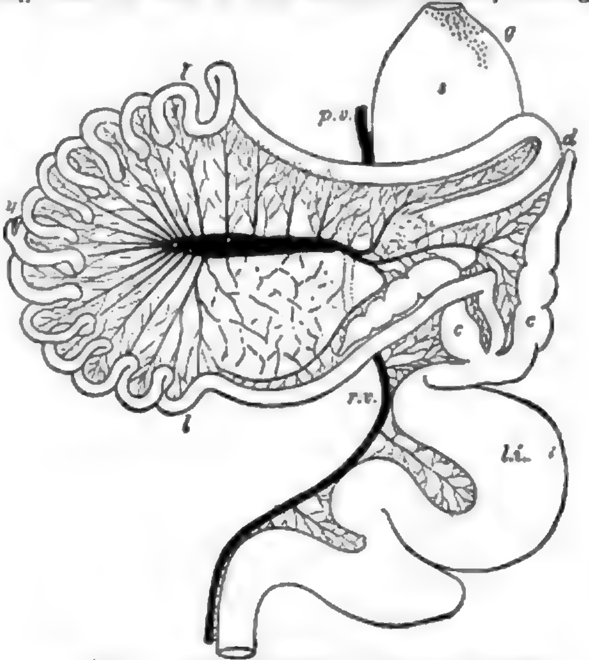


FIG. 4.—Intestinal Tract of *Chauna chavaria*.

c.c.	Colic caeca.	*p.v.*	Cut root of portal vein.
d.	Duodenum.	*r.v.*	Rectal vein.
g.	Glandular patch.	*s.*	Proventriculus.
l.l.	Meckel's tract.	*y.*	Meckel's diverticulum, or Yolk-sac vestige.
l.i.	Hind-gut.		

mesentery grew out with these folds, but the presence of adjacent organs, the disturbance due to the outgrowth of the liver, and the secondary relations brought about between different portions of the gut, as the out-growing loops invaded each other's localities, disturbed the primitive simplicity. Three definite regions of outgrowth, however, became conspicuous and are to be recognized in the actual disposition of the gut in existing birds and mammals. The first of these is the *duodenum*. In the vast majority of birds, and in some of the simpler mammals, the portion of the gut immediately distal of the stomach grows out into a long and narrow loop (fig. 4, *d*), the proximal and distal ends of which are close together, whilst the loop itself may remain long and narrow, or may develop minor loops on its course. In mammals generally, however, the duodenum is complex and is not so sharply marked off from the distal portion of the gut as in birds. The second portion is *Meckel's tract*. It consists of the part generally known as the small intestines, the *jejunum* and *ileum* of human anatomy, and stretches from the distal end of the duodenum to the caecum or caeca. It is the chief absorbing portion of the gut, and in nearly all birds and mammals is the longest portion. It represents, however, only a very small part of the primitive straight gut, corresponding to not more than two or three somites of the embryo. This narrow portion grows out to form the greater part of what is called the pendent loop in mammalian embryology. Its anterior or proximal end lies close to the approximated proximal and distal ends of the duodenal loop, whilst its distal end passes into the hind-gut at the colic caecum or caeca. In the embryos of all birds and mammals, the median point of Meckel's tract, the part of the loop which has grown out farthest from the dorsal edge of the mesentery, is marked by the *diverticulum caecum vitelli*, the primitive connexion of the cavity of the gut with the narrowing stalk of the yolk-sac (fig. 4, *y*). Naturally, in birds where the yolk-sac is of great functional importance this diverticulum is large, and in a majority of the families of birds persists throughout life, forming a convenient point of orientation. In mammals, no doubt in association with the functional reduction of the yolk-sac, this diverticulum, which is known as Meckel's diverticulum, has less importance, and whilst it has been observed in a small percentage of adult human subjects has not been recognized in the adult condition of any lower *Mammalia*.

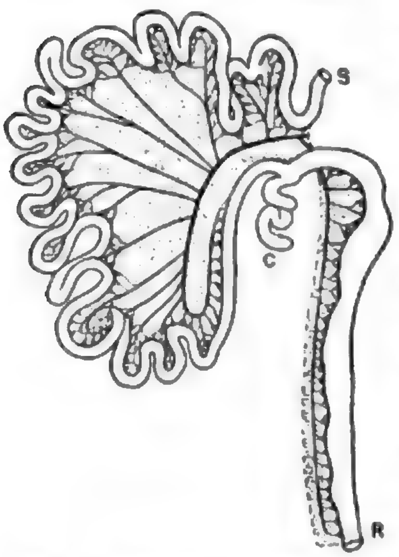


FIG. 5.—Intestinal Tract of *Canis vulpes*. *S*, cut end of duodenum; *C*, caecum; *R*, cut end of rectum.

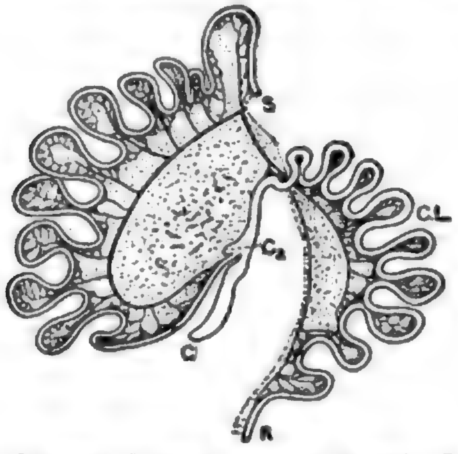


FIG. 6.—Intestinal Tract of *Macropus bennetti*. *S*, cut end of duodenum; *R*, cut end of rectum; *C*, caecum; *C*$_2$, accessory caecum; *C.L*, colic loop of hind-gut.

In birds, Meckel's tract falls into minor folds or loops, the disposition of which forms a series of patterns remarkably different in appearance and characteristic of different groups. In fig. 4 an extremely primitive type is represented. In mammals Meckel's tract remains much more uniform; it may be short, or increase enormously in length, but in either case it falls into a fairly symmetrical shape, suspended at the circumference of a nearly circular expanse of mesentery. Where it is short it is thrown into very simple minor loops (figs. 5, 6 and 7); where it is long, these minor loops form a convoluted mass (figs. 8 and 9).

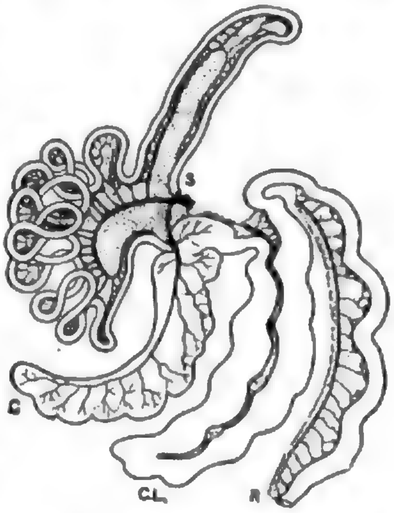


FIG. 7.—Intestinal Tract of Tapir. *S*, cut end of duodenum; *R*, cut end of rectum; *C*, caecum; *CL*, colon.

The third portion of the gut should be termed the *hind-gut* and lies between the caecum or caeca and the anus, corresponding to the large intestines, colon and rectum of human anatomy. It is formed from a much larger portion of the primitive straight gut than the duodenum and Meckel's tract together, and its proximal portion, in consequence, lies very close to the origin of the duodenum. In the vast majority of birds, the hind-gut in the adult is relatively extremely short, often being only from one-eighth to one-thirtieth of the whole length of the gut. A certain number of primitive birds, however, have retained a relatively long condition of the hind-gut (fig. 4), the greatest relative length occurring in struthious birds, and particularly in the ostrich, where the hind-gut exceeds in length the duodenum and Meckel's tract together. Mammals may be contrasted with birds as a group in which the hind-gut is always relatively long, sometimes extremely long, and in which, moreover, there is a strong tendency to differentiation of the hind-gut into regions

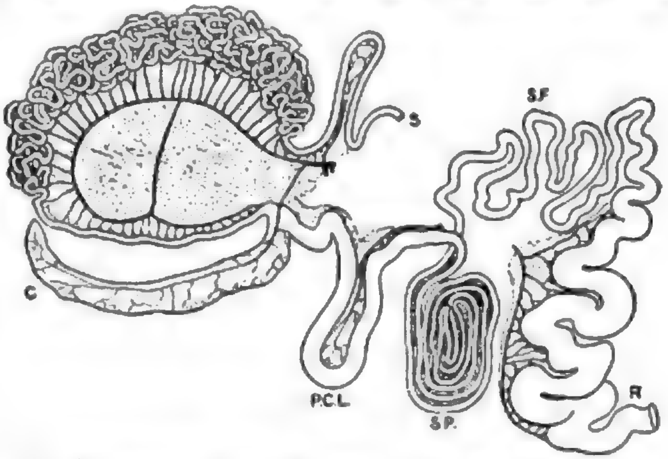


FIG. 8.—Intestinal Tract of Giraffe. *S*, cut end of duodenum; *R*, cut end of rectum; *C*, caecum; *P.C.L*, post-caecal loop; *S.P*, spiral loop; *SF*, third loop of hind-gut.

the characters of which are of systematic importance. The first region is the *colon*, which forms a very simple expansion in mammals such as *Carnivora* (fig. 5), where the whole hind-gut is relatively short, or a series of simple loops in mammals in which the whole gut has a primitive disposition (*e.g. Marsupialia*, fig. 6). In the odd-toed *Ungulata*, the colon (fig. 7) forms an enormously long loop, the two limbs of which are closely approximated and the calibre of which is very large. In *Ruminantia* (fig. 8) the colon is still more highly differentiated, displaying first a simple wide loop, then a complicated watchspring-like coil, and finally a very long, irregular portion. In the higher *Primates* (fig. 9) it forms one enormous very wide loop, corresponding to the ascending, transverse and descending colons of human anatomy, and a shorter distal loop, the omega loop of human anatomy. Other striking patterns are displayed in other mammalian groups.

The second region of the hind-gut is usually known as the *rectum*, and although it is sometimes lengthened it is typically little longer than the portion of the primitive straight gut that it represents.

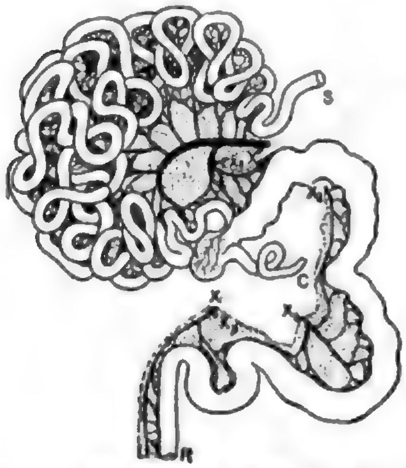


Fig. 9.—Intestinal Tract of Gorilla. *S*, cut end of duodenum; *R*, cut end of rectum; *C*, vermiform appendix of caecum; X, X_1, X_2, cut ends of factors of the portal vein.

Adaptations of the Intestinal Tract to Function.—The chief business of the gut is to provide a vascular surface to which the prepared food is applied so that the nutritive material may be absorbed into the system. Overlying and sometimes obscuring the morphological patterns of the gut, are many modifications correlated with the nature of the food and producing homoplastic resemblances independent of genetic affinity. Thus in birds and mammals alike there is a direct association of herbivorous habit with great relative length of gut. The explanation of this, no doubt, is simply that the vegetable matter which such creatures devour is in a form which requires not only prolonged digestive action, but, from the intimate admixture of indigestible material, a very large absorbing surface. In piscivorous birds and mammals, the gut if very long, with a thick wall and a relatively small calibre, whilst there is a general tendency for the regions of the gut to be slightly or not at all defined. Fish, as it is eaten by wild animals, contains a large bulk of indigestible matter, and so requires an extended absorbing surface; the thick wall and relatively small calibre are protections against wounding by fish bones. In frugivorous birds the gut is strikingly short, wide and simple, whilst a similar change has not taken place in frugivorous mammals. Carnivorous birds and mammals have a relatively short gut. In birds, generally, the relation of the length and calibre of the gut to the size of the whole creature is striking. If two birds of similar habit and of the same group be compared, it will be found that the gut of the larger bird is relatively longer rather than relatively wider. The same general rule applies to Meckel's tract in mammals, whereas in the case of the hind-gut increase of capacity is given by increase of calibre rather than by increased length.

The Colic Caeca.—These organs lie at the junction of the hind-gut with Meckel's tract and are homologous in birds and mammals although it happens that their apparent position differs in the majority of cases in the two groups. In most birds, the hind-gut is relatively very short, and the caecal position, accordingly, is at a very short distance from the posterior end of the body, whereas in most mammals the hind-gut is very long and the position of the caecum or caeca is relatively very much father from the anus. Next, in most birds, the caeca when present are paired, whereas in most mammals there is only a single caecum. On the other hand, in certain birds (herons) as a normal occurrence, and in many birds as an individual variation, only a single caecum occurs. In some mammals, *e.g.* many armadillos, in *Hyrax* and the manatee, the caeca are normally paired; in many other (*e.g.* some rodents and marsupials) in addition to the normal caecum there is a reduced second caecum, whilst in quite a number of forms the relation of the caecum, ileum and colon at their junction is readily intelligible on the assumption that the caeca were originally paired. The origin and many of the peculiarities of the ileo-caecal valve find their best explanation on this hypothesis.

The caeca are hollow outgrowths of the wall of the gut, the blind ends being directed forwards. The caecal wall is in most cases highly glandular and contains masses of lymphoid tissue. In birds and in mammals this tissue may be so greatly increased as to transform the caecum into a solid or nearly solid sac, the calibre of which is for the most part smaller than that of the unmodified caecum. In some birds, the whole area of the caecum may be modified in this way; in mammals, it is generally the terminal portion, which then becomes the *vermiform appendix*, familiar in the anthropoid apes, in man and in some rodents. It is difficult to see in this modification merely a degeneration; not improbably it is the formation of a new glandular organ.

The caeca exhibit almost every gradation of development, from relatively enormous size to complete absence, and there is no definite, invariable connexion between the nature of the food and the degree of their development. In the case of birds, it may be said that on the whole the caeca are generally large in herbivorous forms and generally small in insectivorous, frugivorous, carnivorous and piscivorous forms, but there are many exceptions. Thus, owls and falcons have a diet that is closely similar, and yet owls have a pair of very long caeca, whilst in the *Falconidae* these organs are much reduced and apparently functionless. The insectivorous and omnivorous rollers, motmots and bee-eaters have a pair of large caeca, whilst in passerine birds of similar habit the caeca are vestigial glandular nipples. It is impossible to doubt that family history dominates in this matter. Certain families tend to retain the caeca, others to lose them, and direct adaptation to diet appears only to accelerate or retard these inherited tendencies. So also in mammals, no more than a general relation between diet and caecal development can be shown to exist, although the large size of the single caecum of mammals is more closely associated with a herbivorous as opposed to a carnivorous, frugivorous, piscivorous or omnivorous diet than is the case in birds. There is no relationship between diet and the complete or partial presence of both members of the primi-pair of caeca in mammals, the occurrence of the pair being rather an " accident " of inheritance than in any direct relation to function.

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ALIMONY (from Lat. *alere*, to nourish), in law the allowance for maintenance to which a wife is entitled out of her husband's estate for her support on a decree for judicial separation or for the dissolution of the marriage. Though, as a rule, payable to a wife, it may, if the circumstances of the case warrant it, be payable by the wife to the husband. Alimony is of two kinds, (*a*) temporary (*pendente lite*), and (*b*) permanent. *Temporary* alimony, or alimony pending suit, is the provision made by the husband for the wife in causes between them to enable her to live during the progress of the suit, and is allowed whether the suit is by or against the husband and whatever the nature of the suit may be. The usual English practice is to allot as temporary alimony about one-fifth of the husband's net income; where it appears that the husband has no means or is in insolvent circumstances, the court will refuse to allot temporary alimony. So where the wife is supporting herself by her own earnings, this fact will be taken into consideration. And where the wife and husband have lived apart for many years before the institution of the suit, and she has supported herself during the separation, no alimony will be allotted. Nor will the wife be entitled to alimony where she has sufficient means of support independent of her husband. *Permanent* alimony is that which is allotted to the wife after final decree. By the Matrimonial Causes Act 1907, the court may, if it think fit, on any decree for dissolution or nullity of marriage, order that the husband shall, to the satisfaction of the court, secure to the wife such a gross sum of money or such annual sum of money for any term not exceeding her life, as having regard to her fortune (if any), to the ability of her husband, and to the conduct of the parties, it may deem reasonable. The court may suspend the pronouncing of its decree until a proper deed or instrument has been executed by all necessary parties. The court may also make an order on the husband for payment to the wife during their joint lives of a reasonable monthly or weekly sum for her maintenance; the court may also at any time discharge, modify, suspend or increase the order according to the altered means of the husband; the court has also power to make provision for children. Alimony is paid direct to the wife or to a trustee or trustees on her behalf, but the court may impose any restrictions which seem expedient. We may also describe as a kind of alimony the allowance of a reasonable weekly sum not exceeding £2 which in England, under the Summary Jurisdiction (Married Women) Act 1895, may be given to a married woman on applying to a court of summary jurisdiction if she has been forced by cruelty to leave her husband or has been deserted by him.

United States.—Alimony is granted by the courts of the several states on much the same principle as in England, though in many states the courts of equity as such may grant alimony without divorce or separation proceedings independently of any statute, on the ground that it is just that the husband should support his wife when she lives apart from him for his fault, and since the courts of common law provide no remedy the courts of equity will. This is so in Alabama (*Brady* v. *Brady*, 1905, 39 So. Rep. 237), Kentucky, North Carolina, Iowa, California, Ohio, Virginia, South Dakota and the District of Columbia. In other states alimony without such proceedings is allowed by statute, and such alimony is now very general throughout the United States. The usual grounds for the allowance of it are desertion and such conduct as would amount to legal cruelty. After divorce *a vinculo*, alimony or separate maintenance is sometimes granted on good reason. The marriage must be proven as a fact, but a "common law" marriage, *i.e.* one established by cohabitation and repute, is sufficient. In several states alimony or maintenance is by statute allowed to the husband in certain cases out of the wife's property. This is so in Massachusetts, Virginia, Rhode Island and Iowa. In Oregon he is entitled to one-third of his wife's real estate in addition to maintenance on divorce for her fault. The amount of alimony depends upon the circumstances of each case as in England. Permanent alimony is generally more than when *pendente lite*, and usually one-third the husband's income. It may generally be changed from time to time as the circumstances of the parties change. Judgment for alimony is considered a judgment *in personam* and not *in rem*, and can only be enforced outside the state where rendered in case the husband has been personally served with process within that state. The remarriage of the man is not sufficient ground for reducing the alimony (*Smith* v. *Smith*, 1905, 102 N.W. Rep. 631), but on remarriage of a woman to one able to support her, her former husband being in poor circumstances, it will be reduced (*Kiralfy* v. *Kiralfy*, 1901, 36 Wisc. N.S. 407).

ALIN, OSCAR JOSEF (1846–1900), Swedish historian and politician, was born at Falun on the 22nd of December 1846. In 1872 he became *docent*, and in 1882 professor of political economy at Upsala, of which university he was afterwards rector. In September 1888 he was elected a member of the first chamber of the *Riksdag*, where he attached himself to the conservative protectionist party, over which, from the first, he exercised great authority. But it is as a historian that Alin is most remarkable. Among his numerous works the following are especially worthy of note: *Bidrag till svenska rådets historia under medeltiden* (Upsala, 1872); *Sveriges Historia, 1511–1611* (Stockholm, 1878); *Bidrag till svenska statsrickets historia* (Stockholm, 1884–1887); *Den svensk-norsk Unionen* (Stockholm, 1889–1891), the best book on the Norwego-Swedish Union question from the Swedish point of view; *Fjerde Artiklen af Fredstraktaten i Kiel* (Stockholm, 1899); *Carl Johan ock Sveriges yttre politik, 1810–1815* (Stockholm, 1899); *Carl XIV. ock Rikets Ständer, 1840–1841* (Stockholm, 1893). He also edited *Svenska Riksdagsakter, 1521–1554* (Stockholm, 1887), in conjunction with E. Hildebrand, and *Sveriges Grundlagar* (Stockholm, 1892). He died at Upsala on the 31st of December 1900.

Obituary notice in *Sv. Hist. Tidssk.* (1901). (R. N. B.)

ALIPUR, a suburb of Calcutta, containing Belvedere House, the official residence of the lieutenant-governor of Bengal, and a number of handsome mansions. It lies within the limits of the south suburban municipality, and is a cantonment of native troops. On the Calcutta *maidan*, opposite Alipur Bridge, stood two trees under which duels were fought. It was here that the meeting in 1780 between Warren Hastings and Sir Philip Francis took place.

ALIQUOT (a Lat. word meaning "some," "so many"), a term generally occurring in the phrase "aliquot part," and meaning that one quantity is exactly divisible into another; thus 3 is an aliquot part of 6.

ALIRAJPUR, a native state of India, under the Bhopawar agency in Central India. It lies in Malwa, near the frontier of Bombay. It has an area of 836 sq. m.; and a population (1901) of 50,185. The country is hilly, and many of the inhabitants are aboriginal Bhils. It has from time to time been under British administration. The chief, whose title is Rana, is a Rahtor Rajput. He has an estimated revenue of £8700, and pays a tribute of £700. The Victoria bridge at Alirajpur was built to commemorate the Diamond Jubilee of 1897.

ALISMACEAE (from the Gr. ἄλισμα, a water-plant mentioned by Dioscorides), in botany, a natural order of monocotyledons belonging to the series Helobieae, and represented in Britain by the water plantain, *Alisma Plantago*, the arrow-head, *Sagittaria*, the star-fruit, *Damasonium*, and flowering rush, *Butomus* (from the Gr. βοῦς, ox, τέμνειν, to cut, in allusion to leaves cutting the tongues of oxen feeding on them). They are marsh- or water-plants with generally a stout stem (rhizome) creeping in the mud, radical leaves and a large, much branched inflorescence. The leaves show a great variety in shape, often on the same plant, according to their position in, on or above the water. The submerged leaves are long and grass-like, the floating leaves oblong or rounded, while the aerial leaves are borne on long, thin stalks above the water, and are often heart- or arrow-shaped at the base. The flower-bearing stem is tall; the flowers are borne in whorls on the axis as in arrow-head, on whorled branchlets as in water plantain or in an umbel as in *Butomus* (fig. 1). The flowers are regular and rather showy, generally with three greenish sepals, followed in regular succession by three white or purplish petals, six to indefinite stamens and six to indefinite free carpels. The floral

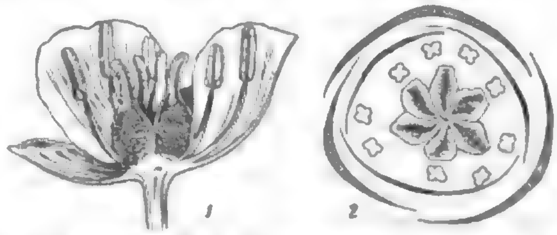


FIG. 1.—Flowering Rush (*Butomus umbellatus*). 1, Flower in vertical section; 2, horizontal plan of arrangement of flower.

arrangement thus recalls that of a buttercup, a resemblance which extends to the fruit, which is a head of achenes or follicles. The flowers contain honey, and attract flies, short-lipped bees or other small insects by the agency of which pollination is effected. The fruit of *Butomus* is of interest in having the seeds borne over the inner face of the wall of the leathery pod (follicle). *Damasonium* derives its popular name, star-fruit, from the fruits spreading when ripe in the form of a star. It is a western Mediterranean plant which spreads to the south of England, where it is sometimes found in gravelly ditches and pools. The order contains about fifty species in fourteen genera, and is widely distributed in temperate and warm zones. *Alisma Plantago* (fig. 2), a common plant in Britain (except in the north) in ditches and edges of streams, is widely distributed in the north temperate zone, and is found in the Himalayas, on the mountains of tropical Africa and in Australia.

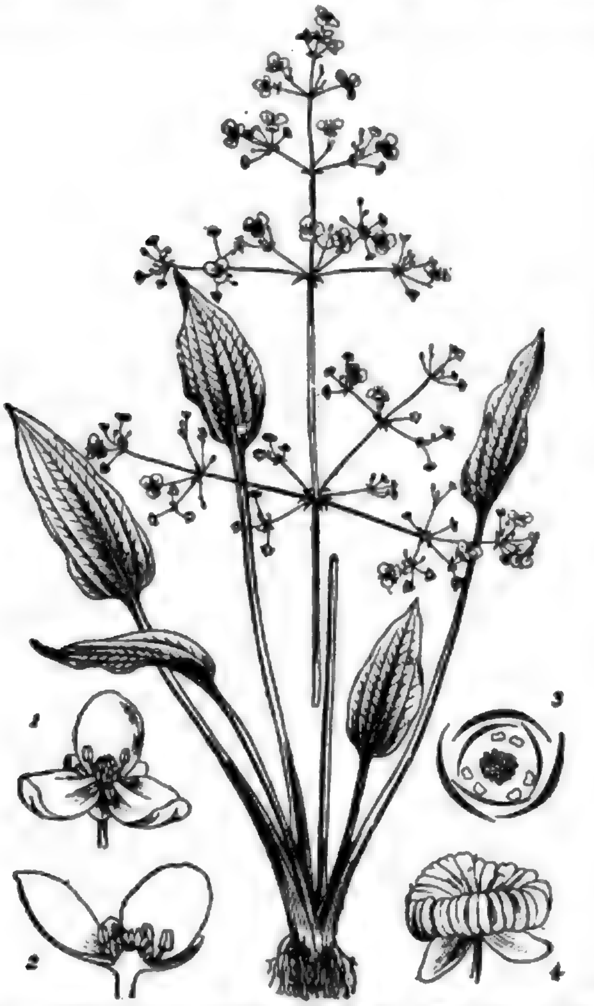


FIG. 2.—Water Plantain (*Alisma Plantago*). Plant about 3 ft. high. 1, Flower; 2, same in vertical section; 3, horizontal plan of flower; 4, mature fruit.

ALISON, ARCHIBALD (1757–1839), Scottish author, son of Patrick Alison, provost of Edinburgh, was born on the 13th of November 1757 at Edinburgh. After studying at the university of Glasgow and at Balliol College, Oxford, he took orders in the Church of England, and was appointed in 1778 to the curacy of Brancepeth, near Durham. In 1784 he married Dorothea, youngest daughter of Professor Gregory of Edinburgh. The next twenty years of his life were spent in Shropshire, where he held in succession the livings of High Ercall, Roddington and Kenley. In 1800 he removed to Edinburgh, having been appointed senior incumbent of St Paul's Chapel in the Cowgate. For thirty-four years he filled this position with much ability, his preaching attracting so many hearers that a new and larger church was built for him. His last years were spent at Colinton, near Edinburgh, where he died on the 17th of May 1839. Alison published, besides a *Life of Lord Woodhouselee*, a volume of sermons, which passed through several editions, and a work entitled *Essays on the Nature and Principles of Taste* (1790), based on the principle of association (see under AESTHETICS, p. 288). His elder son, Dr William Pulteney Alison (1790–1859), was a distinguished Edinburgh medical professor.

SIR ARCHIBALD ALISON, Bart. (1792–1867), the historian, was the younger son, and was born at Kenley, Shropshire, on the 29th of December 1792. He studied at the university of Edinburgh, distinguishing himself especially in Greek and mathematics. In 1814 he passed at the Scottish bar, but he did not at once practise. The close of the war had opened up the continent, and Alison set out in the autumn of 1814 for a lengthened tour in France. It was during this period that the idea of writing his history first occurred to him. A more immediate result of the tour was his first literary work of any importance, *Travels in France during the Years* 1814–1815, written in collaboration with his brother and A. F. Tytler, which appeared in the latter year. On his return to Edinburgh he practised at the bar for some years with very fair success. In 1822 he became one of the four advocates-depute for Scotland. As a result of the experience gained in this office, which he held until 1830, he wrote his *Principles of the Criminal Law of Scotland* (1832) and *Practice of the Criminal Law of Scotland* (1833), which in 1834 led to his appointment by Sir Robert Peel to the office of sheriff of Lanarkshire, which ranks next to a judgeship in the supreme court. The office, though by no means a sinecure, gave him time not only to make frequent contributions to periodical literature, but also to write the long-projected *History of Europe*, for which he had been collecting materials for more than fifteen years. The history of the period from the beginning of the French Revolution till the restoration of the Bourbons in 1815 was completed in ten volumes in 1842, and met with a success almost unexampled in works of its class. Within a few years it ran through ten editions, and was translated into many of the languages of Europe, as well as into Arabic and Hindustani. At the time of the author's death it was stated that 108,000 volumes of the library edition and 439,000 volumes of the popular edition had been sold. A popularity so widespread must have had some basis of merit, and the good qualities of Alison's work lie upon the surface. It brought together, though not always in a well-arranged form, an immense amount of information that had before been practically inaccessible to the general public. It at least made an attempt to show the organic connexion in the policy and progress of the different nations of Europe; and its descriptions of what may be called external history—of battles, sieges and state pageants—are spirited and interesting. On the other hand the faults of the work are numerous and glaring. The general style is prolix, involved and vicious; mistakes of fact and false deductions are to be found in almost every page; and the constant repetition of trite moral reflections and egotistical references seriously detracts from its dignity. A more grave defect resulted from the author's strong political partisanship, which entirely unfitted him for dealing with the problems of history in a philosophical spirit. His unbending Toryism made it impossible for him to give any satisfactory explanation of so complex a fact as the French Revolution, or accurately to estimate the forces that were to shape the Europe of the 19th century. A continuation of the History, embracing the period from 1815 to 1852, which was completed in four volumes in 1856, did not meet with the same success as the earlier work. The period being so near as to be almost comtemporary, there was a stronger temptation, which he seems to have found it impossible to resist, to yield to political prejudice, while the materials necessary for a clear knowledge of the influences shaping European affairs were not as yet accessible. The book is now almost wholly out of date. In 1845 Alison was chosen rector of Marischal College, Aberdeen, and in 1851 of Glasgow University. In 1852 a baronetcy was conferred upon him, and in the following year he was made a D.C.L. of Oxford. His literary activity continued till within a short time of his death, the chief works he published in addition to his History being the *Principles of Population* (1840), in answer to Malthus; a *Life of Marlborough* (1847, 2nd edition greatly enlarged, 1852); and the *Lives of Lord Castlereagh and Sir C. Stewart* (1861.) This latter, based on MS. material preserved at Wynyard Park, is still of value, not only as the only available biography, but more especially because Alison's Tory sympathies enabled him to give a juster appreciation of the character and work of Castlereagh than the Liberal writers by whom for many years he was misjudged and condemned (see LONDONDERRY, Robert Stewart, 2nd marquess of). Three volumes of Alison's political, historical and miscellaneous essays were reprinted in 1850. He died at Possil House, Glasgow, on the 23rd of May 1867. His autobiography, *Some Account of my Life and Writings*, edited by his daughter-in-law, Lady Alison, was published in 1883 at Edinburgh. Sir Archibald Alison married in 1825 Elizabeth Glencairn, daughter of Colonel Tytler, by whom he had three children, Archibald, Frederick and Eliza Frances Catherine. Both sons became distinguished officers.

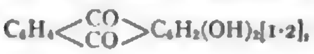
SIR ARCHIBALD ALISON, Bart. (1826–1907), the elder of the sons, entered the 72nd Highlanders in 1846. He served at the siege of Sevastopol; and during the Indian Mutiny he was military secretary to Sir Colin Campbell and was severely wounded at the relief of Lucknow, losing an arm. From 1862 to 1873 he was assistant adjutant-general at headquarters, Portsmouth and Aldershot. He was second in command of the Ashanti expedition 1873–1874, and was made a K.C.B. For three years Alison was deputy adjutant-general in Ireland, and then, for a few months, commandant of the Staff College. He was promoted to be major-general in 1877, and was head of the intelligence branch of the war office (1878–1882). He commanded the troops at Alexandria in 1882 until the arrival of Sir Garnet Wolseley, led the Highland brigade at the battle of Tel-el-Kebir, and remained in command of the army of occupation until 1883. He commanded at Aldershot 1883–1888, was for some months adjutant-general to the forces during Lord Wolseley's absence in Egypt, was made G.C.B. in 1887, was promoted general, and became a military member of the Council of India in 1889. He retired in 1893 and died in 1907.

ALIWAL, a village of British India, in the Ludhiana district of the Punjab, situated on the left bank of the Sutlej, and famous as the scene of one of the great battles of the 1st Sikh War. Late in January 1846 it was held by Ranjur Singh, who had crossed the river in force and threatened Ludhiana. On the 28th Sir Harry Smith, with a view to clearing the left or British bank, attacked him, and after a desperate struggle thrice pierced the Sikh troops with his cavalry, and pushed them into the river, where large numbers perished, leaving 67 guns to the victors. The consequence of the victory was the submission of the whole territory east of the Sutlej to the British.

ALIWAL NORTH, a town of South Africa, on the south bank of the Orange River, 4300 ft. above the sea, and 282 m. by rail N.W. by N. of the port of East London. Pop. (1904) 5566, of whom 1758 were whites. The town, a trading and agricultural centre for the N.E. part of the Cape and the neighbouring regions of Basutoland and Orange Free State, presents a pleasing appearance. It contains many fine stone buildings. The streets are lined with trees, and water from the neighbouring sulphur springs flows along them in open channels. The river, here the boundary between the Cape province and Orange Free State, is crossed by a stone bridge 860 ft. long. The sulphur springs, 1 m. from the town, which yield over 500,000 gallons daily, are resorted to for the cure of rheumatism and skin diseases. By reason of its dry and bracing climate, Aliwal North is also a favourite residence of sufferers from chest complaints. In the neighbourhood are stone quarries. Aliwal North is the capital of a division of the province of the same name, with an area of 1330 sq. m. and a pop. (1904) of 14,857, of whom 40% are whites.

Aliwal North was so called to distinguish it from Aliwal South, now Mossel Bay, the seaport of the pastoral Grasveld district, on the west side of Mossel Bay. Both places were named in honour of Sir Harry Smith, governor of Cape Colony 1847–1852, Aliwal (see above) being the village in the Punjab where in 1846 he gained a great victory over the Sikhs. Crossing the Orange River at this spot in September 1848, Sir Harry noted that it was "a beautiful site for a town," and in the May following the town was founded. In the early months of the Boer War of 1899–1902 Aliwal North was held by the Boers. It was reoccupied by the British in March 1900.

ALIZARIN, or 1·2 DIOXYANTHRAQUINONE,



$$C_6H_4{<}\begin{smallmatrix}CO\\CO\end{smallmatrix}{>}C_6H_2(OH)_2[1\cdot2],$$

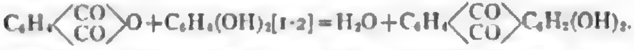
a vegetable dyestuff formerly prepared from madder root (*Rubia tinctorum*) which contains a glucoside ruberythric acid ($C_{26}H_{28}O_{14}$). This glucoside is readily hydrolysed by acids or ferments, breaking up into alizarin and glucose:

$$C_{26}H_{28}O_{14}+2H_2O=2C_6H_{12}O_6+C_{14}H_8O_4$$
Ruberythric acid = Glucose + Alizarin.

Alizarin was known to the ancients, and until 1868 was obtained entirely from madder root. The first step in the synthetical production of alizarin was the discovery in 1868 of C. Graebe and C. Liebermann that on heating with zinc dust, alizarin was converted into anthracene. In order to synthesize alizarin, they converted anthracene into anthraquinone and then brominated the quinone. The dibrominated product so obtained was then fused with caustic potash, the melt dissolved in water, and on the addition of hydrochloric acid to the solution, alizarin was precipitated. This process, owing to its expensive nature, was not in use very long, being superseded by another, discovered simultaneously by the above-named chemists and by Sir W. H. Perkin; the method being to sulphonate anthraquinone, and then to convert the sulphonic acid into its sodium salt and fuse this with caustic soda.

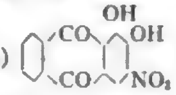
In practice, the crude anthracene is purified by solution in the higher pyridine bases, after which treatment it is frequently sublimed. It is then oxidized to anthraquinone by means of sodium dichromate and sulphuric acid in leaden vats, steam heated so that the mixture can be brought to the boil. When oxidation is complete the crude anthraquinone is separated in filter presses and heated with an excess of commercial oil of vitriol to 120° C., the various impurities present in the crude material being sulphonated and rendered soluble in water, whilst the anthraquinone is unaffected; it is then washed, to remove impurities, and dried. The anthraquinone so obtained is then heated for some hours at about 150-160° C. with fuming sulphuric acid (containing about 40-50 % SO_3), and by this treatment is converted into anthraquinone-β-monosulphonic acid. The solution is poured into water and sodium carbonate is added to neutralize the excess of acid, when the sodium salt of the monosulphonic acid (known as silver salt) separates out. This is filtered, washed, and then fused with caustic soda, when the sulpho-group is replaced by a hydroxyl group, and a second hydroxyl group is simultaneously formed; in order to render the formation of this second group easier, a little potassium chlorate or sodium nitrate is added to the reaction mixture. The melt is dissolved in water and the dyestuff is liberated from the sodium salt by hydrochloric or sulphuric acid, or is converted into the calcium salt by digestion with hot milk of lime, then filtered and the calcium salt decomposed by acid. The precipitated alizarin is then well washed and made into a paste with water, in which form it is put on to the market.

K. Lagodzinski (*Berichte*, 1895, 28, p. 1427) has synthesized alizarin by condensing hemipinic acid [$(CH_3O)_2C_6H_2(COOH)_2$] with benzene in the presence of aluminium chloride. The product on acidification gives a compound $C_{15}H_{12}O_5\cdot H_2O$ which is probably an oxy-methoxy-benzoyl benzoic acid. This is dissolved in cold concentrated sulphuric acid, in which it forms a yellowish red solution, but on heating to 100° C. the colour changes to red and violet, and on pouring out upon ice, the monomethyl ether of alizarin is precipitated. This compound is hydrolysed by hydriodic acid and alizarin is obtained. It can also be synthesized by heating catechol with phthalic anhydride and sulphuric acid at 150° C.

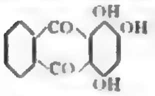


$$C_6H_4\left\langle\begin{matrix}CO\\CO\end{matrix}\right\rangle O+C_6H_4(OH)_2[1\cdot2]=H_2O+C_6H_4\left\langle\begin{matrix}CO\\CO\end{matrix}\right\rangle C_6H_2(OH)_2.$$

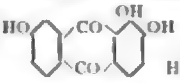
Pure alizarin crystallizes in red prisms melting at 290° C. It is insoluble in water, and not very soluble in alcohol. It dissolves readily in caustic alkalis on account of its phenolic character, and it forms a yellow-coloured di-acetate. Its value as a dyestuff depends on its power of forming insoluble compounds (lakes) with metallic oxides. It has no affinity for vegetable fibres, and consequently cotton goods must be mordanted before dyeing with it (see Dyeing).

Numerous derivatives of alizarin are known. On solution in glacial acetic acid and addition of nitric acid, β-nitroalizarin (alizarin orange)  is produced, and this on heating with sulphuric acid and glycerin is converted into alizarin blue.

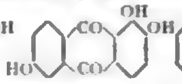
The trioxyanthraquinones—purpurin, anthrapurpurin, anthragallol and flavopurpurin—are also very valuable dyestuffs. These compounds may be represented by the following formulae:



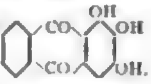
Purpurin.



Anthrapurpurin.

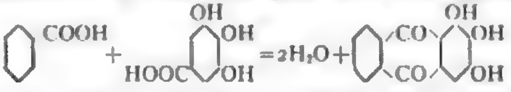


Flavopurpurin.



Anthragallol.

Purpurin (1·2·4 trioxyanthraquinone) is found with alizarin in madder root; it is now prepared synthetically by oxidizing alizarin with manganese dioxide and sulphuric acid. After the separation of the silver salt (see above) obtained on sulphonating anthraquinone, the remaining acid liquid gives on treatment with calcium carbonate the calcium salt of anthraquinone 2·6 disulphonic acid (anthraquinone-a-disulphonic acid). This is converted into the sodium salt by means of sodium carbonate, and on alkali fusion yields *flavopurpurin*. In a similar manner *anthrapurpurin* is prepared by alkali fusion of anthraquinone 2·8 disulphonic acid. *Anthragallol* is synthetically prepared by the condensation of benzoic and gallic acids with sulphuric acid



or from pyrogallol and phthalic anhydride in the presence of sulphuric acid or zinc chloride.

A. Baeyer in 1890, by heating alizarin with fuming sulphuric acid for 24-48 hours at 35-40° C., obtained a product, which after treatment with caustic soda gave a sulphuric acid ester of quinalizarin, and this after acidification and boiling was converted into quinalizarin (Alizarin Bordeaux) or 1·2·6·9 tetra-oxyanthraquinone. Penta-oxyanthraquinones have been obtained from purpurin and anthrapurpurin, while a hexa-oxyanthraquinone has been obtained from 1·5 dinitro-anthraquinone.

ALKAHEST (a pseudo-Arabic word believed to have been invented by Paracelsus), a liquid, much sought after by the alchemists, having the power of dissolving gold and every other substance, which it was supposed would possess invaluable medicinal qualities.

ALKALI, an Arabic term originally applied to the ashes of plants, from which by lixiviation carbonate of soda was obtained in the case of sea-plants and carbonate of potash in that of land-plants. The method of making these "mild" alkalis into "caustic" alkalis by treatment with lime was practised in the time of Pliny in connexion with the manufacture of soap, and it was also known that the ashes of shore-plants yielded a hard soap and those of land-plants a soft one. But the two substances were generally confounded as "fixed alkali" (carbonate of ammonia being "volatile alkali"), till Duhamel du Monceau in 1736 established the fact that common salt and the ashes of sea-plants contain the same base as is found in natural deposits of soda salts ("mineral alkali"), and that this body is different from the "vegetable alkali" obtained by incinerating land-plants or wood (pot-ashes). Later, Martin Heinrich Klaproth, finding vegetable alkali in certain minerals, such as leucite, proposed to distinguish it as potash, and at the same time assigned to the mineral alkali the name *natron*, which survives in the symbol, Na, now used for sodium. The word alkali supplied the symbol for potassium, K (*kalium*). In modern chemistry alkali is a general term used for compounds which have the property of neutralizing acids, and is applied more particularly to the highly soluble hydrates of sodium and potassium and of the three rarer "alkali metals," caesium, rubidium and lithium, also to aqueous ammonia. In a smaller degree these alkaline properties are shared by the less soluble hydrates of the "metals of the alkaline earths," calcium, barium and strontium, and by thallium hydrate. An alkali is distinguished from an acid or neutral substance by its action on litmus, turmeric and other indicators.

ALKALI MANUFACTURE. The word "alkali" denotes both soda and potash, but by "alkali manufacture" we understand merely the manufacture of sodium sulphate, carbonate and hydrate. The corresponding potash compounds are not manufactured in the United Kingdom, but exclusively in Germany (from potassium chloride and from the mother-liquor of the strontia process in the manufacture of beetroot sugar) and in France (from *vinasse*). The term *alkali* is employed in a technical sense for the carbonate and hydrate (of sodium), but since in the Leblanc process the manufacture of sodium sulphate necessarily precedes that of the carbonate, we include this as well as the manufacture of hydrochloric acid which is inseparable from it. We also treat of the utilization of hydrochloric acid for the manufacture of chlorine and its derivatives, which are usually comprised within the meaning of the term "alkali manufacture." A great many processes have been proposed for the manufacture of alkali from various materials, but none of these has become of any practical importance except those which start from sodium chloride (common salt); and among the latter again only three classes of processes are actually employed for manufacturing purposes, viz. the Leblanc, the ammonia-soda, and the electrolytic processes.

I. The Leblanc Process

The *Leblanc process*, which was invented by Nicolas Leblanc (*q.v.*) about 1790, begins with the decomposition of sodium chloride by sulphuric acid, by which sodium sulphate and hydrochloric acid are produced. The sodium sulphate is afterwards fluxed with calcium carbonate and coal, and a mixture is thus obtained from which sodium carbonate can be extracted by exhausting it with water.

Leblanc himself for a time carried out his process on a manufacturing scale, but he was ruined in the political troubles of the time and died by his own hand in 1806. His invention was, however, at once utilized by others in France; and in Great Britain, after a few previous attempts on a small scale, it was definitely introduced by James Muspratt (*q.v.*) in 1823. From that time onward the Leblanc process spread more and more, and for a considerable period nearly all the alkali of commerce was made by it. The rise of the ammonia-soda process (since 1870) gradually told upon the Leblanc process, which in consequence has been greatly restricted in Great Britain and Germany, and has become practically extinct in all other countries, except as far as its first part, the manufacture of sodium sulphate and hydrochloric acid, is concerned.

The production of alkali in Great Britain, soon after the introduction of the Leblanc process, became the most extensive in the world, and outstripped that of all other countries put together. With the rise of the ammonia-soda process, for which the economic conditions are nearly as favourable in other countries, the predominance of Great Britain in that domain has become less, but even now that country produces more alkali than any other single country. Most of the British alkali works are situated in South Lancashire and the adjoining part of Cheshire, near the mouth of the Tyne and in the West of Scotland.

Various industries are carried on in Leblanc alkali works, as follows:—

1. Manufacture of sodium sulphate.
2. Manufacture of hydrochloric acid.
3. Preparation of chlorine.
4. Employment of chlorine for the manufacture of bleaching-powder and of chlorates.
5. Manufacture of ordinary alkali from sulphate of soda.
6. Manufacture of caustic soda.
7. Manufacture of soda crystals.
8. Recovery of sulphur from alkali waste.

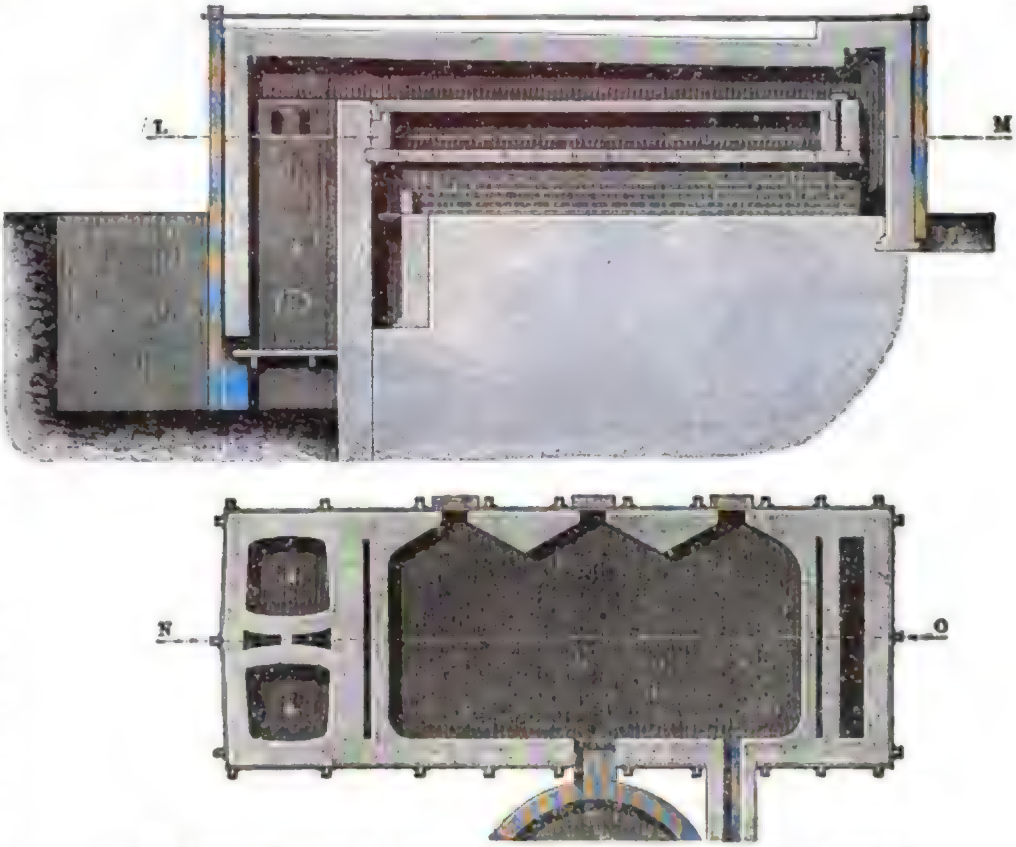
1. *Manufacture of Sodium Sulphate.*—This is commercially known as *salt-cake*, and is made by decomposing common salt with sulphuric acid of about 80%, the reaction being $2NaCl+H_2SO_4=Na_2SO_4+2HCl$. This reaction proceeds in two stages. At first principally acid sodium sulphate, $NaHSO_4$, is formed together with some normal sulphate; later, when the temperature has risen, the $NaHSO_4$ acts with more NaCl so that nearly all of it is converted into Na_2SO_4. The gaseous hydrochloric acid evolved during all this time must be absorbed in water, unless it is directly converted into chlorine (see below, 2 and 3).

The process is carried out either in hand-wrought furnaces, or mechanical furnaces, both called "decomposing" or "salt-cake furnaces." In the former case, the first reaction is produced in cast-iron pans or "pots," very heavy castings of circular section, fired from below, either directly or by the waste heat from the muffle-furnace. The reaction is completed in a "roasting-furnace." The latter was formerly often constructed as a reverberatory furnace, which is easy to build and to work, but the hydrochloric acid given off here, being mixed with the products of the combustion of the fuel, cannot be condensed to strong acid and is partly, if not entirely, wasted. It is, therefore, decidedly preferable to employ "muffle-furnaces" in which the heating is performed from without, the fire-gases passing first over the arch and then under the bottom of the muffle. This requires more time and fuel than the work in "open" furnaces, but in the muffles the gaseous hydrochloric acid is separated from the fire-gases, just like that evolved in the pot, and can therefore be condensed into strong hydrochloric acid, like the pot-acid. This roaster-acid is, however, of less value than the pot-acid, as it contains more impurities.

It is not easy to keep the muffles permanently tight, and as soon as any leakages occur, either hydrochloric acid must escape into the fire-flue, or some fire-gases must enter into the muffle. The former is decidedly more objectionable than the latter, as it means that uncondensed hydrochloric acid is sent into the air. This drawback has been overcome by the construction of "plus-pressure" furnaces (figs. 1 and 2), where the fire-grate is placed 11 ft. below the top of the muffle. In consequence the fire-gases, when arriving there by the chimney shaft (*a*), have already a good upward draught, and when circulatung round the muffle are at a lower pressure than the gases within the muffle, so that in case of any cracks being formed, no hydrochloric acid escapes into the fire-flues, but vice versa.

Since the work with ordinary hand-wrought salt-cake furnaces is disagreeable and costly, many attempts have been made to construct mechanical salt-cake furnaces. Of these J. Mactear's furnaces (fig. 3) have met with the greatest success. They consist of a horizontal pan, 17 ft. wide, which is made up of a central pan (*c*), and a series of concentric compartments (c^1), (c^2), (c^3), and which is supported on a frame (*d d*), revolving round a perpendicular axis on the wheels (*n n*). It is covered with an arch and heated on the top from one side (*l*), either by an ordinary coal-grate or by a gas-producer. A set of stirring blades carried in the frame (*b b*), and driven by gearing, passes through a gap in the arch in such a manner that the gases cannot escape outwards. The salt is conveyed to the furnace by a chain of buckets running on the pulley (*g*), and passing into the hopper (*h*), and through the pipe (*i*) is mixed with the proper amount of acid supplied by the pipe (*f*). The mixture is fed in continuously to the central pan (*c*), whence it overflows into the compartments (c^1), (c^2), (c^3) successively until it reaches the circumference, where it is discharged continously by *o* and *p* into the collecting-box (*q*), being now converted into salt-cake. This furnace acts very well, and has been widely introduced both in Great Britain and in other countries, but it has one great drawback, apart from its high cost, viz. that all the hydrochloric acid gas gets mixed with fire-gases, and consequently is condensed in a weaker and less pure form than from ordinary pots and muffles. This has led some factories which had introduced such furnaces to revert to hand-wrought muffle-furnaces.

Much was expected at one time from the "direct salt-cake process" of Hargreaves and Robinson, in which common salt is



FIGS. 1 and 2.—Salt-cake Furnace. (Sectional Elevation and Plan.) Scale $\frac{1}{100}$.

Figs. 1-9 from Lunge's *Handbuch der Soda-Industrie*, by permission of Friedr. Vieweg u. Sohn.

subjected in a series of large cast-iron cylinders to the action of pyrites-burner gases and steam at a low red heat. The reaction going on here is: $2NaCl+SO_2+O+H_2O=Na_2SO_4+2HCl$. This means that the previous manufacture of sulphuric acid in the vitriol-chambers is done away with, but this apparently great simplification is balanced by the great cost of the Hargreaves plant, and by the fact that the whole of the hydrochloric acid is mixed with nine or ten times its volume of inert gases. Owing to this, it is practically impossible to condense the gaseous hydrochloric acid into the commercial acid, although this acid may be obtained sufficiently strong to be worked up in the Weldon chlorine process (see below, 3). Therefore the Hargreaves process has been introduced only in a few places.

Although the consumption of salt-cake for the manufacture of alkali is now much less than formerly, since the Leblanc alkali process has been greatly restricted, yet it is largely made and will continue to be made for the use of glassmakers, who use it for the ordinary description of glass in the place of soda-ash. Nor must it be overlooked that salt-cake must be made as long as there is a sale for hydrochloric acid, or a consumption of the latter for the manufacture of chlorine.

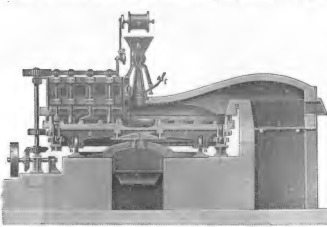


FIG. 3.—Mechanical Salt-cake Furnace. (Sectional Elevation.) Scale $\frac{1}{80}$.

2. *Manufacture of Hydrochloric Acid* (commercially also known as "muriatic acid"). This unavoidable gaseous bye-product of the manufacture of salt-cake was, during the first part of the 19th century, simply sent into the air. When its deleterious effects upon vegetation, building materials, &c., became better known, and when at the same time an outlet had been found for moderate quantities of hydrochloric acid, most factories made more or less successful attempts to "condense" the gas by absorption in water. But this was hardly anywhere done to the fullest possible extent, and in those districts where a number of alkali works were located at no great distance from one another, their aggregate escapes of hydrochloric and other acids created an intolerable nuisance. This was most notably the case in South Lancashire, and it led to the passing of Lord Derby's "Alkali Act," in 1863, supplemented by further legislation in 1874, 1881 and later. There is hardly another example in the annals of legislative efforts equal to this, in respect of the real benefit conferred by it both on the general public and on the manufacturers themselves. This is principally the consequence of the exemplary way in which the duties of inspector under these acts were carried out by Dr R. Angus Smith (1817–1884) and his successors, who directed their efforts not merely to their primary duty of preventing nuisance, but quite as much to showing manufacturers how to make the most of the acid formerly wasted in one shape or another. Not merely Great Britain but all mankind has been immensely benefited by the labours of the British alkali inspectors, which were, of course, supplemented by the work of technical men in all the countries concerned. The scientific and technical principles of the condensation of hydrochloric acid are now thoroughly well understood, and it is possible to recover nearly the whole of it in the state of strong commercial acid, containing from 32 to 36% of pure hydrochloric acid, although probably the majority of the manufacturers are still content to obtain part of the acid in a weaker state, merely to satisfy the requirements of the law prescribing the prevention of nuisance. The principles of the condensation, that is of converting the gaseous hydrochloric acid given off during the decomposition of common salt into a strong solution of this gas in water, can be summarized in a few words. The hydrochloric acid gas, which is always diluted with air, sometimes to a very great extent, must be brought into the most intimate contact possible with water, which greedily absorbs it, forming ordinary hydrochloric acid, and this process must be carried so that scarcely any hydrochloric acid remains in the escaping gases. The maximum escape allowed by the Alkali Act, viz. 5% of the total hydrochloric acid, is far above that which is now practically attained. For a proper utilization of the condensed acid it is nearly always imperative that it should be as strong as possible, and this forms a second important consideration in the construction of the condensing apparatus. Since the solubility of hydrochloric acid in water decreases with the increase of the temperature, it is necessary to keep the latter down—a task which is rendered somewhat difficult both by the original heat retained by the gases on their escape from the decomposing apparatus, and by the heat given off through the reaction of hydrochloric acid upon water.

Very different methods have been employed to effect all the above purposes. In Great Britain Gay-Lussac's coke-towers, adapted by W. Gossage to the condensation of hydrochloric acid, are still nearly everywhere in use, frequently combined with a number of stone tanks through which the gas from the furnaces travels before entering the towers, meeting on its way the acid condensed in the tower. This process is excellent in effecting a complete condensation of the hydrochloric acid as prescribed by the Alkali Acts, and for recovering the bulk of the acid in a tolerably strong state, but less so for recovering nearly the whole of it in the most concentrated state, although even this is occasionally attained. On the continent of Europe, where the last-named requirement has been for a long time more urgent than in Great Britain, another system has been generally preferred, namely, passing the gas through a long series of stoneware receivers, and ultimately through a small tower packed with stoneware or coke, making the acid flow in the opposite direction to the gas. Great success has also been obtained by "plate-towers" made of stoneware, which allow both the coke-towers and most of the stoneware receivers to be dispensed with.

3. *Preparation of Chlorine.*—In this place we speak only of

the preparation of chlorine from hydrochloric acid by chemical processes; the electrolytic processes will be treated hereafter. It is clear that free chlorine must be prepared from hydrochloric acid by oxidizing the hydrogen. This can be done most easily by "active" oxygen, such as is present in the peroxides, in chromic or permanganic acid. Practically the only agent employed in this way, and that already by C. W. Scheele, the discoverer of chlorine, in 1774, is the peroxide of manganese (manganese dioxide), found in considerable quantities in nature as "manganese ore" (the purest of which is called pyrolusite), and also artificially regenerated from the waste liquors of a former operation. Even now, where chlorine is required for immediate use in some other chemical operations on a comparatively small scale, it is obtained by the action of hydrochloric acid on native manganese dioxide, according to the equation: $MnO_2+4HCl=MnCl_2+Cl_2+2H_2O$. This action must be promoted by heating the mixture, but even then nothing like all of the hydrochloric acid employed is made to act as above, because the attack on the manganese ore requires a certain minimum concentration of the acid. Formerly, instead of free hydrochloric acid a mixture of common salt and sulphuric acid was sometimes employed, but this is never done on a manufacturing scale now. Owing to the impossibility of employing any metal in contact with the acid, the "chlorine stills," where the above reaction is carried out, must be made of acid-proof stones or "chemical" stoneware. This process is very costly, as much of the acid and all of the manganese is wasted. Moreover it is of a most disagreeable kind, as the waste "still-liquor," containing very much free hydrochloric acid and even some free chlorine, forms a most deleterious impurity when finding its way into drains or watercourses, apart from the intolerable nuisance caused by the escapes of chlorine from the stills and otherwise, which cannot be at all times avoided.

Many endeavours were made to avoid the loss of the manganese in this operation, but with only partial or no success. The difficulty was only overcome by the *Weldon process*, being the inventions of Walter Weldon from 1866 onwards, and his process up to this day furnishes the greater proportion of chlorine manufactured in the world. It begins with "still-liquor," obtained in the old way from native manganese ore and hydrochloric acid. This liquor is first treated with carbonate of lime (ground chalk or limestone) in a "neutralizing-well," made of acid-proof material and provided with wooden stirring-gear. Here the free hydrochloric acid is converted into calcium chloride, and at the same time any ferric chloride present is converted into insoluble ferric hydroxide: $2FeCl_3+8CaCO_3+3H_2O=2Fe(OH)_3+3CaCl_2+3CO_2$. The sulphuric acid present is mostly precipitated as calcium sulphate. The mud thus formed is settled out, and the clear liquor, which is now quite neutral and contains both manganese and calcium chlorides, is mixed with cream of lime and treated by a strong current of air, produced by a blowing-engine. This is done in a tall iron cylinder, say 9 ft. wide and 30 ft. high, called the "oxidizer." The air-pipe goes right to the bottom of the cylinder and there branches out into perforated side-pipes, so that the mass is thoroughly stirred up all the time. The first action of the lime is to convert the manganese chloride into manganous hydrate ($Mn(OH)_2$) and calcium chloride; then more lime is added which greatly promotes and hastens the oxidizing process. The object of the latter is to convert the manganous hydroxide by the atmospheric oxygen into manganese dioxide, but this would take place much too slowly if there was not an excess of lime present ready to combine with the manganese dioxide to form a calcium manganite. Only so much lime is used that an acid manganite is formed corresponding to one molecule of calcium oxide to two of manganous oxide. This additional lime, which is called the "basis," certainly takes up hydrochloric acid in the next stage of the process, but that causes no more waste of acid than the incomplete action on native manganese ore, mentioned before. The product obtained, called "Weldon mud," is of such fine texture that it acts immediately with hydrochloric acid when mixed with it in the "Weldon stills" (fig. 4), and that this acid can be almost entirely neutralized thereby. The new still-liquor formed in this manner is treated as above, so that the manganese does its work over and over again. There is only a slight mechanical loss, which is reduced in the best managed works to about 2 parts of manganese dioxide to 100 of bleaching-powder. There are also other advantages of this process which explain its wide extension, in spite of the fact that only from 30 to 35 parts of the hydrochloric acid employed is converted into chlorine, the remainder ultimately leaving the factory in the shape of a harmless but useless solution of calcium chloride.

Weldon's later attempts at superseding his classical process by other inventions which utilize a larger proportion of the chlorine, introduced as hydrochloric acid, have not been successful in the long run, although some of them were aided by the great technical skill of A. R. Péchiney. But the *Deacon process*, the invention of Henry Deacon (who was greatly aided by his chemist Dr Ferdinand Hurter), carried out since 1868, has attained to better, although nothing like complete, success in that direction.

The Deacon process, like the Weldon process, effects its object by the oxidizing action of atmospheric air, but in a very different manner. Weldon retained the principle of the Scheele process, by employing the active oxygen of manganese dioxide to convert hydrochloric acid into free chlorine, and he employed the atmospheric oxygen only indirectly, for the recovery of manganese dioxide from the manganese chloride formed. But Deacon worked on the direct reaction: $2HCl+O=H_2O+Cl_2$. This reaction in ordinary circumstances is so slow as to be practically useless. If, however, a "contact-substance" is employed and that at the proper temperature, the process goes on at an immensely quickened rate and can even be carried out as a continuous operation. The only substance which possesses sufficiently strong catalytic properties for the reaction is cupric chloride. If pieces of porous clay are soaked in a solution of this salt and dried and kept at a temperature of 450° C. (in practice it is necessary to go to a rather higher temperature), it is possible continuously to convert a united stream of hydrochloric acid and atmospheric air, passed through the contact-substance in a "decomposer" (fig. 5), to a larger extent into chlorine and water, of course mixed with the excess of oxygen and all the nitrogen of the air. On a small scale it is possible to push the decomposition as far as 90% of the hydrochloric acid, but on the large scale only at most 60% is reached. The mixture of hydrochloric acid and air is taken directly from the "decomposing-pan" of an ordinary salt-cake furnace, is first cooled down in pipes sufficiently to condense most of the moisture present

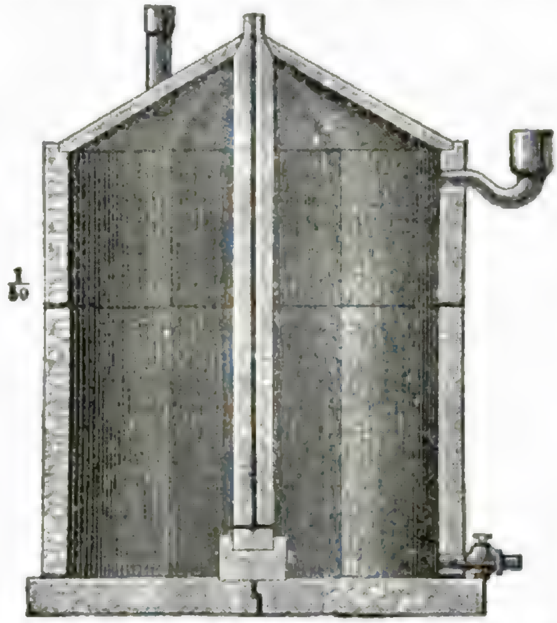


FIG. 4.—Weldon Chlorine Still. (Sectional Elevation.) Scale $\frac{1}{50}$.
C, Stone steam column resting in stone socket *K*.

(together with about 8% of the hydrochloric acid), and then passed through a cast-iron superheater and from this into the "decomposer." The gaseous mixture, issuing from the latter, is washed with water in the usual condensing apparatus, to remove the 40 or 50 parts of hydrochloric acid left unchanged, and can then be immediately employed for the manufacture of chlorate of potash.

Where (as is the more usual case) the chlorine has to serve for the manufacture of bleaching-powder, it must first be deprived of the great amount of moisture which it contains, by means of coke-towers fed with moderately strong sulphuric acid. As the gas issuing from these contains only about 5 volumes % of hydrochloric acid, it cannot be made to act upon lime in the ordinary bleaching-powder chambers, but specially constructed chambers must be provided (see fig. 4). The movement of the gases through all this complicated set of apparatus is produced by a Root's blower placed at the end of it all.

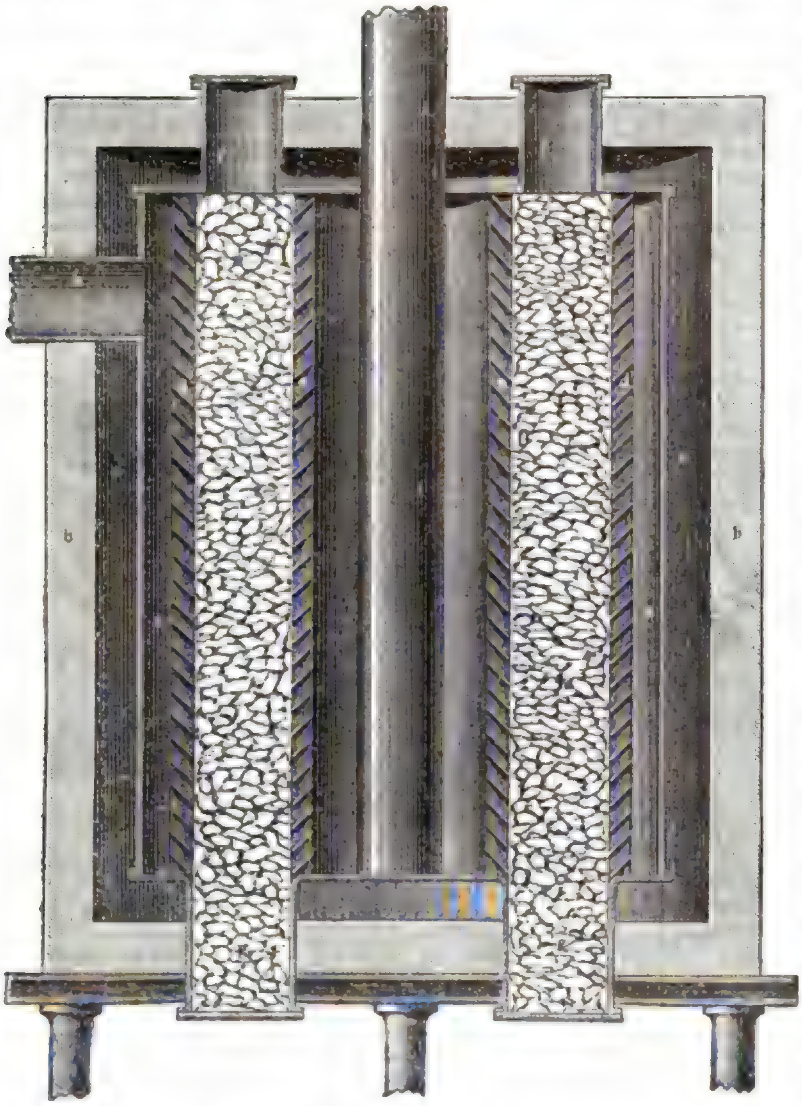


FIG. 5.—Deacon "Decomposer." (Sectional Elevation.) Scale $\frac{1}{48}$. *a*,*a*, Upright cast-iron cylinders; *b*,*b*, brick jacket; *c*,*c*, flues; *d*, *e*, iron plates arranged like venetian blinds, between which the contact-substance is contained; *f*, charging hole; *g*, discharging hole; *h*, entrance pipe for gas; *i*, exit pipe for gas.

The Deacon process makes cheaper chlorine than the Weldon process, but the plant is complicated and costly and the working requires a great deal of attention. In skilled hands it has been proved to yield excellent results.

The hydrochloric acid from the calcining-furnaces or "roasters" cannot be employed immediately for the Deacon process, as the sulphuric acid always contained in the roaster gases soon "poisons" the contact-substance and renders it inoperative. This acid must, therefore, be condensed in the ordinary way into liquid hydrochloric acid and formerly could be worked up only by the Weldon process. R. Hasenclever has overcome this drawback by running this impure acid into moderately strong sulphuric acid (140° Twaddell), blowing in air at the same time. This produces a mixed current of pure hydrochloric acid gas and air, which is carried into a Deacon decomposer where it acts in the usual manner. The sulphuric acid, of which 6 or 7 parts are used to one of impure liquid hydrochloric acid, is always reserved for use in the same process, by driving off the excess of water in a lead pan, fired from the top, so that the principal expense of the process is that of the fuel required for the last operation.

4. *Applications of Chlorine.*—Some of the chlorine manufactured (practically only such as is obtained by the electrolysis of chlorides) is condensed by cold and pressure into *liquid chlorine*. If this is anhydrous, as it must be in any case for this purpose, it does not act upon the metal of the compressors, nor upon the iron bottles in which it is sent out. It may even be sent out in tank wagons, similar to those which are employed for carrying sulphuric acid, holding 10 tons each.

Sometimes the chlorine is employed directly for *bleaching purposes*, especially for some kinds of paper. A number of organic chlorinated products are also produced on a large scale. But most of the chlorine is utilized for the production of bleaching-powder, of bleach-liquor, and of chlorate of potash.

Bleaching-powder is a compound obtained by the action of free chlorine on hydrated lime, containing a slight excess of water at ordinary temperatures or slightly above these. Its composition approaches the formula $CaOCl_2$, and it is regarded as a double salt of calcium chloride and hypochlorite, which by the action of water splits up into a mixture of these salts. It always contains a certain quantity of chemically combined water and also an excess of lime. Usually this lime is regarded only as mechanically mixed with the bleaching-compound, $CaOCl_2$, but some chemists adopt formulae in which this lime is equally represented.

For the manufacture of bleaching-powder, limestone of high degree of purity (especially free from magnesia and iron) is carefully burned so as to drive out nearly all the carbon dioxide without overheating the lime. The quick-lime is then slaked with the requisite quantity of water; the product is passed through a fine-meshed wire sieve and is spread in layers of 2 or 3 in. at the bottom of large boxes, the "bleaching-powder chambers," made of lead, or sometimes of cast-iron protected by paint, of slate or even of tarred wood. Chlorine, generated in an ordinary or a Weldon still, is passed in and is rapidly absorbed. When the absorption becomes slow, the gas is cut off and the chamber is left to itself for twelve hours or more, when it will be found that all the chlorine has been taken up. Now the door of the chamber is opened, the powder lying at the bottom is turned over and the treatment with gas is repeated. Sometimes a third treatment is necessary in order to get the product up to the strength required in commerce, viz. 35% of "available" chlorine. The finished product is packed into wooden casks lined with brown paper. The work of packing is a most disagreeable and unhealthy operation which is best relieved by erecting the chambers at a higher level and placing the casks underneath, communication being made by means of traps in the chamber-bottom, so that the packers can do their work outside the chambers. The bleaching-powder casks must be kept in a dry place, as cool as possible, and never exposed to the direct rays of the sun, in order to prevent a decomposition which now and then has even led to explosions.

The weak chlorine from the Deacon process cannot be treated in this manner, as chambers of impossibly large dimensions would be required. Originally the absorption of the Deacon chlorine took place in a set of chambers, constructed of large slabs of stone, containing a great many horizontal shelves superposed over one another. About sixteen such chambers were combined in such manner that the fresh gas passed into that chamber which had been the longest time at work and in which the bleaching-powder was nearly finished, and so forth until the gas, now all but entirely exhausted, reached the last-filled chamber in which it met with fresh lime and there gave up the last of the chlorine. These "Deacon chambers" occupied a large space, besides being expensive to build and difficult to keep in repair.

They are now mostly replaced by an apparatus, the invention of R. Hasenclever, consisting of four horizontal cast-iron cylinders with internal stirring-gear. The fresh lime is continually charged into the top cylinder, is gradually moved towards the other end, falls down into the next lower cylinder and thus gradually makes its way to the lowest cylinder. The weak chlorine gas from the Deacon apparatus travels precisely the opposite way, from the bottom upwards, the result being that finished bleaching-powder is continually discharged at the bottom and air free from chlorine leaves the apparatus at the top.

Bleaching-powder is manufactured to the extent of several hundred thousands of tons annually, almost entirely for the use of papermakers and cotton bleachers. Smaller quantities are used for disinfection and other purposes. It is usually sold in "tierces," that is, casks containing about 10 cwt.

Bleach-liquors.—If the chlorine is made to act on cream of lime, care being taken that the temperature does not rise above 35° and that the chlorine is not in excess, a solution is obtained containing a mixture of calcium chloride and hypochlorite which is a very convenient agent for bleachers, but which does not bear the expense of carriage over long distances. Similar liquids are obtained with a basis of sodium ("eau de Javel"), by passing chlorine into solutions of sodium carbonate. The former kind of bleach-liquor is mostly used in the industry of cotton, the latter in that of linen.

Chlorate of Potash.—Formerly all chlorate of potash, as some is still, was obtained by passing chlorine into milk of lime, allowing the temperature to rise almost to the boiling-point, and continuing until the bleaching-solution, originally formed, is converted into a mixture of calcium chlorate and chloride, the final reaction being $6Ca(OH)_2+6Cl_2=5CaCl_2+Ca(ClO_3)_2+6H_2O$. On adding to this solution, after settling out the mud, a quantity of potassium chloride equivalent to the calcium chlorate, the reaction $Ca(ClO_3)_2+2KCl=CaCl_2+2KClO_3$ is produced, the ultimate proportions thus being theoretically $2KClO_3$ to $6CaCl_2$, though in reality there is rather more calcium chloride present. When this solution is concentrated by evaporation and cooled down, about five-sixths of the chlorate of potash crystallizes out. It is purified by redissolving and crystallization, and is sold either in the state of crystals or finely ground. During these operations care must be taken lest a spark should produce the inflammation of the chlorate on contact with any organic substance. Large quantities of potassium chlorate exposed to strong heat in contact with the wood of casks or the timber of a roof have produced violent explosions.

Most of the chlorate of potash is now prepared by electrolysis of potassium chloride (see below). It is employed for fire-works, for some descriptions of explosives, for safety matches and as an oxidizer in some operations, especially in dyeing and tissue printing. For the last-named purpose it is sometimes replaced by sodium chlorate. The chlorates are usually sold in wooden kegs containing 1 cwt. each.

5. *The Manufacture of Soda-ash from Salt-cake by the Leblanc process.*—This process consists in heating a mixture of commercial

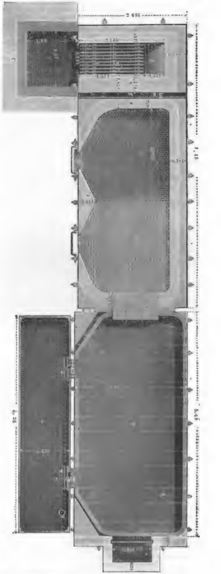


FIG. 6.—Black-ash Furnace and Boiling-down Pan. Scale $\frac{1}{75}$.

sulphate of soda (salt-cake) with about the same weight of crushed limestone and half its weight of coal, until the materials are fluxed and a reaction has taken place, the principal phase of which is expressed by the equation $Na_2SO_4+CaCO_3+2C=2CO_2+Na_2CO_3+CaS$. A number of secondary reactions, however, occur, owing partly to the excess of calcium carbonate and coal and partly to the impurities present, so that the solid product of the process, which is called "black-ash," has a somewhat complicated composition. Its principal constituents are always sodium carbonate and calcium sulphide, which are separated by the action of water, the former being soluble and the latter insoluble.

The furnace in which the reaction taks place is shown in fig. 6 in a sectional plan. It is called a "black-ash" furnace, and belongs to the class of reverberatory furnaces. A large fire-grate (*ab*), having a cave (*c*) to facilitate stoking and stepped back at (*d*), is bounded on one side by a fire-bridge (*e*); on the other side of this, separated by an air-channel (*g*), there is first the proper fluxing bed (*h*), and behind this the "back-bed" (*i*) for pre-heating the charge. The flame issuing from the furnace by (*o*) is always further utilized for boiling down the liquors obtained in a later stage, either in a pan (*p*) fired from the top and supported on pillars (*qq*) as shown in the drawing, or in pans heated from below. The charge of salt-cake (generally 3 cwt.), limestone and coal is roughly mixed and put upon the back-bed; when the front-bed has become empty it is drawn forward and exposed to the full heat of the fire, with frequent stirring. After about three-quarters of an hour the substances are so far fluxed or softened that the reaction now sets in fully, as shown by the copious escape of gas. This is at first colourless carbon dioxide, but later on inflammable gases come out of the mass, which at this stage has turned into a thicker, pasty condition, showing that the end of the reaction is near. The inflammable gas is carbon monoxide, which, however, does not burn with its proper purple flame, but with a flame tinged bright yellow by the sodium present. This carbon monoxide is formed by the action of coal on the lime, formed at this stage from the original limestone. When the "candles" of carbon monoxide appear, the pasty mass is quickly drawn out of the furnace into iron "bogies," where it solidifies into a grey, porous mass, the "black-ash." Care must be taken to heat it no longer than necessary, as it otherwise turns red and yields bad soda.

The hand-wrought black-ash furnace has been mostly superseded in the large factories by the revolving black-ash furnace, shown in fig. 7. These furnaces possess a large cylindrical shell (*e*), lined with fire-bricks, and made to revolve round its horizontal axis by means of a toothed wheel fixed on its exterior; (*ff*) are tire-seats holding tires (*gg*), which work in friction rollers (*h*). The flame of a fixed fireplace (*a*) enters through an "eye" (*b*) in the centre of the front end of the cylinder and issues in the centre of the back end, first into a large dust-chamber (*m*), and then over or under boiling-down pans (*p*). These mechanical furnaces do the work of from four to ten ordinary furnaces according to their size, with comparatively very little expense for labour, but they must be very carefully managed and the black-ash from them is more difficult to lixiviate than that from hand-wrought furnaces, because it is less porous. The lixiviation of the black-ash requires great care, as the calcium sulphide is liable to be changed into soluble calcium compounds, which immediately react with sodium carbonate and destroy a corresponding quantity of the latter, rendering the soda weaker and impure. This change of the calcium sulphide may be brought about either by the oxidizing action of the air or by "hydrolysis," produced by prolonged contact with hot water, the use of which, on the other hand, cannot be avoided in order to extract the sodium carbonate itself. The apparatus which has been found most suitable for the purpose was devised by Professor H. Buff of Giessen, and first practically carried out by Charles Dunlop at St Rollox. It consists of a number of tanks or "vats," placed at the same level and connected by pipes which reach nearly to the bottom of one tank and open out at the top into the next tank. The vats are also provided with false bottoms, outlet cocks, steam pipes and so forth. Tepid water is run in at one end of the series, where nearly exhausted black-ash is present; the weak liquor takes up more soda from the intermediate tanks and at last gets up to full strength in the last tank, charged with fresh black-ash and kept at a higher temperature, viz. 60° C. When the first tank has been quite exhausted, the water is turned on to the next, the first tank is emptied by discharging the "alkali-waste," and is filled with fresh black-ash, whereupon it becomes the last of the series. In spite of all precautions a certain quantity of impurities is always formed, but this should be kept down as much as possible by strictly watching the temperature in the vats and by taking care that the black-ash in the wet state is never exposed to the air. The unavoidable contamination with muddy particles of vat-waste is removed by allowing the vat-liquor to rest for some hours in a separate tank and settling out the mud.

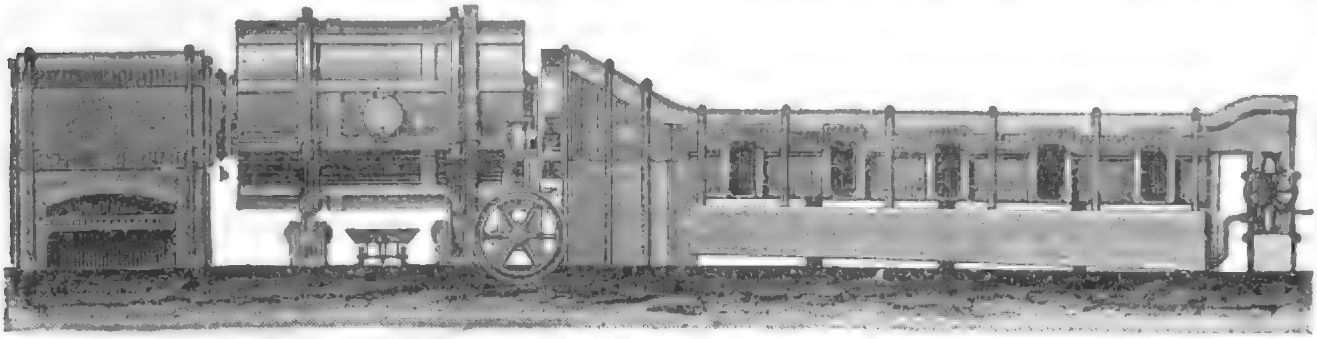


FIG. 7.—Revolving Black-ash Furnace. (Elevation.) Scale $\frac{1}{180}$.

The clear vat-liquor, if allowed to cool down to ordinary temperature, would separate out part of the sodium carbonate in the shape of decahydrated crystals. As these do not come out sufficiently pure, they would not be marketable and therefore they are not allowed to be formed, but the liquid, while still hot, is either run into the boiling-down pans, or submitted to one of the purifying operations to be described below. If it is boiled down without further purification, the resulting soda-ash is not of the first quality, but it is sufficiently pure for many purposes. The boiling down is most economically performed by means of large iron pans covered with a brick arch and heated from the top by the waste flame issuing from the black-ash furnaces (see figs. 6 and 7). It is continued until the contents of the pan have been coverted into a thick paste of small crystals of monohydrated sodium carbonate, permeated by a mother-liquor which is removed by draining on perforated plates or by a centrifugal machine, and is always returned to the pans. The drained crystals are dried and heated to redness in a reverberatory furnace; when "finished," the mass is of an impure white or light yellow colour and is sold as ordinary "soda-ash." It is not easy to make it stronger than 92% of sodium carbonate, which is technically expressed as "52 degrees of available soda" (see next page). If purer and stronger soda-ash is wanted, the boiling down must be carried out in pans fired from below, and the crystals of monohydrated sodium carbonate "fished" out as they are formed, but this is mostly done after submitting the liquor to the purifying operations which we shall now describe.

The dried or "finished" soda-ash is ground to a pretty fine powder and is packed into wooden casks or "tierces," holding from 10 to about 20 cwt. each, according to the way of filling them.

The principal impurities of crude vat-liquor are sodium hydrate and sulphide, the latter of which always leads to the formation of soluble double sulphur salts of sodium and iron. The other impurities are of minor importance. The sulphides can be removed by "oxidizing" them into thiosulphates by means of atmospheric air, with or without the assistance of other agents, such as manganese peroxide; or by "carbonating" them with lime-kiln or other gases containing carbon dioxide; or by precipitating them with lead or zinc oxide. The last mentioned is the best but costliest method, and is employed only in the manufacture of the highest strengths of caustic soda. The most usual process, where soda-ash is to be made, is the "carbonating." This is usually effected either by forcing lime-kiln gas through the liquor, contained in a closed iron vessel, or by passing the gases through an iron tower filled with coke or other materials, suitable for subdividing the stream of the gases and that of the vat-liquor which trickles down in the tower. The same apparatus is used for "oxidizing" by means of atmospheric air passed through by means of an injector; sometimes both air and carbon dioxide are passed in at the same time. The operation is finished when all the sodium sulphide has been converted into normal sodium carbonate, partly also into acid sodium carbonate (bicarbonate) $NaHCO_3$; at the same time a precipitate is formed, consisting of ferrous sulphide, alumina and silica, which is removed by another settling tank, and the clear liquor is now ready either for boiling down in a "fishing-pan" for the manufacture of white soda-ash, or for the process of causticizing.

Soda-ash (as well as caustic soda) is sold by degrees of "available soda." This means that portion which neutralizes the acid employed for testing, and the degrees mean the percentage of Na_2O thus found, whether it be present as Na_2CO_3, $NaOH$, or sodium aluminate or silicate. The purest soda-ash, equal to 100% Na_2CO_3, would be 58½ degrees of available soda. The ordinary commercial strength of Leblanc soda-ash is from 52 to 54 degrees (in former times much was sold in the state of 48%).

6. *Manufacture of Caustic Soda.*—Most of the Leblanc liquor is nowadays converted into caustic soda, as white soda-ash is more easily and cheaply made by the ammonia-soda process. We shall therefore in this place describe the manufacture of caustic soda. This is always made from the carbonate by the action of slaked lime: $Na_2CO_3 + Ca(OH)_2 = CaCO_3 + 2NaOH$. The calcium carbonate, being insoluble, is easily separated from the caustic liquor by filtration. But as this reaction is reversible, we must observe the conditions necessary for directing it in the right sense. These are: diluting with water so as not to exceed 10% of sodium carbonate to 90% of water; boiling this mixture; and keeping it well agitated. At the best about 92% of the sodium carbonate can be converted into caustic soda, 8% remaining unchanged.

The operation is performed in iron cylinders, provided with an agitating arrangement. This may consist of a steam injector by means of which air is made to bubble through the liquid, which produces both the required agitation and the heating, and at the same time oxidizes at least part of the sulphides; but this method of agitation causes a great waste of steam and at the same time a further dilution of the liquor. Many, therefore, prefer mechanical stirring by means of paddles, fixed either to a vertical or to a horizontal shaft, and inject only sufficient steam to keep the mass at the proper temperature. Some heat is also gained by the slaking of the caustic lime within the liquor. After from half an hour to a whole hour the conversion of sodium carbonate into sodium hydrate is brought about as far as is practicable. The whole mass is now run into the *filters*, which are always constructed on the vacuum principle. They are iron boxes, in which a bed is made of bricks, above them gravel, and over this sand, covered on the top by iron grids. The space below the sieve thus formed is connected by means of an outlet tap with a closed tank, and this again communicates with a vacuum pump. By this means the filtration is quickened by the atmospheric pressure, and goes on very rapidly, as also does the subsequent washing. The filtered caustic liquor passes to the concentration plants; the washings are employed for diluting fresh vat-liquor for the next operation, or for dissolving solid soda-ash for the same purpose. The washed-out calcium carbonate, which always contains much calcium hydrate and 2 or 3% of soda in various forms, usually goes back to the black-ash furnaces, but it cannot be always used up in this way, and what remains is thrown upon a heap outside the works. Attempts have been made to use it in the manufacture of Portland cement, but without much success.

The clear caustic soda liquor must be concentrated in such a way that the caustic soda cannot to any great extent be reconverted into sodium carbonate, and that the "salts" which it contains, sodium carbonate, sulphate, chloride, &c., can be separated during the process. Formerly the most usual concentrating apparatus was the "boat-pan" (fig. 8). This is an oblong iron pan, the bottom of which slopes from both sides to a narrow channel. The latter rests on a brick pillar; the remaining part of the sloping bottom is heated, either by the waste fire from a black-ash furnace or by a special fireplace. This arrangement has the effect that the salts, as they separate out, slide down the sloping part and arrive in the central channel, which is not exposed to the fire-gases, so that they quietly settle there, without caking to the pan, until they are fished out by means of perforated ladles. These boat-pans were for many years almost everywhere employed, and did their work quite well, but rather expensively. At many works they have been replaced by either Thélen pans or vacuum pans.

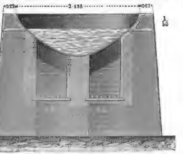


FIG. 8.—Caustic Soda Concentration Boat-pan. (Sectional Elevation.) Scale $\frac{1}{50}$.

The "Thélen pan" (thus named from its inventor, a foreman at the Rhenania works near Aachen) is a mechanically worked fishing-pan, which requires considerably less labour and coal than ordinary boat-pans. It is a long trough, of nearly semi-circular section, the whole bottom being exposed to the fire-gases. A horizontal shaft runs length-ways through the trough, and is provided with stirring blades, arranged in such a manner that they constantly scrape the bottom, so that the salts cannot burn fast upon it, and are at the same time moved forward towards one of the ends of the trough where they are automatically removed by means of a chain of buckets.

The most efficient evaporating apparatus, as far as economy of fuel is concerned, is the vacuum-pan, of which from two to five are combined to form a set, but it has the drawback that the removal of the salts is much more difficult than with the this recovery is carried out in the most efficient manner, the process cannot possibly pay; but so much progress has been made in this direction that the loss of ammonia is very slight indeed, merely a fraction per cent. The ammonia is for the major part found in the mother-liquor as ammonium chloride. A smaller but still considerable portion exists here and in the washings in the shape of ammonium carbonates. These compounds differ in their behaviour to heat. The ammonium carbonates are driven out from their solutions by mere prolonged boiling, being thereby decomposed into ammonia, carbon dioxide and water, but the ammonium chloride is not volatile under these conditions, and must be decomposed by milk of lime: $2NH_4Cl+Ca(OH)_2=2NH_3+CaCl_2+2H_2O$. The solution of calcium chloride is run to waste, the ammonia is re-introduced into the process.

Both these reactions are carried out in tall cylindrical columns or "stills," consisting of a number of superposed cylinders, having perforated horizontal partitions, and provided with a steam-heating arrangement in the enlarged bottom portion. The milk of lime is introduced at a certain distance from the bottom. The steam causes the action of the lime on the ammonium chloride to take place in this lower portion of the still, from which the steam, mixed with all the liberated ammonia, rises into the upper portion of the column where its heat serves to drive out the volatile ammonium carbonate. Just below the top there is a cooling arrangement, so that nearly all the water is condensed and runs back into the column, while the ammonia, with the carbon dioxide formerly combined with part of it, passes on first through an outside cooler where the remaining water is condensed, and afterwards into the vessels, already described, where the ammonia is absorbed by a solution of salt and thus again introduced into the process.

The reversible character of the principal reaction has the consequence that a considerable portion of the sodium chloride (up to 33 %) is lost, being contained in the waste calcium chloride solution which issues from the ammonia stills. This is, however, not of much importance, as it had been introduced in the shape of a brine where its value is very slight (6d. per ton of NaCl). It is true that all the chlorine combined with the sodium is lost partly as NaCl and partly as $CaCl_2$; none of the innumerable attempts at recovering the chlorine from the waste liquor has been made to pay, and success is less likely than ever since the perfection of the electrolytic processes. (See CHLORINE.) For all that, especially in consequence of the small amount of fuel required, and the total absence of the necessity of employing sulphur compounds as an intermediary, the ammonia-soda process has supplanted the Leblanc process almost entirely on the continent of Europe and to a great extent in Great Britain.

III. ELECTROLYTIC ALKALI MANUFACTURE

In theory by far the simplest process for making alkalis together with free chlorine is the electrolysis of sodium (or potassium) chloride. When this takes place in an aqueous solution, the alkaline metal at once reacts with the water, so that a solution of an alkaline hydrate is formed while hydrogen escapes. The reactions are therefore (we shall in this case speak only of the sodium compounds): (1) $NaCl=Na+Cl$, (2) $Na+H_2O=NaOH+H$.

The chlorine escapes at the anode, the hydrogen at the cathode. If the chlorine and the sodiun hydrate can act upon each other within the liquid, *bleach-liquors* are formed: $2NaOH+Cl_2=NaOCl+NaCl+H_2O$. The production of these for the use of papermakers and bleachers of textile fabrics has become an important industry, but does not enter into our province.

If, however, the action of the chlorine on the sodium hydrate is prevented, which can be done in various ways, they can both be collected in the isolated state and utilized as has been previously described, viz. the *chlorine* can be used for the manufacture of liquid chlorine, bleaching-powder or other bleaching compounds, or chlorates, and the solution of *sodium hydrate* can be sold as such, or converted into solid caustic soda. Precisely the same can be done in the electrolysis of potassium chloride.

There is a third way of conducting the action, viz. so that the chlorine can act upon the caustic soda or potash at a higher concentration and temperature, in which case *chlorates* are directly formed in the liquid: $KCl+3H_2O=KClO_3+3H_2$. This has indeed become the principal, because it is the cheapest, process for the manufacture of potassium and sodium chlorate. Perchlorates can also be made in this way.

In all these cases the chlorine, or the products made from it, really play a greater part than the alkali. From 58.5 parts by weight of NaCl we obtain theoretically $23Na=40NaOH=53Na_2CO_3$, together with 35.5 Cl, or 100 bleaching-powder. As the weight of bleaching-powder consumed in the world is at most one-fifth of that of alkali, calculated as Na_2CO_3, it follows that only about one-tenth of all the alkali required could be made by electrolysis, even supposing the Leblanc process to be entirely abolished. The remaining nine-tenths of alkali must be supplied from other sources, chiefly the ammonia-soda process. As long as the operation of the Leblanc process is continued, it will supply a certain share of both kinds of products. Trustworthy statistics on this point cannot be obtained, because most firms withhold any information as to the extent of their production from the public.

The first patents for the electrolysis of alkaline chloride were taken out in 1851 and several others later on; but commercial success was utterly impossible until the invention of the dynamo machine allowed the production of the electric current at a sufficiently cheap rate. The first application of this machine for the present purpose seems to have been made in 1875 and the number of patents soon rapidly increased; but although a large amount of capital was invested and many very ingenious inventions made their appearance, it took nearly another twenty years before the manufacture of alkali in this way was carried out in a continuous way on a large scale and with profitable results. A little earlier the manufacture of *potassium chlorate* (on the large scale since 1890) had been brought to a definite success by H. Gall and the Vicomte A. de Montlaur; a few years later the processes worked out at the Griesheim alkali works (near Frankfort) for the manufacture of caustic potash and chlorine established definitely the success of electrolysis in the field of potash, but even then none of the various processes working with sodium chloride had emerged from the experimental stage. Only more recently the manufacture of caustic soda by electrolysis has also been established as a permanent and paying industry, but as the greatest secrecy is maintained in everything belonging to this domain, and as neither patent specifications nor the sanguine assertions and anticipations of interested persons throw much real light on the actual facts of the case, nothing certain can be said either in regard to the date at which the profitable manufacture of caustic soda was first carried out by electrolysis, or as to what extent this is the case at the present moment.

We shall here give merely an outline of those more important processes which are known to be at present working profitably on a large scale.

(1) The *Diaphragm process* is probably the only one employed at present for the decomposition of potassium chloride, and it is also used for sodium chloride. A hot, concentrated solution of the alkaline chloride is treated by the electric current in large iron tanks which at the same time serve as cathodes. The anodes are made of retort-carbon or other chlorine-resisting material and they are mounted in cells which serve as diaphragms. The material of these cells is usually cement, mixed with certain soluble salts which impart sufficient porosity to the material. The electrolysis is carried on until about a quarter of the chloride has been transformed; it must be stopped at this stage lest the formation of hypochlorite and chlorate should set in. The alkaline liquid is now transferred to vacuum pans, constructed in such a manner that the unchanged chloride, which "salts out" during the concentration, can be removed without disturbing the vacuum, and here at last a concentrated pure

solution of KOH or NaOH is obtained which is sold in this state, or "finished" as solid caustic in the manner described in the section treating of the Leblanc soda.

(2) The *Castner-Kellner process* employs no diaphragm, but a mercurial cathode. The electrolysis takes place in the central compartment of a tripartite trough which can be made to rock slightly either to one side or the other. The bottom of the trough is covered with mercury. The sodium as it is formed at the cathode at once dissolves in the mercury which protects it against the action of the water as long as the percentage of sodium in the mercury does not exceed, say, 0·02%. When this percentage has been reached, the cell is rocked to the other side, so that the amalgam flows into one of the outer compartments where the sodium is converted by water into sodium hydrate. At the same time fresh mercury, from which the sodium had been previously extracted, flows from the other outside compartment into the central one. After a certain time the whole is rocked towards the other side, and the process is continued until the outer compartments contain a strong solution of caustic soda, free from chloride and hypochlorite.

(3) *Aussig process.*—Here the anode is fixed in a bell, mounted in a larger iron tank where the cathodes are placed. The whole is filled with a solution of common salt. As the electrolysis goes on, NaOH is formed at the cathodes and remains at the bottom. The intermediate layer of the salt solution, floating over the caustic soda solution, plays the part of a diaphragm, by preventing the chlorine evolved in the bell from acting on the sodium hydrate formed outside, and this solution offers much less resistance to the electric current than the ordinary diaphragms. This process therefore consumes less power than most others.

(4) The *Acker-Douglas process* electrolyses sodium chloride in the molten state, employing a cathode consisting of molten lead. The latter dissolves the sodium as it is formed and carries it to an outer compartment where by the action of water the sodium is converted into caustic soda, while the lead returns to the inner compartment. This process is carried on at Niagara Falls, but it is uncertain to what extent.

(5) The *Hargreaves-Bird process* avoids certain drawbacks attached to other processes, by employing a wire diaphragm and converting the caustic soda as it issues on the other side of this, by means of carbon dioxide, into a mixture of sodium carbonate and bicarbonate, which separates out in the solid state. This process is but little used.

It stands to reason that the electrolytic processes have been principally developed in localities where the electric current can be produced in the cheapest possible manner by means of water power, but this is not the only condition to be considered, as the question of freight to a centre of consumption and other circumstances may also play an important part. Where coal is very cheap indeed and the other conditions are favourable, it is possible to establish such an industry with a prospect of commercial success, even when the electric current is produced by means of steam-engines.

Natural Soda.—This is the term applied to certain deposits of alkaline salts, or their solutions, which occur, sometimes in very large quantities, in various parts of the world. The oldest and best known of these are the Natron lakes in Lower Egypt. The largest occurrence of natural soda hitherto known is that in Owen's Lake and other salt lakes situated in eastern California. The soda in all of these is present as "sesquicarbonate," in reality 4/3 carbonate: $NaHCO_3 \cdot Na_2CO_3 \cdot H_2O$, and is always mixed with large quantities of chloride and sulphate, which makes its extraction more difficult than would appear from the outset. Hence, although for many centuries (up to Leblanc's invention) hardly any soda was available except from this source, and although we now know that millions of tons of it exist, especially in the west of the United States, there is as yet very little of it practically employed, and that only locally.

REFERENCES.—The principal work on the manufacture of alkali is G. Lunge's *Sulphuric Acid and Alkali* (2nd ed., vols. ii. and iii., 1895–1896). This work has also appeared in a German and a French edition. The same author wrote the articles on the manufacture of sodium and potassium compounds and on chlorine in Thorpe's *Dictionary of Applied Chemistry* (3 vols., 1890–1893). The subject is also treated, very much more briefly, in Sorel's *Industrie chimique minérale* (1902), and of course in every other general treatise on chemical technology. A special treatise on the manufacture of ammonia soda ash has been published in German by H. Schreib. Consult also the official *Annual Reports on Alkali*, &c., and, from 1864 onwards, *Journal of the Society of Chemical Industry*, *Fischers Jahresberichte der chemischen Technologie*, and *Zeitschrift für angewandte Chemie*. (G. L.)

ALKALINE EARTHS. The so-called alkaline earth-metals are the elements beryllium, magnesium, calcium, strontium and barium. By the early chemists, the term *earth* was used to denote those non-metallic substances which were insoluble in water and were unaffected by strong heating; and as some of these substances (*e.g.* lime) were found to be very similar in properties to those of the alkalis, they were called alkaline earths. The alkaline earths were assumed to be elements until 1807, when Sir H. Davy showed that they were oxides of various metals. The metals comprising this group are never found in the uncombined condition, but occur most often in the form of carbonates and sulphates; they form oxides of the type RO, and in the case of calcium, strontium and barium, of the type RO_2. The oxides of type RO are soluble in water, the solution possessing a strongly alkaline reaction and rapidly absorbing carbon dioxide on exposure; they are basic in character and dissolve readily in acids with the formation of the corresponding salts. As the atomic weight of the element increases, it is found that the solubility of the sulphates in water decreases.

Beryllium to a certain extent stands alone in many of its chemical properties, resembling to some extent the metal aluminium. Beryllium and magnesium are permanent in dry air; calcium, strontium and barium, however, oxidize rapidly on exposure. The salts of all the metals of this group usually crystallize well, the chlorides and nitrates dissolve readily in water, whilst the carbonates, phosphates and sulphates are either very sparingly soluble or are insoluble in water.

ALKALOID, in chemistry, a term originally applied to any organic base, *i.e.* a nitrogenous substance which forms salts with acids; now, however, it is usual to restrict the term to bases of vegetable origin and characterized by remarkable toxicological effects. Such bases occur almost exclusively in the dicotyledons, generally in combination with malic, citric, tartaric or similar plant-acids. They may be extracted by exhausting the plant-tissues with a dilute acid, and precipitating the bases with potash, soda, lime or magnesia. The separation of the mixed bases so obtained is effected by repeated fractional crystallization, or by taking advantage of certain properties of the constituents.

A chemical classification of alkaloids is difficult on account of their complex constitution. I. A. Wyschnegradsky, and afterwards W. Königs, expressed the opinion that the alkaloids were derivatives of pyridine or quinoline. This view has been fairly well supported by later discoveries; but, in addition to pyridine and quinoline nuclei, alkaloids derived from isoquinoline are known. The purely chemical literature on the alkaloids is especially voluminous; and from the assiduity with which the constitutions of these substances have been and are still being attacked, we may conclude that their synthesis is but a question of time. Piperine, conine, atropine, belladonine, cocaine, hyoscyamine and nicotine have been already synthesized; the constitution of several others requires confirmation, while there remain many important alkaloids—quinine, morphine, strychnine, &c.—whose constitution remains unknown.

The following classification is simple and convenient; the list of alkaloids makes no pretence at being exhaustive.

(1) Pyridine group. Piperine; conine; trigonelline; arecaidine; guvacine; pilocarpine; cytisine; nicotine; sparteine.

(2) Tropine group. Alkaloids characterized by containing the tropine (*q.v.*) nucleus. Atropine; cocaine; hygrine; ecgonine; pelletierine.

(3) Quinoline group. The alkaloids of the quina-barks:

quinine, &c.; the *strychnos* bases: strychnine, brucine; and the *veratrum* alkaloids: veratrine, cevadine, &c.

(4) Isoquinoline group. The opium alkaloids: morphine, codeine, thebaine, papaverine, narcotine, narceine, &c.; and the complicated substances hydrastine and berberine.

In addition to the above series there are a considerable number of compounds derived from purin which are by some writers classed with the alkaloids. These are treated in the article Purin. There are also reasons for including such compounds as muscarine, choline, neurine and betaine in this group.

The greater number of these substances are of considerable medicinal value; this aspect is treated generally in the article Pharmacology. Reference should also be made to the articles on the individual alkaloids for further details as to their medicinal and chemical properties.

The chemistry of the alkaloids is treated in detail by Amé Pictet in his *La Constitution chimique des alcaloides végétaux* (Paris, 1897); enlarged and translated by H. C. Biddle with the title *The Vegetable Alkaloids* (New York, 1904); and by J. W. Bruhl, E. Hjelt, and O. Aschan: *Die Pflanzen-Alkaloide* (1900). A pamphlet, *Die Alkaloidchemie in den Jahren 1900–1904*, by Julius Schmidt, may also be consulted.

ALKAN, CHARLES HENRI VALENTIN MORHANGE (1813–1888), French musical composer, was born and died in Paris. Alkan was his *nom de guerre*. Admitted to the Conservatoire of Paris in his sixth year, he had a distinguished career there until 1830. He visited London in 1833, after which he settled in Paris as a pianoforte teacher till his death. He is important as the composer of a large number of pianoforte *études*, embodying the most extravagant technical difficulties. His invention was not modern enough to secure for these works that attention which they deserve as representing a pianoforte technique and sense of effect in some respects more advanced even than that of Liszt, though lacking Liszt's economy and tact.

ALKANET (dim. from Span. *alcaña*, Arab. *al-henna* = henna, Egyptian privet, or *Lawsonia inermis*), a plant, *Alkanna* or *Anchusa tinctoria*, of the order Boraginaceae, also known as orchanet, dyer's bugloss, Spanish bugloss or bugloss of Languedoc, which is grown in the south of France and on the shores of the Levant. Its root yields a fine red colouring matter which has been used to tint tinctures, oils, wines, varnishes, &c.

AL KASR AL KEBIR ("the great castle," in Span. Alcazar Kebir, in Port. Alcaçer Quibir), a town of Morocco, on the river Lekkus, 80 m. N.W. of Fez. Pop. about 10,000. Its mud and pantile dwellings are here and there relieved by a mosque tower, but the aspect of the town is far from inviting. It is frequently flooded in winter and in consequence fever is prevalent. The weekly market, held on Sundays in the centre of the town, gives to the place an appearance of bustle. A vice-governor is appointed for the town by the basha of Laraiche, one for the country round by the sultan of Morocco, a condition which causes much confusion on market-days. Al Kasr al Kebir was built, according to Leo Africanus, by Yakub el Mansur (1184–1199). Not far from the town, by the banks of the river Makhazan, is the site of the battle fought in 1578 between Dom Sebastian, king of Portugal, and the Moors under Abd el Malek, in which the Moors were victorious, though both kings perished, as well as the deposed Mahommed XI., who had called in the Portuguese to his aid against Abd el Malek.

ALKMAAR, a town in the province of North Holland, kingdom of Holland, 24½ m. by rail N.N.W. of Amsterdam, connected by steam-tramway with Haarlem and Amsterdam, and on the North Holland canal. Pop. (1900) 18,373. Alkmaar is a typical North Holland town, with tree-lined canals and brightly coloured 17th-century houses. The old city walls have been replaced by pleasant gardens and walks, and there is a park in which stands a fine monument (1876) by J. T. Stracké (1817–1891), symbolizing *Alcmaria victrix*, to commemorate the siege by the Spaniards in 1573. The Groote Kerk (1470–1498), dedicated to St Lawrence, is a handsome building and contains the tomb of Floris V., count of Holland (d. 1296), a brass of 1546, and some paintings (1507). In the town hall (1507) are the library and a small museum with two pictures by the 17th-century artist Caesar van Everdingen, who with his more celebrated brother Allart van Everdingen (*q.v.*) was a native of the town. The weigh-house (1582) is a picturesque building with quaint gable and tower. Just outside the town lies the Alkmaar wood, at the entrance to which stands the military cadet school which serves as a preparatory school for the royal military academy at Breda. Alkmaar derives its chief importance from being the centre of the flourishing butter and cheese trade of this region of Holland. It is also a considerable market for horses, cattle and grain, and there is a little boat-building and salt and sail-cloth manufacture. Tramways connect Alkmaar with Egmond and with the pretty summer resort of Bergen, which lies sheltered by woods and dunes.

The name of Alkmaar, which means "all sea," first occurs in the 10th century, and recalls its former situation in the midst of marshlands and lakes. It was probably originally a fishing-village, but with the reclamation of the surrounding morasses, *e.g.* that of the Schermer in 1685, and their conversion into rich meadow land, Alkmaar gradually acquired an important trade. In 1254 it received a charter from William II., count of Holland, similar to that of Haarlem, but in the 15th century duke Philip the Good of Burgundy made the impoverishment of the town, due to ill-government, the excuse for establishing an oligarchical régime, by charters of 1436 and 1437. As the captial of the ancient district of Kennemerland between den Helder and Haarlem, Alkmaar frequently suffered in the early wars between the Hollanders and the Frisians, and in 1517 was captured by the united Gelderlanders and Frisians. In 1573 it successfully sustained a seven-weeks' siege by 16,000 Spaniards under the duke of Alva. In 1799 Alkmaar gave its name to a convention signed by the duke of York and the French general Brune, in accordance with which the Russo-British army of 23,000 men, which was defeated at Bergen, evacuated Holland. A monument was erected in 1901 to commemorate the Russians who fell.

ALLACCI, LEONE [Leo Allatius] (1586–1669), Greek scholar and theologian, was born in the island of Chios. His early years were passed in Calabria and at Rome, where he finally settled as teacher of Greek at the Greek college, at the same time devoting himself to the study of classics and theology. In 1622, after the capture of Heidelberg by Tilly, the elector Maximilian of Bavaria presented its splendid library composed of 196 cases of MSS. (*bibliotheca Palatina*) to Pope Gregory XV. Allacci was sent to superintend its removal to Rome, where it was incorporated with the Vatican library. On the death of Gregory, Allacci became librarian to Cardinal Berberini, and subsequently (1661) librarian of the Vatican, which post he held till his death on the 18th (or 19th) of January 1669. It is noteworthy that, although a Greek by birth, he became an ardent Roman Catholic and the bitter enemy of all heretics, including his own countrymen. Allacci was a very industrious and voluminous writer, but his works, although they bear ample testimony to his immense learning, show an absence of the true critical faculty, and are full of intolerance, especially on religious subjects. For a list of these, J. A. Fabricius's *Bibliotheca Graeca* (xi. 437) should be consulted, where they are divided into four classes: editions, translations and commentaries on ancient authors; works relating to the dogmas and institutions of the Greek and Roman Churches; historical works; miscellaneous works. The number of his unpublished writings is also very large; the majority of them are included in the MSS. of the Vallicellian library.

The main source of our knowledge of Allatius is the incomplete life by Stephanus Gradi, *Leonis Allatii vita*, published by Cardinal Mai, in *Nova Bibliotheca Patrum*. A complete enumeration of his works is contained in E. Legrand, *Bibliographie hellénique du XVIIème siècle* (Paris, 1895, iii. 435-471). The accounts of C. N. Sathas in Νεοελληνικὴ φιλολογία (Athens, 1868), and of the pseudo-prince Demetrius Rhodokanakis, *Leonis Allatii Hellas* (Athens, 1872), are inaccurate and untrustworthy. For a special account of his share in the foundation of the Vatican Library, see Curzio Mazzi, *Leone Allacci e la Palatina di Heidelberg* (Bologna, 1893). The theological aspect of his works is best treated by the Assumptionist Father L. Petit in A. Vacant's *Dictionnaire de théologie* (Paris, 1900, cols. 830-833).

ALLAH, the Arabic name used by Moslems of all nationalities for the one true God. It is compounded of *al*, the definite article, and *ilah*, meaning a god. The same word is found in Hebrew and Aramaic as well as in ancient Arabic (Sabaean). The meaning of the root from which it is derived is very doubtful; cf. Lane's

Arabic-English Lexicon, p. 82, and the Oxford *Hebrew and English Lexicon*, pp. 61 ff.

ALLAHABAD, a city of British India, the capital of the United Provinces of Agra and Oudh, giving its name to a district and a division. The city is situated at the confluence of the Ganges and the Jumna in 25°26′ N. lat. and 81°50′ E. long., 564 m. from Calcutta by rail. Its most conspicuous feature is the fort, which rises directly from the banks of the confluent rivers and completely commands the navigation of both streams. Within the fort are the remains of a splendid palace, erected by the Emperor Akbar, and once a favourite residence of his. A great portion of it has been destroyed, and its hall is converted into an arsenal. Outside the fort the places of most importance are the sarai and gardens of Khasru, the son of the Emperor Jehangir, and the Jama Masjid or Great Mosque. When the town first came into the hands of the English this mosque was used as a residence by the military officer commanding the station, and afterwards as an assembly room. Ultimately it was returned to its former owners, but the Mahommedans considered it desecrated, and it has never since been used as a place of worship. Allahabad (Illahabad) was the name given to the city when Akbar built the great fort. To the Hindus it is still known by its ancient name of Prag or Prayag ("place of sacrifice"), and it remains one of the most noted resorts of Hindu pilgrimage. It owes its sanctity to its being the reputed confluence of three sacred streams—the Ganges, the Jumna and the Saraswati. This last stream, however, actually loses itself in the sands of Sirhind, 400 m. north-west of Allahabad. The Hindus assert that the stream joins the other two rivers underground, and in a subterraneous temple below the fort a little moisture trickling from the rocky walls is pointed out as the waters of the Saraswati. An annual fair is held at Allahabad at the confluence of the streams on the occasion of the great bathing festival at the full moon of the Hindu month of Magh. It is known as the Magh-mela, lasts for a whole month, and is attended by as many as 250,000 persons in ordinary years, either for religious or commercial purposes. Every twelfth year there is a special occasion called the Kumbh-mela, which is attended by a million of devotees at one time. Allahabad was taken by the British in 1765 from the wazir of Oudh, and assigned as a residence to Shah Alam, the titular emperor of Delhi. Upon that prince throwing himself into the hands of the Mahrattas, the place was resumed by the British in 1771 and again transferred to the nawab of Oudh, by whom it was finally ceded together with the district to the British in 1801, in commutation of the subsidy which the wazir had agreed to pay for British protection. During the Mutiny of 1857, Allahabad became the scene of one of the most serious outbreaks and massacres which occurred in the North-Western Provinces. The fort was held by a little garrison of Europeans and loyal Sikhs, until it was relieved by General Neill on June 11th of that year.

The modern buildings of Allahabad include Government House, the High Court, the Mayo memorial and town hall, the Muir central college, the Thornhill and Mayne memorial library and museum, the Naini central jail, and the Anglican and Roman Catholic cathedrals. The Jumna is crossed by a railway bridge and there are two bridges of boats over the Ganges. The military cantonments contain accommodation for all three arms and are the headquarters of a brigade in the 8th division of the eastern army corps. At Allahabad is published the *Pioneer*, perhaps the best known English paper in India. There is an American mission college. Here is the junction of the great railway system which unites Bengal with Central India and Bombay, and is developing into a great centre of inland and export trade. The population in 1901 was 172,032.

The DISTRICT OF ALLAHABAD has an area of 2811 sq. m. In shape it is an irregular oblong, and it is very difficult to define its boundaries, as at one extremity it wanders into Oudh, while on the south the villages of the state of Rewa and those of this district are hopelessly intermingled. The Jumna and the Ganges enclose within their angle a fertile tract well irrigated with tanks and wells. The East Indian railway and the Grand Trunk road afford the principal means of land communication. In 1901 the population was 1,489,358, showing a decrease of 4% in the decade due to famine.

The division of Allahabad has an area of 17,270 sq. m. The population in 1901 was 5,540,702, showing a decrease of 4% in the decade due to the famine of 1896–1897, which was severely felt throughout the division. It comprises the seven districts of Cawnpore, Fatehpur, Banda, Hamirpur, Allahabad, Jhansi and Jalaun.

ALLAMANDA, named after J. N. S. Allamand (1713–1787), of Leiden, a genus of shrubby, evergreen climbers, belonging to the natural order Apocynaceae, and a native of tropical America. Several species are grown in hot-houses for the beauty of their foliage and flowers; the latter, borne in many-flowered panicles, have a funnel-shaped corolla with a narrow tube, and often yellow in colour. The plants are of comparatively easy culture, and very effective when trained to wires beneath the roof of the house.

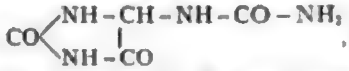
ALLAN, DAVID (1744–1796), Scottish historical painter, was born at Alloa. On leaving Foulis's academy of painting at Glasgow (1762), after seven years' successful study, he obtained the patronage of Lord Cathcart and of Erskine of Mar, on whose estate he had been born. The latter furnished him with the means of proceeding to Rome (1764), where he remained for a number of years engaged principally in copying the old masters. Among the original works which he then painted was the "Origin of Portraiture"—representing a Corinthian maid drawing her lover's shadow—well known through Domenico Cunego's excellent engraving. This gained for him the gold medal given by the Academy of St Luke in the year 1773 for the best specimen of historical composition. Returning from Rome in 1777, he resided for a time in London, and occupied himself in portrait-painting. In 1780 he removed to Edinburgh, where, on the death of Alexander Runciman in 1786, he was appointed director and master of the Academy of Arts. There he painted and etched in aquatint a variety of works, those by which he is best known—as the "Scotch Wedding," the "Highland Dance," the "Repentance Stool," and his "Illustrations of the Gentle Shepherd"—being remarkable for their comic humour. He was called the "Scottish Hogarth"; but his drolleries hardly entitle him to this comparison. Allan died at Edinburgh on the 6th of August 1796.

ALLAN, SIR HUGH (1810–1882), Canadian financier, was born on the 29th of September 1810, at Saltcoats, Ayrshire, Scotland, the son of Captain Alexander Allan, a shipmaster. He emigrated to Canada in 1826, and in 1831 entered the employ of the chief shipbuilding and grain-shipping firm of Montreal, of which he became a junior partner in 1835. In 1853 he organized the Allan Line of steamships, plying between Montreal, Liverpool and Glasgow; till his death he was closely associated with the commercial growth and prosperity of Canada, and in 1871 was knighted in recognition of his services. In 1872–1873 he obtained from the Canadian government a charter for building the Canadian Pacific railway, but the disclosures made with reference to his contributions to the funds of the Conservative party led to the Pacific scandal (see CANADA, *History*), and that company was soon afterwards dissolved. He died in Edinburgh on the 9th of December 1882.

See J. C. Dent, *Canadian Portrait Gallery* (1881).

ALLAN, SIR WILLIAM (1782–1850), Scottish painter, was born at Edinburgh, and at an early age entered as a pupil in the School of Design established in Edinburgh by the Board of Trustees for Arts and Manufactures, where he had as companions, John Wilkie, John Burnet the engraver, and others who afterward distinguished themselves as artists. Here Allan and Wilkie were placed at the same table, studied the same designs, and contracted a lifelong friendship. Allan continued his studies for some time in London; but his attempt to establish himself there was unsuccessful, and after exhibiting at the Royal Academy (1805) his first picture, "A Gipsy Boy and Ass," an imitation in style of Opie, he determined, in spite of his scanty resources, to seek his fortune abroad. He accordingly set out the same year for Russia, but was carried by stress of weather to Memel, where he remained for some time, supporting himself by his pencil. At last, however, he reached St Petersburg, where the kindness of Sir Alexander Crichton, the court physician, and other friends procured him abundant employment. By excursions into southern Russia, Turkey, the Crimea and Circassia, he filled his portfolio with vivid sketches, of which he made admirable use in his subsequent pictures. In 1814 he returned to Edinburgh, and in the two following years exhibited at the Royal Academy "The Circassian Captives" and "Bashkirs conducting Convicts to Siberia." The former picture remained so long unsold, that, thoroughly disheartened, he threatened to retire to Circassia when, through the kindness of Sir Walter Scott, a subscription of 1000 guineas was obtained for the picture, which fell by lot into the possession of the earl of Wemyss. About the same time the Grand Duke Nicholas, afterwards tsar of Russia, visited Edinburgh, and purchased his "Siberian Exiles" and "Haslan Gheray crossing the River Kuban," giving a very favourable turn to the fortunes of the painter, whose pictures were now sought for by collectors. From this time to 1834 he achieved his greatest success and firmly established his fame by the illustration of Scottish history. His most important works of this class were "Archbishop Sharpe on Magus Moor"; "John Knox admonishing Mary Queen of Scots" (1823), engraved by Burnet; "Mary Queen of Scots signing her Abdication" (1824); and "Regent Murray shot by Hamilton of Bothwellhaugh." The last procured his election as an associate of the Royal Academy (1825). Later Scottish subjects were "Lord Byron" (1831), portraits of Scott and "The Orphan" (1834), which represented Anne Scott seated near the chair of her deceased father. In 1830 he was compelled, on account of an attack of ophthalmia, to seek a milder climate, and visited Rome, Naples and Constantinople. He returned with a rich store of materials, of which he made excellent use in his "Constantinople Slave Market" and other productions. In 1834 he visited Spain and Morocco, and in 1841 went again to St Petersburg, when he undertook, at the request of the tsar, his "Peter the Great teaching his Subjects the Art of Shipbuilding," exhibited in London in 1845, and now in the Winter Palace of St Petersburg. His "Polish Exiles" and "Moorish Love-letter," &c., had secured his election as a Royal Academician in 1835; he was appointed president of the Royal Scottish Academy (1838), and royal limner for Scotland, after Wilkie's death (1841); and in 1842 received the honour of knighthood. His later years were occupied with battle-pieces, the last he finished being the second of his two companion pictures of the "Battle of Waterloo." He died on the 22nd of February 1850, leaving a large unfinished picture—"Bruce at Bannockburn."

ALLAN-DESPRÉAUX, LOUISE ROSALIE (1810–1856), French actress, was "discovered" by Talma at Brussels in 1820, when she played Joas with him in *Athalie*. At his suggestion she changed her surname, Ross, for her mother's maiden name, and, as Mlle. Despréaux, was engaged for children's parts at the Comédie Française. At the same time she studied at the Conservatoire. By 1825 she had taken the second prize for comedy, and was engaged to play *ingénue* parts at the Comédie Française, where her first appearance in this capacity was as Jenny in *L'Argent* on the 8th of December 1826. In 1831 the director of the Gymnase succeeded in persuading her to join his company. Her six years at this theatre, during which she married Allan, an actor in the company, were a succession of triumphs. She was then engaged at the French theatre at St Petersburg. Returning to Paris, she brought with her, as Legouvé says, a thing she had unearthed, through a Russian translation, a little comedy never acted till she took it up, a production half-forgotten, and esteemed by those who knew it as a pleasing piece of work in the Marivaux style—*Un Caprice* by Alfred de Musset, which she had played with success in St Petersburg. Her selection of this piece for her reappearance at the Théâtre Française (1847) laid the corner-stone of Musset's lasting fame as a dramatist. In the following year his comedy *Il ne faut jurer de rien* was acted at the same theatre, and thus led to the production of his finer plays. Among plays by other authors in which Mme. Allan won special laurels at the Théâtre Française, were *Par droit de conquête*, *Péril en la demeure*, *La joie fait peur*, and *Lady Tartuffe*. In the last, with a part of only fifty lines, and playing by the very side of the great Rachel, she yet held her own as an actress of the first rank. Mme. Allan died in Paris, in the height of her popularity, in March 1856.

ALLANTOIN, $C_4H_6N_4O_3$ or 

$$CO\begin{cases}NH-CH-NH-CO-NH_2\\ \quad\ \ |\\ NH-CO\end{cases}$$

, the diureide of glyoxylic acid. It is found in the allantoic liquid of the cow, and in the urine of sucking calves. It can be obtained by the oxidation of uric acid by means of lead dioxide, manganese dioxide, ozone or potassium permanganate:

$$C_5H_4N_4O_3 + H_2O + O = C_4H_6N_4O_3 + CO_2.$$

It has been synthesized by E. Grimaux by heating one part of glyoxylic acid with two parts of urea for ten hours at 100° C.: $2CO(NH_2)_2 + CH(OH)_2COOH = 3H_2O + C_4H_6N_4O_3$. It forms glancing prisms of neutral reaction slightly soluble in water. On standing with concentrated potassium hydroxide solution it gives potassium allantoate $C_4H_7N_4O_4K$. On heating with water it undergoes hydrolysis into urea and allanturic acid $C_3H_4O_3N_2$. It is reduced by sodium amalgam to glycouril $C_4H_6N_4O_2$, whilst with hydriodic acid it yields urea and hydantoin $C_3H_4N_2O_2$. Hot concentrated sulphuric acid also decomposes allantoin, with production of ammonia, and carbon monoxide and dioxide. By dry distillation it gives ammonium cyanide.

ALLEGHANY, or **THE ALLEGHANIES** (a spelling now more common than Allegheny), a name formerly used of all the Appalachian Mountains (*q.v.*), U.S.A., and now sometimes of all that system lying W. and S. of the Hudson river, being steep and narrow-crested in Pennsylvania (1500–1800 ft.), and in Maryland, Virginia and West Virginia higher (3000 ft.-4473 ft). and with broader crests. Another usage applies to the ridges ("the Alleghany Ridges") parallel to the Blue Ridge; the north-western part of this region is sometimes called the Alleghany Front or the Front of the Alleghany Plateau. The Alleghany Plateau is the north-westernmost division of the Appalachian system; it is an eroded mass of sedimentary rock sloping north-westward to the Prairie and Lake Plains and reaching south-west from the south-western part of New York state through Tennessee and into Alabama.

ALLEGHENY, formerly a city of Allegheny county, Pennsylvania, U.S.A., on the N. bank of the Allegheny and Ohio rivers, opposite Pittsburg; since 1907 a part of Pittsburg. Pop. (1890) 105,287; (1900) 129,896, of whom 30,216 were foreign-born and 3315 were negroes; of the foreign-born 12,022 were from Germany, 5070 from Ireland, 3929 from Austria, and 2177 from England; (1906, estimate) 145,240. Allegheny is served by the Baltimore & Ohio and the Pittsburg & Western railways, by the Pittsburg, Ft. Wayne & Chicago, the Western Pennsylvania, the Buffalo & Allegheny Valley, the Cleveland & Pittsburg, the Erie & Pittsburg, the Pittsburg, Youngstown & Ashtabula, and the Chautauqua divisions of the Pennsylvania railway system, and by Ohio river freight and passenger boats. Extending along the river fronts for about 6½ m. are numerous large manufactories and the headquarters of the shipping interests; farther back are the mercantile quarters and public buildings; and on the hills beyond are the residence districts, commanding extensive views of the valley. Two of the principal thoroughfares, Federal and Ohio streets, intersect at a central square, in which are the city hall, public library, post office and the market-place; and surrounding the main business section on the E., N. and W. is City Park of 100 acres, with lakes and fountains, and monuments to the memory of Alexander von Humboldt, George Washington and T. A. Armstrong. Farther out is Riverview Park (219 acres), in which is the Allegheny Astronomical Observatory, and elsewhere are a soldiers' monument and a monument (erected by Andrew Carnegie) in memory of Colonel Johnes Anderson. In Allegheny are the following institutions of higher learning:—the Allegheny Theological Seminary (United Presbyterian), opened in 1825; the Western Theological Seminary of the Presbyterian Church, opened in 1827; and the Theological Seminary of the Reformed Presbyterians, opened in 1856. There is a fine Carnegie library with a music-hall. Among penal and charitable institutions are the Riverside State Penitentiary, three hospitals, three homes for orphans, a home for the friendless and an industrial school. Six bridges spanning the river and electric lines crossing them have brought Allegheny into close industrial and social relations with the main part of Pittsburg, and on the hills of Allegheny are beautiful homes of wealthy men. As a manufacturing centre Allegheny was outranked in 1905 by only two cities in the state—Philadelphia and Pittsburg; among the more important of its large variety of manufactures are the products of slaughtering and meat-packing establishments, iron and steel rolling mills, the products of foundries and machine-shops, pickles, preserves and sauces, the products of railway-construction and repair shops, locomotives, structural iron and plumbers' supplies. In 1905 the total value of Allegheny's factory products was $45,830,272; this showed an apparent decrease (exceeded by one city only) of $7,365,106, from the product-value of 1900, but the decrease was partly due to the more careful census of 1905, in which there were not the duplications of certain items which occurred in the 1900 census. But in the five years there was a decrease of 3865 in the average number of wage-earners, and the iron and steel output was much less. In 1905 Allegheny ranked first among the cities of the United States in the manufacture of pickles, preserves and sauces, the product ($6,216,778) being 20·9% of that for the whole country. An important industry is the shipment of coal, especially on barges down the Ohio.

Allegheny was laid out in 1788 on a portion of a tract which the state had previously reserved opposite Pittsburg, with a view to bringing some valuable land into the market for the payment of its soldiers' claims. When ordered by the state to be laid out, it was also named as the site of the county-seat of the newly erected county of Allegheny, but the opposition of Pittsburg was so strong that by a supplementary act in the following year that town was made the county-seat. In 1828 Allegheny was incorporated as a borough and in 1840 it was chartered as a city. The city suffered severely in 1874 from a fire started by a fire-cracker on the 4th of July and from a flood caused by a great rain-storm on the 26th of the same month, but these calamities were followed by years of great prosperity and rapid growth. In 1906 the question of uniting Allegheny with Pittsburg under one municipal government was submitted to a joint vote of the electorate of the two cities, in accordance with an act of the state legislature, which had been passed in February of that year, and a large majority voted for the union; but there was determined opposition in Allegheny, every ward of the city voting in the negative; the constitutionality of the act was challenged; the supreme court of the state on the 11th of March 1907 declared the act valid, and on the 18th of November 1907 this decision was affirmed by the Supreme Court of the United States.

See J. E. Parke, *Recollections of Seventy Years and Historical Gleanings of Allegheny, Pennsylvania* (Boston, 1886).

ALLEGIANCE (Mid. Eng. *ligeaunce*; med. Lat. *ligeantia*, &c.; the *al-* was probably added through confusion with another legal term, *allegeance*, an allegation; the Fr. *allégeance* comes from the English; the word is formed from "liege," of which the derivation is given under that heading; the connexion with Lat. *ligare*, to bind, is erroneous), the duty which a subject or a citizen owes to the state or to the sovereign of the state to which he belongs. It is often used by English legal commentators in a larger sense, divided by them into natural and local, the latter applying to the deference which even a foreigner must pay to the institutions of the country in which he happens to live; but it is in its proper sense, in which it indicates national character and the subjection due to that character, that the word is important. In that sense it represents the feudal *liege homage*, which could be due only to one lord, while simple homage might be due to every lord under whom the person in question held land. The English doctrine, which was at one time adopted in the United States, asserted that allegiance was indelible:—*Nemo potest exuere patriam*. Accordingly, as the law stood before 1870, every person who by birth or naturalization satisfied the conditions described in the article Alien, though he should be removed in infancy to another country where his family resided, owed an allegiance to the British crown which he could never resign or lose, except by act of parliament or by the recognition of the independence or the cession of the portion of British territory in which he resided. By the Naturalization Act 1870, it was made possible for British subjects to renounce their nationality and allegiance, and the ways in which that nationality is lost are defined. So British subjects voluntarily naturalized in a foreign state are deemed aliens from the time of such naturalization, unless, in the case of persons naturalized before the passing of the act, they have declared their desire to remain British subjects within two years from the passing of the act. Persons who from having been born within British territory are British subjects, but who at birth became under the law of any foreign state subjects of such state, and also persons who though born abroad are British subjects by reason of parentage, may by declarations of alienage get rid of British nationality. Emigration to an uncivilized country leaves British nationality unaffected: indeed the right claimed by all states to follow with their authority their subjects so emigrating is one of the usual and recognized means of colonial expansion.

The doctrine that no man can cast off his native allegiance without the consent of his sovereign was early abandoned in the United States, and in 1868 congress declared that "the right of expatriation is a natural and inherent right of all people, indispensable to the enjoyment of the rights of life, liberty and the pursuit of happiness," and one of "the fundamental principles of the republic" (*United States Revised Statutes*, sec. 1999). Every citizen of a foreign state in America owes a double allegiance, one to it and one to the United States. He may be guilty of treason against one or both. If the demands of these two sovereigns upon his duty of allegiance come into conflict, those of the United States have the paramount authority in American law.

The oath of allegiance is an oath of fidelity to the sovereign taken by all persons holding important public office and as a condition of naturalization. By ancient common law it might be required of all persons above the age of twelve, and it was repeatedly used as a test for the disaffected. In England it was first imposed by statute in the reign of Elizabeth (1558) and its form has more than once been altered since. Up to the time of the revolution the promise was, "to be true and faithful to the king and his heirs, and truth and faith to bear of life and limb and terrene honour, and not to know or hear of any ill or damage intended him without defending him therefrom." This was thought to favour the doctrine of absolute non-resistance, and accordingly the convention parliament enacted the form that has been in use since that time—"I do sincerely promise and swear that I will be faithful and bear true allegiance to His Majesty . . ." (see Oath).

See also the articles Citizen, Naturalization: and Salmond on "Citizenship and Allegiance," in the *Law Quarterly Review* (July 1901, January 1902). (Jno. W.)

ALLEGORY (ἄλλος, other, and ἀγορεύειν, to speak), a figurative representation conveying a meaning *other* than and in addition to the literal. It is generally treated as a figure of rhetoric, but the medium of representation is not necessarily language. An allegory may be addressed to the eye, and is often embodied in painting, sculpture or some form of mimetic art. The etymological meaning of the word is wider than that which it bears in actual use. An allegory is distinguished from a *metaphor* by being longer sustained and more fully carried out in its details, and from an *analogy* by the fact that the one appeals to the imagination and the other to the reason. The fable or parable is a short allegory with one definite moral. The allegory has been a favourite form in the literature of nearly every nation. The Hebrew scriptures present frequent instances of it, one of the most beautiful being the comparison of the history of Israel to the growth of a vine in the 80th psalm. In classical literature one of the best known allegories is the story of the stomach and its members in the speech of Menenius Agrippa (Livy ii. 32); and several occur in Ovid's *Metamorphoses*. Perhaps the most elaborate and the most successful specimens of allegory are to be found in the works of English authors. Spenser's *Faerie Queene*, Swift's *Tale of a Tub*, Addison's *Vision of Mirza*, and, above all, Bunyan's *Pilgrim's Progress*, are examples that it would be impossible to match in elaboration, beauty and fitness, from the literature of any other nation.

ALLEGRI, GREGORIO, Italian priest and musical composer, probably of the Correggio family, was born at Rome either in 1560 or in 1585. He studied music under G. Maria Nanini, the intimate friend of Palestrina. Being intended for the church, he obtained a benefice in the cathedral of Fermo. Here he composed a large number of motets and sacred pieces, which, being brought under the notice of Pope Urban VIII., obtained for him an appointment in the choir of the Sistine Chapel at Rome. He held this from December 1629 till his death on the 18th of February 1652. His character seems to have been singularly pure and benevolent. Among the musical compositions of Allegri were two volumes of concerti, published in 1618 and 1619; two volumes of motets, published in 1620 and 1621; besides a number of works still in manuscript. He was one of the earliest composers for stringed instruments, and Kircher has given one specimen of this class of his works in the *Musurgia*. But the most celebrated composition of Allegri is the *Miserere*, still annually performed in the Sistine Chapel at Rome. It is written for two choirs, the one of five and the other of four voices, and has obtained a celebrity which, if not entirely factitious, is certainly not due to its intrinsic merits alone. The mystery in which the composition was long enshrouded, no single copy being allowed to reach the public, the place and circumstances of the performance, and the added embellishments of the singers, account to a great degree for much of the impressive effect of which all who have heard the music speak. This view is confirmed by the fact that, when the music was performed at Venice by permission of the pope, it produced so little effect that the emperor Leopold I., at whose request the manuscript had been sent, thought that something else had been substituted. In spite of the precautions of the popes, the *Miserere* has long been public property. In 1769 Mozart (*q.v.*) heard it and wrote it down, and in 1771 a copy was procured and published in England by Dr Burney. The entire music performed at Rome in Holy Week, Allegri's *Miserere* included, has been issued at Leipzig by Breitkopf and Härtel. Interesting accounts of the impression produced by the performance at Rome may be found in the first volume of Mendelssohn's letters and in Miss Taylor's *Letters from Italy*.

ALLEGRO (an Italian word, meaning "cheerful," as in Milton's poem), a term in music to indicate quick or lively time, coming between *andante* and *presto;* it is frequently modified by the addition of qualifying words. It is also used of a separate piece of music, or of a movement in a sonata, symphony, &c.

ALLEINE, JOSEPH (1634–1668), English Nonconformist divine, belonged to a family originally settled in Suffolk. As early as 1430 some of them—sprung of Alan, lord of Buckenhall—settled in the neighbourhood of Calne and Devizes, whence descended the immediate ancestors of "worthy Mr Tobie Alleine of Devizes," father of Joseph, who, the fourth of a large family, was born at Devizes early in 1634. 1645 is marked in the title-page of a quaint old tractate, by an eye-witness, as the year of his *setting forth in the Christian race*. His elder brother Edward had been a clergyman, but in this year died; and Joseph entreated his father that he might be educated to succeed his brother in the ministry. In April 1649 he entered Lincoln College, Oxford, and on the 3rd of November 1651 he became scholar of Corpus Christi College. On the 6th of July 1653 he took the degree of B.D., and became a tutor and chaplain of Corpus Christi, preferring this to a fellowship. In 1654 he had offers of high preferment in the state, which he declined; but in 1655 George Newton, of the great church of St Mary Magdalene, Taunton, sought him for assistant and Alleine accepted the invitation. Almost coincident with his ordination as associate pastor came his marriage with Theodosia Alleine, daughter of Richard Alleine. Friendships among "gentle and simple"—of the former, with Lady Farewell, grand-daughter of the protector Somerset—bear witness to the attraction of Alleine's private life. His public life was a model of pastoral devotion. This is all the more remarkable as he found time to continue his studies, one monument of which was his *Theologia Philosophica* (a lost MS.), a learned attempt to harmonize revelation and nature, which drew forth the wonder of Baxter. Alleine was no mere scholar or divine, but a man who associated on equal terms with the founders of the Royal Society. These scientific studies were, however, kept in subordination to his proper work. The extent of his influence was, in so young a man, unique, resting on the earnestness and force of his nature. The year 1662 found senior and junior pastors like-minded, and both were among the two thousand ejected ministers. Alleine, with John Wesley (grandfather of the celebrated John Wesley), also ejected, then travelled about, preaching wherever opportunity was found. For this he was cast into prison, indicted at sessions, bullied and fined. His *Letters from Prison* were an earlier *Cardiphonia* than John Newton's. He was released on the 26th of May 1664; and in spite of the Conventicle, or Five Mile Act, he resumed his preaching. He found himself again in prison, and again and again a sufferer. His remaining years were full of troubles and persecutions nobly borne, till at last, worn out by them, he died on the 17th of November 1668; and the mourners, remembering their beloved minister's words while yet with them, "If I should die fifty miles away, let me be buried at Taunton," found a grave for him in St Mary's chancel. No Puritan nonconformist name is so affectionately cherished as is that of Joseph Alleine. His chief literary work was *An Alarm to the Unconverted* (1672), otherwise known as *The Sure Guide to Heaven*, which had an enormous circulation. His *Remains* appeared in 1674.

See *Life*, edited by Baxter; *Joseph Alleine: his Companions and Times*, by Charles Stanford (1861); Wood's *Athenae*, iii. 819; Palmer's *Nonc. Mem.* iii. 208.

ALLEINE, RICHARD (1611–1681), English Puritan divine, was born at Ditcheat, Somerset, where his father was rector. He was a younger brother of William Alleine, the saintly vicar of Blandford. Richard was educated at St Alban's Hall, Oxford, where he was entered commoner in 1627, and whence, having taken the degree of B.A., he transferred himself to New Inn, continuing there until he proceeded M.A. On being ordained he became assistant to his father, and immediately stirred the entire county by his burning eloquence. In March 1641 he succeeded the many-sided Richard Bernard as rector of Batcomb (Somerset). He declared himself on the side of the Puritans by subscribing "The testimony of the ministers in Somersetshire to the truth of Jesus Christ" and "The Solemn League and Covenant," and assisted the commissioners of the parliament in their work of ejecting unsatisfactory ministers. Alleine continued for twenty years rector of Batcomb and was one of the two thousand ministers ejected in 1662. The Five Mile Act drove him to Frome Selwood, and in that neighbourhood he preached until his death on the 22nd of December 1681. His works are all of a deeply spiritual character. His *Vindiciae Pietatis* (which first appeared in 1660) was refused licence by Archbishop Sheldon, and was published, in common with other nonconformist books, without it. It was rapidly bought up and "did much to mend this bad world." Roger Norton, the king's printer, caused a large part of the first impression to be seized on the ground of its not being licensed and to be sent to the royal kitchen. Glancing over its pages, however, it seemed to him a sin that a book so holy—and so saleable—should be destroyed. He therefore bought back the sheets, says Calamy, for an old song, bound them and sold them in his own shop. This in turn was complained of, and he had to beg pardon on his knees before the council-table; and the remaining copies were sentenced to be "bisked," or rubbed over with an inky brush, and sent back to the kitchen for lighting fires. Such "bisked" copies occasionally occur still. The book was not killed. It was often reissued with additions, *The Godly Man's Portion* in 1663, *Heaven Opened* in 1666, *The World Conquered* in 1668. He also published a book of sermons, *Godly Fear*, in 1664, and other less noticeable devotional compilations.

See Calamy, *s.v.*; Palmer's *Nonconf. Mem.* iii. 167-168; C. Stanford's *Joseph Ailleine*; *Researches at Batcomb and Frome Selwood*; Wood's *Athenae* (Bliss), iv. 13.

ALLEMANDE (Fr. for *danse allemande*, or German dance), a name for two kinds of dance, one a German national dance, in 2-4 time, the other somewhat resembling a waltz. The movement in a suite following the prelude, and preceding the courante (*q.v.*), with which it is contrasted in rhythm, is also called an allemande, but has no connexion with the dance. The name, however, is given to pieces of music based on the dance movement, examples of which are found in Beethoven's German dances for the orchestra.

ALLEN, ETHAN (1739-1789), American soldier, was born at Litchfield, Connecticut, on the 10th of January 1739. He removed, probably in 1769, to the "New Hampshire Grants," where he took up lands, and eventually became a leader of those who refused to recognize the jurisdiction of New York, and contended for the organization of the "Grants" into a separate province. About 1771 he was placed at the head of the "Green Mountain Boys," an irregular force organized for resistance to the "Yorkers." On the 10th of May 1775, soon after the outbreak of the War of American Independence, in command of a force, which he had assisted some members of the Connecticut assembly to raise for the purpose, he captured Ticonderoga from its British garrison, calling upon its commanding officer—according to the unverified account of Allen himself—to surrender "in the name of the great Jehovah and the Continental Congress." Seth Warner being elected colonel of the "Green Mountain Boys" in July 1775, Allen, piqued, joined General Philip Schuyler, and later with a small command, but without rank, accompanied General Richard Montgomery's expedition against Canada. On the 25th of September 1775 near Montreal he was captured by the British, and until exchanged on the 6th of May 1778 remained a prisoner at Falmouth, England, at Halifax, Nova Scotia, and in New York. Upon his release he was brevetted colonel by the Continental Congress. He then, as brigadier-general of the militia of Vermont, resumed his opposition to New York, and from 1779 to 1783, acting with his brother, Ira Allen, and several others, carried on negotiations, indirectly, with Governor Frederick Haldimand of Canada, who hoped to win the Vermonters over to the British cause. He seems to have assured Haldimand's agent that "I shall do everything in my power to make this state a British province." In March 1781 he wrote to Congress, with characteristic bluster, "I am as resolutely determined to defend the independence of Vermont as congress that of the United States, and rather than fail will retire with the hardy Green Mountain Boys into the desolate caverns of the mountains and wage war with human nature at large." He removed to Burlington, Vermont, in 1787, and died there on the 11th of February 1789. He was, says Tyler, "a blustering frontier hero—an able-minded ignoramus of rough and ready humour, of boundless self-confidence, and of a shrewdness in thought and action equal to almost any emergency." Allen wrote a *Narrative of Colonel Ethan Allen's Captivity* (1779), the most celebrated book in the "prison literature" of the American revolution; *A Vindication of the Inhabitants of Vermont to the Government of New York and their Right to form an Independent State* (1779); and *Reason, the Only Oracle of Man; or A Compendious System of Natural Religion, Alternately adorned with Confutations of a Variety of Doctrines incompatible with it* (1784).

Ethan's youngest brother, Ira Allen (1751-1814), born on the 21st of April 1751 at Cornwall, Connecticut, also removed to the New Hampshire Grants, where he became one of the most influential political leaders. In 1775 he took part in the capture of Ticonderoga and the invasion of Canada. He was a member of the convention which met at Winchester, Vermont, and in January 1777 declared the independence of the New Hampshire Grants; served (1776-1786) as a member of the Vermont council of safety; conducted negotiations, on behalf of Vermont, for a truce with the British and for an exchange of prisoners, in 1781; served for eight terms in the general assembly, and was state treasurer from 1778 to 1786 and surveyor-general from 1778 to 1787. In 1789, by a gift of £4000, he made possible the establishment of the university of Vermont, of which institution, chartered in 1791 and built at Burlington in deference to his wishes, he was thus virtually the founder. In 1795, on behalf of the state, he purchased from the French government arms for the Vermont militia, of which he was then the ranking major-general, but he was captured by a British cruiser west of Ireland on his return journey, was charged with attempting to furnish insurrectionary Irish with arms, and after prolonged litigation in the British courts, the case not being finally decided until 1804, returned to Vermont in 1801. During his absence he had been dispossessed of his large holdings of land through the operation of tax laws, and to escape imprisonment for debt, he removed to Philadelphia, where on the 4th of January 1814 he died. He published a dull and biassed, but useful *Natural and Political History of Vermont* (1798), reissued (1870) in vol. i. of the *Collections* of the Vermont Historical Society.

There is no adequate biography of Ethan Allen, but Henry Hall's *Ethan Allen* (New York, 1892) may be consulted. The best literary estimate may be found in M. C. Tyler's *Literary History of the American Revolution* (2 vols., New York, 1897).

ALLEN, GRANT [Charles Grant Blairfindie], (1848-1899), English author, son of a clergyman of Irish descent, was born at Kingston, Ontario, Canada, on the 24th of February 1848. He was educated partly in America and France, and in England at King Edward's School, Birmingham, and afterwards at Merton, Oxford. He was for a few years a schoolmaster in Jamaica, but then made his home in England, where he became prominent as a writer. He died at his house on Hindhead, Haslemere, on the 24th of October 1899. Grant Allen was a voluminous author. He was full of interesting scientific knowledge and had a gift for expression both in biological exposition and in fiction. His more purely scientific books (such as *Physiological Aesthetics*, 1877; *The Evolutionist at Large*, 1881; *The Evolution of the Idea of God*, 1897) contain much original matter, popularly expressed, and he was a cultured exponent of the evolutionary idea in various aspects of biology and anthropology. He first attracted attention as a novelist with a sensational story, *The Devil's Die* (1888), though this was by no means his first attempt at fiction; and *The Woman who Did* (1895), which had a *succès de scandale* on account of its treatment of the sexual problem, had for the moment a number of cheap imitators. Other volumes flowed from his pen, and his name became well known in contemporary literature. But his reputation was essentially contemporary and characteristic of the vogue peculiar to the journalistic type.

ALLEN, JAMES LANE (1850-), American novelist, was born near Lexington, Kentucky, on the 21st of December 1850. He graduated at Kentucky University, Lexington, in 1872, taught at Fort Spring, Kentucky, at Richmond and at Lexington, Missouri, and from 1877 to 1879 at the academy of Kentucky University, where he was principal and taught modern languages; in 1880 he was professor of Latin and English at Bethany College, Bethany, West Virginia; and then became head of a private school at Lexington, Kentucky. Subsequently he gave up teaching, went to New York City, where he secured commissions for sketches of the "Blue Grass" region, and thereafter devoted himself to literature. His *Choir Invisible*, coming after other successful stories, made his name well known in England as well as America. His published works include: *With Flute and Violin* (1891), *The Blue Grass Region* (1892), *John Gray* (1893), *A Kentucky Cardinal* (1894), *Aftermath* (1895), *A Summer in Arcady* (1896), *The Choir Invisible* (1897), *The Reign of Law* (1900), *The Mettle of the Pasture* (1903), and *The Bride of the Mistletoe* (1909.)

ALLEN, JOHN (1476-1534), English divine, after studying at both Oxford and Cambridge, was sent by Archbishop Warham on an ecclesiastical mission to Rome. On his return he held a number of livings in succession, and in 1516 was rector of South Ockenden, Essex, and prebendary of Lincoln Cathedral. In the suppression of the minor monasteries in 1524-1525 he gave Wolsey much assistance, and became prebendary of Nottingham in 1526 and of St Paul's, London, in 1527. These prebends he resigned in 1528 on his election as archbishop of Dublin. For four years he was chancellor of Ireland but his career was full of trouble. In 1531 he was fined under the Statutes of Provisors and Praemunire, and in 1534 met a violent death at the hands of Lord Thomas Fitzgerald's followers.

ALLEN, or Alleyn, **THOMAS** (1542–1632), English mathematician, was born at Uttoxeter in Staffordshire on the 21st of December 1542. He was admitted scholar of Trinity College, Oxford, in 1561; and graduated as M.A. in 1567. In 1580 he quitted his college and fellowship, retired to Gloucester Hall, and became famous for his knowledge of antiquity, philosophy and mathematics. Having received an invitation from Henry Percy, earl of Northumberland, a great friend and patron of men of science, he spent some time at the earl's house, where he became acquainted with Thomas Harriot, John Dee and other famous mathematicians. He was also intimate with Sir Robert Cotton, William Camden, and their antiquarian associates. Robert Dudley, earl of Leicester, had a particular esteem for Allen, and would have conferred a bishopric upon him, but his love of solitude made him decline the offer. His great skill in mathematics and astrology earned him the credit of being a magician; and the author of *Leicester's Commonwealth* accuses him of employing the art of "figuring" to further the earl of Leicester's unlawful designs, and of endeavouring by the black art to bring about a match between his patron and Queen Elizabeth. Allen was indefatigable in collecting scattered manuscripts relating to history, antiquity, astronomy, philosophy and mathematics. A considerable part of his collection was presented to the Bodleian library by Sir Kenelm Digby. He died on the 30th of September 1632 at Gloucester Hall. He published in Latin the second and third books of *Claudius Ptolemy of Pelusium, Concerning the Judgment of the Stars, or, as it is commonly called, of the Quadripartite Construction, with an Exposition.* He also wrote notes on John Bale's *De Scriptoribus M. Britanniae.*

ALLEN, WILLIAM (1532–1594), English cardinal, born at Rossall, Lancashire, went in 1547 to Oriel College, Oxford, and in 1556 became principal of St Mary Hall and proctor. According to Anthony Wood, he was appointed to a canonry at York in or about 1558; he therefore had already entered the clerical state by receiving the tonsure. On the accession of Elizabeth, he was deprived upon refusing the oath of supremacy, but remained in the university until 1561. His known opposition to the new learning in religion giving much offence, he escaped from England and went to Louvain, where were gathered many students who had left the English universities for conscience' sake. Here he continued his theological studies and began to write controversial treatises. In 1562, on account of health, he returned secretly to Lancashire and did much, by exhortation and private meetings, to restrain those Catholics who attended the new services in order to save their property from confiscation. His presence being known to the government, he left Lancashire and retired to the neighbourhood of Oxford, which he frequently visited, and where he influenced many of the students. After writing a treatise in defence of the priestly power to remit sins, he was obliged to leave and retired to Norfolk, leaving England soon after in 1565. He returned to Flanders, was ordained at Malines, and began to lecture in theology at the Benedictine college in that city. In 1567 he went to Rome for the first time, and there began his plan for establishing a college where English students could live together and finish their theological course. The idea subsequently developed into the establishing of a missionary college, or seminary, to keep up a supply of priests for England as long as the country remained separated from the Holy See. With the help of friends, and notably of the Benedictine abbots of the neighbouring monasteries, a college was established at Douai (September 29, 1568); and here Allen was joined by many of the English exiles. This college, the first of the seminaries ordered by the council of Trent, received the papal approval shortly after its establishment; the king of Spain took it under his protection and assigned it an annual grant. Allen continued his own theological studies and, after taking his doctorate, became regius professor at the university. Gregory XIII. in 1575 granted him a monthly pension of 100 golden crowns, and, as the number of students had now risen to one hundred and twenty, summoned him to Rome to undertake the establishing of a similar college in the papal city. By Allen's advice, the old English hospice was turned into a seminary and Jesuits were placed there to help Dr Maurice Clennock, the rector. The pope appointed Allen to a canonry in Courtrai and sent him back to Douai (July 1576); but here he had to face a new difficulty. Besides the reported plots to assassinate him by agents of the English government, the insurgents against Spain, urged on by Elizabeth's emissaries, expelled the students from Douai as being partisans of the enemy (March 1578). Allen moved his establishment to Reims under the protection of the house of Guise; and it was here that the English translation of the Scriptures, known as the Douai Version, was begun under his direction (see Bible, English). In 1577 he began a correspondence with Robert Parsons (*q.v.*), the Jesuit, an intimacy that was fraught with disaster. He was summoned again to Rome in 1579 to quell the first of the many disturbances that befell the English college under the Jesuit influence. Brought now into personal contact with Parsons, Allen fell completely under the dominating personality of the redoubtable Jesuit, and gave himself up entirely to his influence. He arranged that the Society should take over the English college at Rome and should begin the Jesuit mission to England (1580). This short-sighted policy was the cause of much grave trouble in the near future. Returning to Reims he began to take a part in all the political intrigues which Parsons' fertile brain had hatched for the promotion of the Spanish interest in England. Allen's political career dates from this period. Parsons had already intended to remove Allen from the seminary at Reims, and for this purpose, as far back as the 6th of April 1581, had recommended him to Philip II. to be promoted to the cardinalate. In furtherance of the intrigues, Allen and Parsons went to Rome again in 1585 and there Allen was kept for the rest of his life. In 1587, during the time that he was being skilfully played with by Philip's agents, he wrote, helped by Parsons, a shameless defence of a shameful deed. Sir William Stanley, an English officer, had surrendered Deventer to the Spaniards; and Allen wrote a book in defence of Stanley, saying that all Englishmen were bound, under pain of damnation, to follow the traitorous example, as Elizabeth was no lawful queen. He shared in all the projects for the invasion of England, and was to have been archbishop of Canterbury and lord chancellor had they succeeded. Representing in reality only his own party, Allen had on the continent the position of the head of the Roman Catholics of England; and as such, just after the death of Mary, queen of Scots, he wrote to Philip II. (March 19, 1587) to exhort him to undertake the enterprise against England, and declared that the Catholics there were clamouring for the king to come and punish "this woman, hated by God and man." After much negotiation, he was made cardinal by Sixtus V. on the 7th of August 1587, nominally to supply the loss of the queen of Scotland, but in reality to ensure the success of the Armada. On his promotion Allen wrote to Reims that he owed the hat, under God, to Parsons. One of his first acts was to issue, under his own name, two violent works for the purpose of inciting the Catholics of England to rise against Elizabeth: "The Declaration of the Sentence of Sixtus V." a broadside, and a book, *An Admonition to the nobility and people of England* (Antwerp, 1588). On the failure of the Armada, Philip, to get rid of the burthen of supporting Allen as a cardinal, nominated him to the archbishopric of Malines, but the canonical appointment was never made. Gregory XIV. made him librarian at the Vatican; and he served on the commission for the revision of the Vulgate. He took part in four conclaves, but never had any real influence after the failure of the Armada. Before his death, which took place in Rome on the 16th of October 1594, he found reasons to change his mind concerning the wisdom of the Jesuit politics in Rome and England, and would have tried to curb their activities, had he been spared. The rift became so great that ten years after his death, Agazzari could write to Parsons: "So long as Allen walked in this matter (*the scheme for England*) in union with and fidelity to the Company, as he used to do, God preserved him, prospered and exalted him; but when he began to leave this path, in a manner, the threads of his plans and life were cut short together." As a cardinal Allen had lived in poverty and he died in debt.

While we cannot withhold a tribute of respect from Allen for his zeal and earnestness, and recognize that his foundation at Douai survives to-day in the two Catholic colleges at Ushaw and Ware, it is impossible to deny that he injured the work with which his name will ever be associated, by his disastrous intercourse with Father Parsons. Known as a sharer in that plotter's schemes, he gave a reasonable pretext to Elizabeth's government for regarding the seminaries as hotbeds of sedition. That they were not so is abundantly proved. The superiors kept their political actions secret from the students, and would not allow such matters even to be talked about or treated as theoretical abstractions in the schools. Dr Barrett, writing (April 14, 1583) to Parsons, makes open complaint of Allen's secrecy and refusal to communicate. How far Allen was really admitted to the full confidence of Parsons is a question; and his later attitude to the Society goes to prove that he at last realized that he had been tricked. Like James II. with Fr. Petre, Allen had been "bewitched" for a time and only recovered himself when too late.

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ALLEN, WILLIAM FRANCIS (1830–1889), American classical scholar, was born at Northborough, Massachusetts, on the 5th of September 1830. He graduated at Harvard College in 1851 and subsequently devoted himself almost entirely to literary work and teaching. In 1867 he became professor of ancient languages and history (afterwards Latin language and Roman history) in the university of Wisconsin. He died in December 1889. His contributions to classical literature chiefly consist of schoolbooks published in the Allen (his brother) and Greenough series. The *Collection of Slave Songs* (1867), of which he was joint-editor, was the first work of the kind ever published.

ALLEN, BOG OF, the name given to a congeries of morasses in Kildare, King's County, Queen's County and Westmeath, Ireland. Clane Bog, the eastern extremity, is within 17 m. of Dublin, and the morasses extend westward almost to the Shannon. Their total area is about 238,500 acres. They do not form one continuous bog, the tract of the country to which the name is given being intersected by strips of dry cultivated land. The rivers Brosna, Barrow and Boyne take their rise in these morasses, and the Grand and Royal canals cross them. The Bog of Allen has a general elevation of 250 ft. above sea level, and the average thickness of the peat of which it consists is 25 ft. It rests on a subsoil of clay and marl.

ALLENSTEIN, a garrison town of Germany, in the province of East Prussia, on the river Alle, 100 m. by rail N.E. from Thorn, and 30 m. from the Russian frontier. Pop. (1900) 24,295. It has a medieval castle, several churches, a synagogue and various industries—iron-foundries, saw-mills, brick-works, and breweries; also an extensive trade in cereals and timber.

ALLENTOWN, a city and the county-seat of Lehigh county, Pennsylvania, U.S.A., on the Lehigh river, about 62 m. N.N.W. of Philadelphia. Pop. (1890) 25,228; (1900) 35,416, of whom 2994 were foreign-born, 1065 being of German birth; (1910) 51,913. It is served by the Central of New Jersey, the Lehigh Valley, the Perkiomen (of the Reading system) and the Philadelphia & Reading railways. The city is situated on high ground sloping gently towards the river and commanding diversified views of the surrounding country. Hamilton Street, the principal business thoroughfare, extends over 2 m. from E. to W., and in what was once the centre of the city is Centre Square, in which there is a monument to the memory of the soldiers and sailors who fell in the Civil War. Allentown is the seat of a state homoeopathic hospital for the insane, of the Allentown College for Women (Reformed Church, 1867), and of Muhlenberg College (1867), an Evangelical Lutheran institution which grew out of the Allentown Seminary (established in 1848 and incorporated as the "Allentown Collegiate Institute and Military Academy" in 1864); in 1907 the college had 191 students, of whom 109 were in the Allentown Preparatory School (1904), formerly the academic department of the college and still closely affiliated with it. The surrounding country is well adapted to agriculture, and slate, iron ore, cement rock and limestone are found in the vicinity. Allentown is an important manufacturing centre, and the value of its manufactured products increased 90·9 % from 1890 to 1900, and of its factory product 13·2 % between 1900 and 1905. In 1905 the city ranked sixth among the cities of the country in the manufacture of silk and silk goods, its most important industry. Other important manufactures are iron and steel, slaughtering and meat-packing products, boots and shoes, cigars, furniture, men's clothing, hosiery and knit goods, jute and jute goods, linen-thread, malt liquors, brick, cement, barbed wire, wire nails and planing-mill products. Allentown's total factory product in 1905 was valued at $16,966,550, of which $3,901,249, or 23 %, was the value of silk and silk goods. The municipality owns and operates its water-works. Allentown was first settled in 1751; in 1762 it was laid out as a town by James Allen, the son of a chief-justice of the province, in honour of whose family the city is named; in 1811 it was incorporated as a borough and its name was changed to Northampton; in 1812 it was made the county-seat; in 1838 the present name was again adopted; and in 1867 the first city charter was secured. The silk industry was introduced in 1881.

ALLEPPI, or AULAPALAY, a seaport of southern India, in the state of Travancore, 33 m. south of Cochin, situated on a strip of coast between the sea and one of those backwaters that here form the chief means of inland communication. Pop. (1901) 24,918. There is a lighthouse, 85 ft. high, with a revolving white light visible 18 m. out at sea. Though the third town in the state in point of population, Alleppi is the first in commercial importance. It commands a fine harbour, affording safe anchorage for the greater part of the year. It was opened to foreign trade towards the latter end of the 18th century. The exports consist of coffee, pepper, cardamoms and coco-nuts. There are factories for coir-matting. The raja has a palace, and Protestant missionaries have a church.

ALLESTREE, or ALLESTRY, **RICHARD** (1619–1681), royalist divine and provost of Eton College, son of Robert Allestree, and a descendant of an ancient Derbyshire family, was born at Uppington in Shropshire. He was educated at Coventry and later at Christ Church, Oxford, under Richard Busby. He entered as a commoner in 1636, was made student shortly afterwards, and took the degree of B.A. in 1640 and of M.A. in 1643. In 1642 he took up arms for the king under Sir John Biron. On the arrival of the parliamentary forces soon afterwards in Oxford he secreted the Christ Church valuables, and the soldiers found nothing in the treasury "except a single groat and a halter in the bottom of a large iron chest." He escaped severe punishment only by the hasty retirement of the army from the town. He was present at the battle of Edgehill in October 1642, after which, while hastening to Oxford to prepare for the king's visit to Christ Church, he was captured by a troop of Lord Say's soldiers from Broughton House, being soon afterwards set free on the surrender of the place to the king's forces. In 1643 he was again under arms, performing "all duties of a common soldier" and "frequently holding his musket in one hand and his book in the other." At the close of the Civil War, he returned to his studies, took holy orders, was made censor and became a "noted tutor." But he still remained an ardent royalist. He voted for the university decree against the Covenant, and, refusing submission to the parliamentary visitors in 1648, he was expelled. He found a retreat as chaplain in the house of the Hon. Francis Newport, afterwards Viscount Newport, in whose interests he undertook a journey to France. On his return he joined two of his friends, Dolben and Fell, afterwards respectively archbishop of York and bishop of Oxford, then resident at Oxford, and later joined the household of Sir Antony Cope of Hanwell, near Banbury. He was now frequently employed in carrying despatches between the king and the royalists in England. In May 1659 he brought a command from Charles in Brussels, directing the bishop of Salisbury to summon all those bishops, who were then alive, to consecrate clergymen to various sees "to secure a continuation of the order in the Church of England," then in danger of becoming extinct.[1] While returning from one of these missions, in the winter before the Restoration, he was arrested at Dover and committed a prisoner to Lambeth Palace, then used as a gaol for apprehended royalists, but was liberated after confinement of a few weeks at the instance, among others, of Lord Shaftesbury. At the Restoration he became canon of Christ Church, D.D. and city lecturer at Oxford. In 1663 he was made chaplain to the king and regius professor of divinity. In 1665 he was appointed provost of Eton College, and proved himself a capable administrator. He introduced order into the disorganized finances of the college and procured the confirmation of Laud's decree, which reserved five of the Eton fellowships for members of King's College. His additions to the college buildings were less successful; for the "Upper School," constructed by him at his own expense, was falling into ruin almost in his lifetime, and was replaced by the present structure in 1689. Allestree died on the 28th of January 1681, and was buried in the chapel at Eton College, where there is a Latin inscription to his memory. His writings are:—*The Privileges of the University of Oxford in point of Visitation* (1647)—a tract answered by Prynne in the *University of Oxford's Plea Rejected*; *18 sermons whereof 15 preached before the king* . . . (1669); *40 sermons whereof 21 are now first published* . . . (2 vols., 1684); sermons published separately including *A Sermon on Acts xiii. 2*, (1660); *A Paraphrase and Annotations upon all the Epistles of St Paul* (joint author with Abraham Woodhead and Obadiah Walker, 1675, see edition of 1853 and preface by W. Jacobson). In the *Cases of Conscience* by J. Barlow, Bishop of Lincoln (1692), Allestree's judgment on *Mr Cottington's Case of Divorce* is included. A share in the composition, if not the sole authorship, of the books published under the name of the author of the *Whole Duty of Man* has been attributed to Allestree (Nichols's *Anecdotes*, ii. 603), and the tendency of modern criticism is to regard him as the author. His lectures, with which he was dissatisfied, were not published. Allestree was a man of extensive learning, of moderate views and a fine preacher. He was generous and charitable, of "a solid and masculine kindness," and of a temper hot, but completely under control.

AUTHORITIES.—Wood's *Athenae Oxonienses* (edited by Bliss), iii. 1269; Wood's *Fasti*, i. 480, 514, ii. 57, 241, 370; *Richard Allestree, 40 sermons*, with biographical preface by Dr John Fell (2 vols., 1684); *Sufferings of the Clergy*, by John Walker; *Architectural History of Eton and Cambridge*, by R. Willis, i. 420; *Hist. of Eton College*, by Sir H. C. Maxwell-Lyte; *Hist. of Eton College*, by Lionel Cust (1899); *Egerton MSS.*, Brit. Mus. 2807 f. 197 b. For Allestree's authorship of the *Whole Duty of Man*, see Rev. F. Barham, *Journal of Sacred Literature*, July 1864, and C. E. Doble's articles in the *Academy*, November 1884. (P. C. Y.)

ALLEY (from the Fr. *allée*, a walk), a narrow passage-way between two buildings available only for foot passengers or hand-carts, sometimes entered only at one end and known as a "blind alley," or *cul-de-sac*. The name is also given to the long narrow enclosures where bowls or skittles are played.

ALLEYN, EDWARD (1566–1626), English actor and founder of Dulwich College, was born in London on the 1st of September 1566, the son of an innkeeper. It is not known at what date he began to act, but he certainly gained distinction in his calling while a young man, for in 1586 his name was on the list of the earl of Worcester's players, and he was eventually rated by common consent as the foremost actor of his time. Ben Jonson, a critic little prone to exalt the merits of men of mark among his contemporaries, bestowed unstinted praise on Alleyn's acting (*Epigrams*, No. 89). Nash expresses in prose, in *Pierce Penniless*, his admiration of him, while Heywood calls him "inimitable," "the best of actors," "Proteus for shapes and Roscius for a tongue." Alleyn inherited house property in Bishopsgate from his father. His marriage on the 22nd of October 1592 with Joan Woodward, stepdaughter of Philip Henslowe, brought him eventually more wealth. He became part owner in Henslowe's ventures, and in the end sole proprietor of several play-houses and other profitable pleasure resorts. Among these were the Rose Theatre at Bankside, the Paris Garden and the Fortune Theatre in St Luke's—the latter occupied by the earl of Nottingham's company, of which Alleyn was the head. He filled, too, in conjunction with Henslowe, the post of "master of the king's games of bears, bulls and dogs." On some occasions he directed the sport in person, and Stow in his *Chronicles* gives an account of how Alleyn baited a lion before James I. at the Tower.

Alleyn's connexion with Dulwich began in 1605, when he bought the manor of Dulwich from Sir Francis Calton. The landed property, of which the entire estate had not passed into Alleyn's hands earlier than 1614, stretched from the crest of that range of Surrey hills on whose summit now stands the Crystal Palace, to the crest of the parallel ridge, three miles nearer London, known in its several portions as Herne Hill, Denmark Hill and Champion Hill. Alleyn acquired this large property for little more than £10,000. He had barely got full possession, however, before the question how to dispose of it began to occupy him. He was still childless, after twenty years of wedded life. Then it was that the prosperous player—the man "so acting to the life that he made any part to become him" (Fuller, *Worthies*)—began the task of building and endowing in his own lifetime the College of God's Gift at Dulwich. All was completed in 1617 except the charter or deed of incorporation for setting his lands in mortmain. Tedious delays occurred in the Star Chamber, where Lord Chancellor Bacon was scheming to bring the pressure of kingly authority to bear on Alleyn with the aim of securing a large portion of the proposed endowment for the maintenance of lectureships at Oxford and Cambridge. Alleyn finally carried his point and the College of God's Gift at Dulwich was founded, and endowed under letters patent of James I., dated the 21st of June 1619. The building had been already begun in 1613 (see DULWICH). Alleyn was never a member of his own foundation, but he continued to the close of his life to guide and control its affairs under powers reserved to himself in the letters patent. His diary shows that he mixed much and intimately in the life of the college. Many of the jottings in that curious record of daily doings and incidents favour the inference that he was a genial, kind, amiable and religious man. His fondness for his old profession is indicated by the fact that he engaged the boys in occasional theatrical performances. At a festive gathering on the 6th of January 1622 "the boyes play'd a playe."

Alleyn's first wife died in 1623. The same year he married Constance, daughter of John Donne, the poet and dean of St Paul's. Alleyn died in November 1626 and was buried in the chapel of the college which he had founded. His gravestone fixes the day of his death as the 21st, but there are grounds for the belief that it was the 25th. A portrait of the actor is preserved at Dulwich. Alleyn was a member of the corporation of wardens of St Saviour's, Southwark, in 1610, and there is a memorial window to him in the cathedral.

ALL FOURS, a card game (known also in America as *Seven Up*, *Old Sledge* or *High-Low-Jack*) usually played by two players, though four may play. A full pack is used and each player receives seven counters. Four points can be scored, one each for ***high***, the highest trump out, for ***low***, the lowest trump dealt, for ***Jack***, the knave of trumps, and for ***game***, the majority of pips in the cards of the tricks that a player has won. Ace counts 4, King 3, Queen 2, Knave 1, and ten 10 points. *Low* is scored by the person to whom it is dealt; *High* of course wins a trick; *Jack* is scored by the player who finally has it among his tricks. If *Jack* is turned up the dealer scores the point. A player who plays a high or low trump is entitled to ask if they are *High* or *Low*. The game is 10 or 11 points. Sir cards are dealt to each, the thirteenth being turned up for trumps. The non-dealer may *propose* or *beg* if he does not like his hand. If the dealer refuses the elder hand scores a point; if he consents he gives and takes three more cards, the seventh being turned up for trumps, which must be of a different suit from the original trump card; otherwise six more cards are dealt out, and so on till a fresh trump suit appears. The non-dealer then leads; the other must trump or follow suit, or forfeit a point. *Jack* may be played to any trick. Each pair of cards is a trick, and is collected by the winner. A fresh deal may be claimed if the dealer exposes one of his adversary's cards, or if he gives himself or his adversary too few or too many. In that case the error must be discovered before a card is played (see also AUCTION PITCH).

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[1] *Egerton MSS.*, Brit. Mus. 2807 f. 197 b; *Life of Dr John Barwick*, ed. by G. F. Barwick (1903), pp. 107, 129, 134.

ALLIA (mod. *Fosso Bettina*), a small tributary of the river Tiber, joining it on the left (east) bank, about 11 m. N. of Rome. It gave its name to the terrible defeat which the Romans suffered at the hands of the Gauls on the 18th of July 390 B.C. Livy (v. 37) and Diodorus (v. 114) differ with regard to the site of the battle, the former putting it on the left, the latter on the right bank of the Tiber. Mommsen and others support Diodorus, but the question still remains open.

See T. Ashby in *Papers of the British School at Rome*, iii. 24.

ALLIANCE, a city of Stark county, Ohio, U. S. A., on the Mahoning river, about 57 m. S.E. of Cleveland, about 1080 ft. above the sea, and about 505 ft. above the level of Lake Erie. Pop. (1890) 7607; (1900) 8974, of whom 1029 were foreign-born; (1906, estimate) 9796. It is served by the Pennsylvania and the Lake Erie, Alliance & Wheeling railways, and by an electric line connecting with Canton and Salem. The city is the seat of Mount Union College (Methodist Episcopal), opened in 1846 as a preparatory school and having in 1907 a library of about 10,000 volumes, a collegiate department (opened in 1858), a normal department (1858), a school of music (1855), a commercial school (1868), a faculty of 29 teachers, and an enrolment of 524 students, of whom 274 were women. Among the manufactures of Alliance are structural iron, steel castings, pressed sheet steel, gun carriages, boilers, travelling cranes, pipe organs, street-car indicators, sashes and doors, and account registers and other material for file and cabinet-bookkeeping. The municipality owns and operates its water-works. Alliance was first settled in 1838, when it was laid out as a town and was named Freedom; it was named Alliance in 1851, was incorporated as a village in 1854, and became a city of the second class in 1888.

ALLIANCE, in international law, a league between independent states, defined by treaty, for the purpose of combined action, defensive or offensive, or both. Alliances have usually been directed to specific objects carefully defined in the treaties. Thus the Triple Alliance of 1688 between Great Britain, Sweden and the Netherlands, and the Grand Alliance of 1689 between the emperor, Holland, England, Spain and Saxony, were both directed against the power of Louis XIV. The Quadruple or Grand Alliance of 1814, defined in the treaty of Chaumont, between Great Britain, Austria, Russia and Prussia, had for its object the overthrow of Napoleon and his dynasty, and the confining of France within her traditional boundaries. The Triple Alliance of 1882 between Germany, Austria and Italy was ostensibly directed to the preservation of European peace against any possible aggressive action of France or Russia; and this led in turn, some ten years later, to the Dual Alliance between Russia and France, for mutual support in case of any hostile action of the other powers. Occasionally, however, attempts have been made to give alliances a more general character. Thus the "Holy Alliance" (*q.v.*) of the 26th of September 1815 was an attempt, inspired by the religious idealism of the emperor Alexander I. of Russia, to find in the "sacred precepts of the Gospel" a common basis for a general league of the European governments, its object being, primarily, the preservation of peace. So, too, by Article VI. of the Quadruple Treaty signed at Paris on the 20th of November 1815—which renewed that of Chaumont and was again renewed, in 1818, at Aix-la-Chapelle—the scope of the Grand Alliance was extended to objects of common interest not specifically defined in the treaties. The article runs:—"In order to consolidate the intimate tie which unites the four sovereigns for the happiness of the world, the High Contracting Powers have agreed to renew at fixed intervals, either under their own auspices or by their respective ministers, meetings consecrated to great common objects and to the examination of such measures as at each one of these epochs shall be judged most salutary for the peace and prosperity of the nations and the maintenance of the tranquillity of Europe."

It was this article of the treaty of the 20th of November 1815, rather than the "Holy Alliance," that formed the basis of the serious effort made by the great powers, between 1815 and 1822, to govern Europe in concert, which will be found outlined in the article on the history of Europe. In general it proved that an alliance, to be effective, must be clearly defined as to its objects, and that in the long run the treaty in which these objects are defined must—to quote Bismarck's somewhat cynical dictum—"be reinforced by the interests" of the parties concerned. Yet the "moral alliance" of Europe, as Count Nesselrode called it, though it failed to secure the permanent harmony of the powers, was an effective instrument for peace during the years immediately following the downfall of Napoleon; and it set the precedent for those periodical meetings of the representatives of the powers, for the discussion and settlement of questions of international importance, which, though cumbrous and inefficient for constructive work, have contributed much to the preservation of the general peace (see EUROPE: *History*). (W. A. P.)

ALLIARIA OFFICINALIS, also known botanically as *Sisymbrium Alliaria*, and popularly as garlic-mustard, Jack-by-the-hedge, or sauce-alone, a common hedge-bank plant belonging to the natural order Cruciferae. It is a rankly scented herb, 2 to 3 ft. high, with long-stalked, coarsely-toothed leaves, and small white flowers which are succeeded by stout long four-sided pods. It is widely spread through the north temperate region of the Old World.

ALLIBONE, SAMUEL AUSTIN (1816–1889), American author and bibliographer, was born in Philadelphia, Pennsylvania, on the 17th of April 1816, of French Huguenot and Quaker ancestry. He was privately educated and for many years was engaged in mercantile business in his native city. He, however, devoted himself chiefly to reading and to bibliographical research; acquired a very unusual knowledge of English and American literature, and is remembered as the compiler of the well-known *Critical Dictionary of English Literature and British and American Authors* (3 vols.: vol. i. 1854, vols. ii. and iii. 1871). To this, two supplementary volumes, edited by John Foster Kirk, were added in 1891. From 1867 to 1873, and again in 1877–1879, Allibone was book editor and corresponding secretary of the American Sunday School Union; and from 1879 to 1888 he was librarian of the Lenox Library, New York City. He died at Lucerne, Switzerland, on the 2nd of September 1889. In addition to his *Critical Dictionary* he published three large anthologies and several religious tracts.

See the "Memoir" by S. D. M'Connell, an address delivered before the Historical Society of Philadelphia (Philadelphia, 1890).

ALLIER (anc. *Elaver*), a river of central France flowing into the Loire. It rises in the department of Lozère, among the Margeride mountains, a few miles east of the town of Mende. The upper course of the Allier separates the mountains of the Margeride from those of the Velay and lies for the most part through deep gorges. The river then traverses the plains of Langeac and Brioude, and receives the waters of the Alagnon some miles above the town of Issoire. Swelled by torrents from the mountains of Dore and Dôme, it unites with the river Dore at its entrance to the department to which it gives its name. It then flows through a wide but shallow channel, joining the Sioule some distance above Moulins, the chief town on its banks. It soon after becomes the boundary line between the departments of Cher and Nièvre, and reaches the Loire 4 m. west of Nevers, after a course of 269 m. Its basin has an area of 6755 sq. m. The Allier is classed as navigable for the last 154 m. of its course, but there is little traffic on it.

ALLIER, a department of central France, formed in 1790 from the old province of Bourbonnais. Pop. (1906) 417,961. Area, 2849 sq. m. It is bounded N. by the department of Nièvre, E. by Saône-et-Loire, from which it is divided by the river Loire, S.E. by Loire, S. by Puy-de-Dôme, S.W. by Creuse and N.W. by Cher. Situated on the northern border of the Central Plateau, the department slopes from south to north. Its highest altitudes are found in the south-east, in the Bois-Noirs, where one point reaches 4230 ft., and in the Monts de la Madeleine. Plains alternating with forests occupy the northern zone of the department, while the central and western regions form an undulating and well-watered plateau. Entering the department in the south, and, like the other chief rivers, flowing almost due north, the Allier drains the central district, receiving on its left the Sioule. East of the Allier is the Bèbre, which joins the Loire within the limits of the department; and on the west the Cher, with its tributary the Aumance. Rigorous and rainy in the south-east, the climate elsewhere is milder though subject to sudden variations. Agriculturally the department is flourishing, the valleys of the Allier and the Sioule known as the Limagne Bourbonnaise comprising its most fertile portion. Wheat, oats, barley and other cereals are grown and exported, and owing to the abundance of pasture and forage, sheep and cattle-rearing are actively carried on. Potatoes and mangels yield good crops. Wines of fair quality are grown in the valley of the Sioule; walnuts, chestnuts, plums, apples and pears are principal fruits. Goats, from the milk of which choice cheese is made, and pigs are plentiful. A large area is under forests, the oak, beech, fir, birch and hornbeam being the principal trees. The mineral waters at Vichy (*q.v.*), Néris, Theneuille, Cusset and Bourbon l'Archambault are in much repute. The mineral wealth of the department is considerable, including coal as well as manganese and bituminous schist; plaster, building stone and hydraulic lime are also produced. Manufactories of porcelain, glass and earthenware are numerous. Montluçon and Commentry are iron-working centres. There are flour mills, breweries and saw-mills; and paper, chemicals, wooden shoes, wool and woollen goods are produced. Besides the products of the soil Allier exports coal, mineral waters and cattle for the Paris market. Building materials, brandy and coal are among the imports. The railways belong chiefly to the Orléans and Paris-Lyons-Mediterranean companies. The lateral canal of the Loire, the Berry Canal and the canal from Roanne to Digoin together traverse about 57 m. in the department. Allier is divided into the arrondissements of Moulins, Gannat, Lapalisse and Montluçon (29 cantons, 321 communes). It forms the diocese of Moulins and part of the ecclesiastical province of Bourges, and falls within the académie (educational division) of Clermont-Ferrand and the region of the XIII. army-corps. Its court of appeal is at Riom. Moulins, the capital, Montluçon and Vichy, are the principal towns. Souvigny possesses the church of a famous Cluniac priory dating from the 11th-12th and 15th centuries, and containing the splendid tombs (15th century) of Louis II. and Charles I. of Bourbon. At St Menoux, Ebreuil and Gannat there are fine Romanesque churches. Huriel has a church of the 11th century and a well-preserved keep, the chief survival of a medieval castle. St Pourçain-sur-Sioule has a large church, dating from the 11th to the 18th centuries. The castle of Bourbon l'Archambault, which belonged to the dukes of Bourbon, dates from the 13th and 15th centuries. The Romanesque churches of Veauce and Ygrande, and the châteaus of Veauce and Lapalisse, are also of interest, the latter belonging to the family of Chabannes.

ALLIES, THOMAS WILLIAM (1813–1903), English historical writer, was born at Midsomer Norton, near Bristol, on the 12th of February 1813. He was educated at Eton and at Wadham College, Oxford, of which he became a fellow in 1833. In 1840 Bishop Blomfield of London appointed him his examining chaplain and presented him to the rectory of Launton, Oxfordshire, which he resigned in 1850 on becoming a Roman Catholic. Allies was appointed secretary to the Catholic poor school committee in 1853, a position which he occupied till 1890. He died in London on the 17th of June 1903. Allies was one of the ablest of the English churchmen who joined the Church of Rome in the early period of the Oxford movement, his chief work, *The Formation of Christendom* (London, 8 vols., 1865–1895) showing much originality of thought and historical knowledge. His other writings: *St Peter, his Name and Office* (1852); *The See of St Peter, the Rock of the Church* (1850); *Per Crucem ad Lucem* (2 vols., 1879), have gone through many editions and been translated into several languages.

See his autobiography, *A Life's Decision* (1880); and the study by his daughter, Mary H. Allies, *Thomas Allies, the Story of a Mind* (London, 1906), which contains a full bibliography of his works.

ALLIFAE (mod. *Alife*), a town of the Samnites, 15 m. N.W. of Telesia, and 17 m. E.N.E. of Teanum. The site of the Samnite city, which in the 4th century B.C. had a coinage of its own, is not known; the Roman town lay in the valley of the Vulturnus, and its walls (4th century) enclose a circuit of 1½ m., in which are preserved remains of large baths (*Thermae Herculis*) and a theatre.

ALLIGATOR (Spanish *el lagarto*, "the lizard"), an animal so closely allied to the crocodile that some naturalists have classed them together as forming one genus. It differs from the true crocodile principally in having the head broader and shorter, and the snout more obtuse; in having the fourth, enlarged tooth of the under jaw received, not into an external notch, but into a pit formed for it within the upper one; in wanting a jagged fringe which appears on the hind legs and feet of the crocodile; and in having the toes of the hind feet webbed not more than half way to the tips. Alligators proper occur in the fluviatile deposits of the age of the Upper Chalk in Europe, where they did not die out until the Pliocene age; they are now restricted to two species, *A. mississippiensis* or *lucius* in the southern states of North America up to 12 ft. in length, and the small *A. sinensis* in the Yang-tse-kiang. In Central and South America alligators are represented by five species of the genus *Caiman*, which differs from *Alligator* by the absence of a bony septum between the nostrils, and the ventral armour is composed of overlapping bony scutes, each of which is formed of two parts united by a suture. *C. sclerops*, the spectacled alligator, has the widest distribution, from southern Mexico to the northern half of Argentina, and grows to a bulky size. The largest, attaining an enormous bulk and a length of 20 ft., is the *C. niger*, the *jacare-assu* or large caiman of the Amazons. The names "alligator" and "crocodile" are often confounded in popular speech; and the structure and habits of the two animals are so similar that both are most conveniently considered under the heading CROCODILE.

ALLINGHAM, WILLIAM (1824–1889), Irish man of letters and poet, was born at Ballyshannon, Donegal, on the 19th of March 1824 (or 1828, according to some authorities), and was the son of the manager of a local bank. He obtained a post in the custom-house of his native town and filled several similar situations in Ireland and England until 1870, when he had retired from the service, and became sub-editor of *Fraser's Magazine*, which he edited from 1874 to 1879. He had published a volume of *Poems* in 1850, followed by *Day and Night Songs*, a volume containing many charming lyrics, in 1855. Allingham was on terms of close friendship with D. G. Rossetti, who contributed to the illustration of the *Songs*. His *Letters to Allingham* (1854–1870) were edited by Dr Birkbeck Hill in 1897. *Lawrence Bloomfield*, a narrative poem illustrative of Irish social questions, appeared in 1864. Allingham married in 1874 Helen Paterson, known under her married name as a water-colour painter. He died at Hampstead on the 18th of November 1889. Though working on an unostentatious scale, Allingham produced much excellent lyrical and descriptive poetry, and the best of his pieces are thoroughly national in spirit and local colouring.

William Allingham: a Diary (1907), edited by Mrs Allingham and D. Radford, contains many interesting reminiscences of Tennyson, Carlyle and other famous contemporaries.

ALLISON, WILLIAM BOYD (1829–1908), American legislator, was born at Perry, Ohio, on the 2nd of March 1829. Educated at Allegheny and Western Reserve Colleges, he studied law, and practised in Ohio until 1857. In that year he settled in Dubuque, Iowa, where he took a prominent part in Republican politics;

and in 1860 he was a delegate to the national convention at Chicago which nominated Abraham Lincoln for the presidency. In 1861 he was appointed a member of the staff of Governor Samuel J. Kirkwood (1813–1894), and was of great service in the work of equipping and organizing the Iowa volunteers. From 1863 until 1871 he served with distinction in the House of Representatives; in 1873 he was elected to the United States Senate, and re-elected in 1878, 1884, 1890, 1896 and 1902. Here he became one of the highest authorities on questions connected with finance, and from 1877 he was a member of the Senate committee on finance. In 1881–1893, and again from 1895, he was chairman of the committee on appropriations, in which position he had great influence. He declined offers of the secretaryship of the treasury made to him by Presidents Garfield and Harrison. He was a prominent candidate for the presidential nomination in the Republican national conventions of 1888 and 1896. In 1892 he was chairman of the American delegation to the International Monetary Conference at Brussels. He died at Dubuque, Iowa, on the 4th of August 1908.

ALLITERATION (from Lat. *ad*, to, and *littera*, letter), the commencing of two or more words, in close juxtaposition, with the same sound. As Milton defined rhyme to be "the jingling sound of like endings," so alliteration is the jingle of like beginnings. All language has a tendency to jingle in both ways, even in prose. Thus in prose we speak of "near and dear," "high and dry," "health and wealth." But the initial form of jingle is much more common—"safe and sound," "thick and thin," "weal or woe," "fair or foul," "spick and span," "fish, flesh, or fowl," "kith and kin." The poets of nearly all times and tongues have not been slow to seize upon the emphasis which could thus be produced.

Although mainly Germanic in its character, alliteration was known to the Latins, especially in early times, and Cicero blames Ennius for writing "O Tite tute, Tati, tibi tanta, tyranne, tulisti." Lucretius did not disdain to employ it as an ornament. We read in Shakespeare:—

"Full fathom five thy father lies:
Of his bones are corals made."

In Pope:—

"Here files of pins extend their shining rows,
Puffs, powders, patches, bibles, billet-doux."

In Gray:—

"Weave the warp and weave the woof,
The winding-sheet of Edward's race."

In Coleridge:—

"The fair breeze blew, the white foam flew,
The furrow followed free;
We were the first that ever burst
Into that silent sea."

Churchill describes himself, in his *Prophecy of Famine*, as one

"Who often, but without success, had prayed
For apt alliteration's artful aid,"—

an example which is itself a proof of his failure; for alliteration is never effective unless it runs upon consonants.

As thus far considered, alliteration is a device wholly dependent on the poet's fancy. He may use it or not, or use it much or little, at his pleasure. But there is an extensive range of Teutonic poetry whose metrical laws are entirely based on alliteration. This, for example, is the principle on which Icelandic verse is founded; and we have a yet nearer interest in it, because it furnishes the key to Anglo-Saxon and a large portion of early English verse. For a specimen take the following lines, the spelling modernized, from the beginning of *Piers the Plowman*:—

"But in a *M*ay *m*orning | on *M*alvern hills,
Me be*f*el a *f*erly | of *f*airy methought;
I was *w*eary of *w*andering | and *w*ent me to rest
Under a *b*road *b*ank | *b*y a *b*urn-side;
And as I *l*ay and *l*eaned | and *l*ooked on the waters,
I *sl*umbered in a *sl*eeping | it *s*ounded so merry."

The rule of this verse is indifferent as to the number of syllables it may contain, but imperative as to the number of accented ones. The line is divided in the middle by a pause, and each half ought to contain two accented syllables. Of the four accented syllables, the first three should begin with the same letter; the fourth is free and may start with any letter. Those who wish for a more minute analysis of the laws of alliterative verse, as practised by the Anglo-Saxon and early English poets, may consult an exhaustive essay on the subject by Professor W. W. Skeat, prefixed to vol. iii. of *Bishop Percy's Folio Manuscript*; only the reader must be on his guard against an error which pervades it, and which this able writer seems to have derived from Rask. The question arises—What is the nature of the cadence in alliterative verse? Now all metrical movement is of two kinds, according as the beat or emphasis begins the movement or ends it. If the beat is initial, we say in classical language that the movement is trochaic or dactylic, according to the number of its syllables; and if the beat is final, we in like manner say that the movement is iambic or anapaestic. Skeat and many others object with some reason to use the classical terms, and therefore brushing them aside, let us put the question in the simplest form—Has the movement of alliterative verse got the initial or the final beat? In the middle of the 18th century Bishop Percy decided this question with sufficient accuracy, though he mixed up his statement with a blunder which it is not easy to account for. He points out how the poets began to introduce rhyme into alliterative verse, until at length rhyme came to predominate over alliteration, and "thus was this kind of metre at length swallowed up and lost in the common burlesque Alexandrine or anapaestic verse, as

"A cobbler there was, and he lived in a stall."

Percy made a serious mistake when he gave the name of Alexandrine to anapaestic verse; but he is quite right in his general statement that alliterative verse became lost in a measure the movement of which had the final beat. Conybeare has stated the fact still more accurately. "In the Saxon poetry a trochaic character is predominant. In *Piers the Plowman* there is a prevailing tendency to an anapaestic cadence." It is the result of a change in the language—the loss of inflexion. Take the word *man*. The genitive in Saxon would be *mannes*, a trochee; in English, *of man*, an iambus. The tendency of the language was thus to pass from a metrical movement, in which the beat was initial, to one in which it was final. It may therefore be quite right to speak of Anglo-Saxon alliterative poetry as trochaic or dactylic, and quite wrong to apply the same terms to the cadence of our later alliterative verse. And this is precisely the error into which Skeat has fallen. He says—"Lines do not always begin with a loud syllable, but often one or two and sometimes (in early English especially) even three soft syllables precede it. These syllables are necessary to the sense, *but not to the scansion of the line*." That is just the point at issue. By leaving out of account the light syllable or syllables at the beginning of a line, and taking his start from the first syllable that has the alliterative beat, Skeat may certainly prove that all the later alliterative poetry has a movement of initial beat But English ears will not submit to this rule. It is those light syllables of no account which have altered the rhythm of English descant from one of initial to one of final beat.

ALLIUM (Lat. for "garlic"), a genus of plants, natural order Liliaceae, with about 250 species (seven of which occur in Britain), found in Central and South Europe, North Africa, the dry country of West and Central Asia, and North and Central America. The plants are bulbous herbs, with flat or rounded radical leaves, and a central naked or leafy stem, bearing a head or umbel of small flowers, with a spreading or bell-shaped white, pink, red, yellow or blue perianth. Several species afford useful foods, such as onion (*Allium Cepa*), leek (*A. Porrum*), shallot or eschallot (*A. ascalonicum*), garlic (*A. sativum*), and chives (*A. schoenoprasum*). A few species are cultivated as border plants; such are *A. Moly*, an old garden plant with bright yellow flowers, and *A. neapolitanum*, the well-known white-flowered species, both natives of southern Europe.

ALLIX, PIERRE (1641–1717), French Protestant divine, was born at Alençon. He was pastor first at St Agobile in Champagne, and then at Charenton, near Paris. The revocation of the edict of Nantes in 1685 compelled him to take refuge in London, where, under the sanction of James II., he opened a church for the French exiles. His reputation for learning was such as to obtain for him, soon after his arrival, the degree of doctor of divinity from both universities, and in 1690 he received from Bishop Burnet the more substantial honour of the treasurership and a canonry in Salisbury Cathedral. He died at London in March 1717. The works of Allix, which are numerous, are chiefly of a controversial and apologetic character, and must be used with caution. In opposition to Bossuet he published *Some Remarks upon the Ecclesiastical History of the Ancient Churches of Piedmont* (1690), and *Remarks upon the Ecclesiastical History of the Ancient Churches of the Albigenses* (1692), with the idea of showing that the Albigenses were not Manichaeans, but historically identical with the Waldenses.

ALLMAN, GEORGE JAMES (1812–1898), British biologist, was born in Cork, Ireland, in 1812, and received his early education at the Royal Academical Institution, Belfast. For some time he studied for the Irish bar, but ultimately gave up law in favour of natural science. In 1843 he graduated in medicine at Dublin, and in the following year was appointed professor of botany in that university, succeeding his namesake, William Allman (1776–1846). This position he held for about twelve years until he removed to Edinburgh as regius professor of natural history. There he remained till 1870, when considerations of health induced him to resign his professorship and retire to Dorsetshire, where he devoted himself to his favourite pastime of horticulture. The scientific papers which came from his pen are very numerous. His most important work was upon the gymnoblastic hydrozoa, on which he published in 1871–1872, through the Ray Society, an exhaustive monograph, based largely on his own researches and illustrated with drawings of remarkable excellence from his own hand. Biological science is also indebted to him for several convenient terms which have come into daily use, *e.g. endoderm* and *ectoderm* for the two cellular layers of the body-wall in Coelenterata. He became a fellow of the Royal Society in 1854, and received a Royal medal in 1873. For several years he occupied the presidential chair of the Linnaean society, and in 1879 he presided over the Sheffield meeting of the British Association. He died on the 24th of November 1898 at Parkstone, Dorsetshire.

ALLOA, a municipal and police burgh and seaport of Clackmannanshire, Scotland. It is situated on the north bank of the Forth, 32 m. from Edinburgh by the North British railway via the Forth Bridge, and 28 m. from Leith by steamer. Pop. (1891) 12,643; (1901) 14,458. The Caledonian railway enters the town from the south-west by a bridge across the river, and also owns a ferry to South Alloa, on the opposite shore, in Stirlingshire. Between Alloa and Stirling the stream forms the famous "links," the course being so sinuous that whereas by road the two towns are but 6½ m. apart, the distance between them by river is nearly 12 m.

For its size and population the town enjoys unusual prosperity, in consequence of its several flourishing industries. Its manufactures of yarn are on the largest scale, the spinning mills often working night and day for many months together. There are also numerous breweries, and Alloa ale has always been famous. The great distillery at Carsebridge yields an immense supply of yeast as well as whisky. Other thriving trades include the glass-works on the shore, pottery-works in the "auld toon," dye-works and a factory for the making of electrical appliances. There is a good deal of shipbuilding, some ironfounding and a brass foundry. The chief article of export is coal from the neighbouring collieries, the other leading exports being ale, whisky, glass and manufactured goods. The imports comprise timber, grain, iron, linseed and flax. The docks, accessible only at high water, include a wet basin and a dry dock. Amongst the principal buildings are the fine Gothic parish church, with a spire 200 ft. high; the town hall, including the free public library, from designs by Alfred Waterhouse, R.A., the gift of Mr J. Thomson Paton; the county and municipal buildings; handsome public baths and gymnasium, presented to the town by Mr David Thomson; the accident hospital; the fever hospital; the museum of the Natural Science and Archaeological Society; the academy, the burgh school and a secondary school with the finest technical equipment in Scotland, given by Mr A. Forrester Paton. There is a public park, besides bowling-greens and cricket and football fields. The old burying-ground was the kirkyard of the former parish church, the tower of which still exists, but a modern cemetery has been formed in Sunnyside. The town owns the water-supply, gas-works and electric-lighting.

Alloa Park, the seat of the earl of Mar and Kellie, is in the immediate vicinity, and in its grounds stand the ruins of Alloa Tower, an ancient structure 89 ft. high, with walls 11 ft. thick, which was built about 1315, and was once the residence of the powerful family of Erskine, descendants of the earl of Mar. The earl who promoted the Jacobite rising in 1715 was born here. Many of the Scots princes received their education as wards of the Lords Erskine and the earls of Mar, the last to be thus educated being Henry, the eldest son of James VI.

ALLOBROGES (in Gr. usually 'Αλλόβριγες), a Celtic tribe in the north of Gallia Narbonensis, inhabiting the low ground called the "island" between the Rhodanus, the Isara and the Graian Alps, corresponding to the modern Dauphiné and Savoy. If the name is rightly interpreted as meaning "aliens," they would seem to have driven out the original inhabitants. Their chief towns were Vienna (Vienne), Genava (Geneva) and Cularo (afterwards Gratianopolis, whence Grenoble). The Allobroges first occur in history as taking part with Hannibal in the invasion of Italy. After the subjugation of the Salluvii (Salyes) by the Romans in 123 B.C., having given shelter to their king Tutomotulus and refused to surrender him, the Allobroges were attacked and finally defeated (August 8, 121) at the junction of the Rhodanus and Isara by Q. Fabius Maximus (afterwards Allobrogicus). But they still remained hostile to Rome, as is shown by the conduct of their ambassadors in the Catilinarian conspiracy (63; see CATILINE); two years later a revolt under Catugnatus was put down by Gaius Pomptinus at Solonium. Under Augustus they were included in Gallia Narbonensis; later, in the Viennensis.

See A. Desjardins, *Géographie historique de la Gaule romaine*, ii. (1876–1893); E. Herzog, *Galliae Narbonensis Historia* (Leipzig, 1864); Mommsen, *Hist. of Rome* (Eng. trans.), bk. iii. ch. 4, iv. ch. 5; T. R. Holmes, *Caesar's Conquest of Gaul* (1899); G. Long in Smith's *Dict. of Greek and Roman Geography*; M. Ihm in Pauly-Wissowa's *Realencyclopädie*, i. 2 (1894); A. Holder, *Alt-celtischer Sprachschatz*; and bibliography in *La grande encyclopédie* (*s.v.*).

ALLOCATUR (from med. Lat. *allocatur*, it is allowed), in law, a certificate given by a taxing master, at the termination of an action, for the allowance of costs.

ALLOCUTION (Lat. *allocutio*, an address), a name given to the formal addresses made by the pope to the College of Cardinals and through them to the church generally. They are usually called forth by ecclesiastical or political circumstances, and aim at safeguarding papal principles and claims. They are published by being affixed to the door of St Peter's Church.

ALLODIUM, or ALODIUM, a legal term for lands which are the absolute property of their owner, and not subject to any service or acknowledgment to a superior. It is thus the opposite of *fe-odum* or fief. The proper derivation of the word has been much discussed and is still doubtful, though it is probably compounded of *all*, whole or entire, and *odh*, property. Allodial tenure seems to have been common throughout northern Europe. It exists in Orkney and Shetland, but is unknown in England, the feudal system having been made universal by William the Conqueror.

ALLOMEROUS (Gr. ἄλλος, other μέρος, part), the quality of bodies (*e.g.* mineral) by virtue of which they can change their elements and proportions while preserving their form.

ALLON, HENRY (1818–1892), English Nonconformist divine, was born on the 13th of October 1818 at Welton near Hull in Yorkshire. Under Methodist influence he decided to enter the ministry, but, developing Congregational ideas, was trained at Cheshunt College. In 1844 he became co-pastor with the Rev. Thomas Lewis of Union Chapel, Islington. In 1852, on the death of Lewis, Allon became sole pastor, and this position he held with increasing influence till his death in 1892. Union Chapel, originally founded by evangelical members of the Church of England and Nonconformists acting in harmony, became during Allon's co-pastorate definitely Congregational in principle and fellowship, and exercised an ever-expanding influence. His chief service to Nonconformity was in connexion with the improvement of congregational worship, and especially the service of praise. In 1852 Dr. H. J. Gauntlett became organist at Union Chapel and conductor of a psalmody class. To meet the wants of this class, Allon published the original edition of his well-known *Congregational Psalmist*. For many years his collection of hymns, chants and anthems was used in hundreds of churches throughout England. In 1860 Allon began to write, at first chiefly for the *Patriot*, then under the editorship of T. C. Turbeville. In 1864, at the age of forty-five, he was elected chairman of the Congregational Union, and in 1866 he undertook the editorship of the *British Quarterly Review* with H. R. Reynolds, the principal of Cheshunt. In 1877 he became sole editor, and in that capacity came into touch with such men as W. E. Gladstone, Matthew Arnold, F. D. Maurice and Dean Stanley. The magazine was discontinued in 1886. In 1871 he received the degree of D.D. from the university of Yale, U.S.A. In 1874 the congregation at Islington decided to erect new buildings. The church, which was built at a cost of £50,000, was specially adapted for congregational worship and was mentioned by an architectural journal as one of the hundred remarkable buildings of the century. The church had in its various departments about 300 teachers in charge of more than 3000 children, and was in its organization one of the earliest instances of the type known as the institutional church. In 1881, on the occasion of the jubilee of the Congregational Union of England and Wales, Allon was again elected chairman. In March 1892 he died suddenly from heart failure. His books were *A Memoir of James Sherman* (1863); the *Sermons of Thomas Binney*, with a biographical and critical sketch (1869); *The Vision of God and other sermons* (1876); *The Indwelling Christ* (1892). Allon was a man of sound judgment, strong will, great moral courage and personal kindness. His acquaintance with literature was wide, his own style lucid and decisive. In social and political affairs he was a convinced individualist. Both as leader of Union Chapel and in denominational affairs his courage and discretion, his simple faith, combined with a broad-minded sympathy with the intellectual movements of the time, made his ministry a widespread influence for good. (D. Mn.)

ALLONGE (from Fr. *allonger*, to draw out), a slip of paper affixed to a negotiable instrument, as a bill of exchange, for the purpose of receiving additional indorsements for which there may not be sufficient space on the bill itself. An indorsement written on the allonge is deemed to be written on the bill itself. An allonge is more usually met with in those countries where the Code Napoléon is in force, as the code requires every indorsement to express the consideration. Under English law, as the simple signature of the indorser on the bill, without additional words, is sufficient to operate as a negotiation, an allonge is seldom necessary.

ALLOPHANE, one of the few minerals known only in the amorphous state. It is a glassy substance, usually occurring as thin encrustations with a mammillary surface; occasionally, however, it is earthy and pulverulent. The colour varies considerably, from colourless to yellow, brown, blue or green. Specimens of a brilliant sky-blue colour, such as those found formerly in Wheal Hamblyn, near Bridestowe in Devonshire, and in Sardinia, are specially attractive in appearance; the colour is here due to the presence of the copper mineral chrysocolla. The hardness is 3, and the specific gravity 1·9. Chemically, it is a hydrous aluminium silicate, $Al_2SiO_5 . 5H_2O$. Allophane is always of secondary origin, resulting from the decomposition of various aluminous silicates, such as felspar. It is often found encrusting fissures and cavities in mines, especially those of copper and iron. It was first observed in 1809 in marl at Gräfenthal, near Saalfield in Thuringia; and has been found in some quantity in the chalk pits at Charlton in Kent, where it lines fissures and funnel-shaped cavities. The name allophane was given by F. Stromeyer in 1816, from the Gr. ἄλλος, another, and φαίνω, to appear, in allusion to the fact that the mineral crumbles and changes in appearance when heated before the blowpipe. Other names for the species are riemannite and elhuyarite, whilst closely allied minerals are carolathine, samoite and schrötterite (opal-allophane).

ALLORI, ALESSANDRO (1535–1607), Italian painter of the Florentine school, was brought up and trained in art by his uncle, Angelo Bronzino (*q.v.*) whose name he sometimes assumed in his pictures. Visiting Rome in his nineteenth year, he carefully studied the works of Michelangelo; but the influence of that great master can only be traced in the anatomical correctness of his drawing of nude figures. He was successful as a portrait painter. His son CRISTOFANO ALLORI (1577–1621), born at Florence, received his first lessons in painting from his father, but becoming dissatisfied with the hard anatomical drawing and cold colouring of the latter, he entered the studio of Gregorio Pagani (1558–1605) who was one of the leaders of that later Florentine school which endeavoured to unite the rich colouring of the Venetians with the correct drawing of Michelangelo's disciples. Allori became one of the foremost of this school. His pictures are distinguished by their close adherence to nature and the delicacy and technical perfection of their execution. His technical skill is proved by the fact that several copies he made after Correggio have been taken to be duplicates by Correggio himself. His extreme fastidiousness limited his power of production, though the number of his works is not so small as is sometimes asserted. Several specimens are to be seen at Florence and elsewhere. The finest of all his works is his "Judith and Holofernes," in the Pitti Palace. The model for the Judith was his mistress, the beautiful Mazzafirra, who is also represented in his Magdalene; and the head of Holofernes is generally supposed to represent himself.

ALLOTMENT (from O. Fr. *à* and *loter*, to divide by lot), the act of allotting; a share or portion assigned. In England, the term denotes a portion of land assigned on partition or under an inclosure award (see COMMONS); also a division of land into small portions for cultivation by a labourer or artisan at a small rent (see ALLOTMENTS AND SMALL HOLDINGS). In company law, "allotment" is the appropriation to an applicant by a resolution of the directors of a certain number of shares in response to an application. The document sent to such an applicant, which announces the number of shares assigned and concludes the contract, is called a *letter of allotment* or *allotment certificate*. A letter of allotment in England requires a sixpenny stamp if the value of the shares amounts to £5 or over, and a penny stamp if less than £5. (See COMPANY.)

Allotment note is a writing by a seaman authorizing his employers to make an allotment of part of his wages, while he is on a voyage, in favour either of a "near" relative (wife, father, mother, grandfather, grandmother, child, grandchild, brother or sister of the seaman), or of a savings bank. Every allotment note must be in a form sanctioned by the Board of Trade.

ALLOTMENTS AND SMALL HOLDINGS. As the meaning of these terms in agricultural tenure varies in different localities, it may be as well to say at once that for the present purpose they are definable as pieces of land detached from cottages, and hired or owned by labouring men to supplement their main income. We do not include any farm, however small, from which the occupier derives his entire support by dairying, market-gardening, or other form of *la petite culture*. So, also, no account is taken of the tiny garden plot, used for growing vegetables for the table and simple flowers, which is properly an appurtenance of the cottage. Clearing away what is extraneous, the essential point round which much controversy has raged is the labourer's share in the land. The claim advanced depends upon tradition. In agriculture, the oldest of all industries, a cash payment is not even now regarded as discharging the obligations between master and servant. Mr Wilson Fox, in reporting to the Board of Trade on the earnings of agricultural labourers in Great Britain, gives, as a typical survival of an old custom, the case of a shepherd whose total income was calculated at £60 a year, but who got only £16 in money, the rest being made up by rights of grazing live-stock, growing crops on his master's land, and kindred privileges. That is exactly in the spirit that used to pervade agriculture, and doubtless had its origin in the manorial system. If we turn back to the 13th century, from Walter of Henley's *Husbandry* it will be seen that practically there were only two classes engaged in agriculture, and corresponding with them were two kinds of land. There were, on the one hand, the employer, the lord, and his demesne land; on the other, the villeins and the land held in villenage. Putting aside for the moment any discussion of the exact degree of servitude, it will be seen that the essence of the bargain was that the villein should be permitted to cultivate a virgate of land for his own use in return for service rendered on the home farm. This is not altered by the fact that the conditions approached those of slavery, that the villeins were *adscripti glebae*, that in some cases their wives and sons were bequeathed by deed to the service of religious houses, and that in many other respects their freedom was limited. Out of this, in the course of centuries, was developed the system prevailing to-day. Lammas lands are indeed a survival from it. There are in the valley of the Lea, and close to London, to take one example, lands allotted annually in little strips till the crops are carried, when, the day being fixed by a reeve, the land becomes a common pasture till the spring closing takes place once more. Perhaps the feature of this old system that bears most directly on the question of allotments was the treatment of the waste of the manor. The lord, like his tenants, was limited by custom as regards the number of beasts he could graze on it. After the havoc of the Black Death in 1349, many changes were necessitated by the scarcity and dearness of labour. It became less unusual for land to be let and for money payment to be accepted instead of services. There was a great demand for wool, and to conduct sheep-farming on a large scale necessitated a re-arrangement of the manor and the enclosure of many common fields under the statute of Merton and the statute of Westminster the Second. Nevertheless, up to the 18th century, a vast proportion of agricultural land was technically waste, on which rights of common were exercised by yeomen, some of whom had acquired holdings by the ordinary methods of purchase or inheritance, while others had merely squatted and built a house on the waste. It is to this period that belongs a certain injustice to which the peasantry were subject. No reasonable doubt can be entertained of the necessity of enclosure. Husbandry, after long stagnation, was making great advance; and among others, Arthur Young raised his voice against the clumsy inconvenient common fields that were the first to be enclosed. Between 1700 and 1797 no fewer than 3110 acts, affecting, as far as can be calculated, about 3,000,000 acres, were put into operation. They seem mostly to have been directed to the common fields. In the first half of the 19th century the movement went on apace. In a single year, 1801, no fewer than 119 acts were passed; and between 1801 and 1842 close on 2000 acts were passed—many of them expressly directed to the enclosure of wastes and commons. The same thing continued till 1869. It touched the peasant directly and indirectly. The enclosure of the common fields proved most hurtful to the small farmer; the enclosure of the waste injured the labourer by depriving him, without adequate compensation, of such useful privileges as the right to graze a cow, a pig, geese or other small animals. It also discouraged him by tending to the extinction of small tenancies and freeholds that were no longer workable at a profit when common rights ceased to go with them. The industrious labourer could previously nourish a hope of bettering his condition by obtaining a small holding. Yet though the labourer suffered, impartial study does not show any intentional injustice. He held a very weak position when those interested in a common affixed to the church door a notice that they intended to petition. As Mr Cowper (afterwards Lord Mount Temple) said in the House of Commons on the 13th of March 1844, "the course adopted had been to compensate the owner of the cottage to whom the common right belonged, forgetting the claims of the occupier by whom they were enjoyed"; and in the same debate Sir Robert Peel pointed out that not only the rights of the tenant, but those of his successors ought to have been studied. The course adopted divorced the labourer from the soil.

Parliament, as a matter of fact, had from a very early period recognized the wisdom of contenting the peasant. In the 14th century the labourer lived in rude abundance. Next century a rural exodus began, owing to the practice of enclosing the holdings and turning them into sheep walks. In 1487 an act was passed enjoining landlords to "keep up houses of husbandry," and attach convenient land to them. Within the next hundred years a number of similar attempts were made to control what we may call the sheep fever of the time. Then we arrive at the reign of Elizabeth and the famous Small Holdings Act passed in 1597—an anticipation of the three-acres-and-a-cow policy advocated towards the end of the 19th century. It required that no person shall "build, convert or ordain any cottage for habitation or dwelling for persons engaged in husbandry" unless the owner "do assign or lay to the same cottage or building four acres of ground at the least." It also provided against any "inmate or under-sitter" being admitted to what was sacred to one family. This measure was not conceived in the spirit of modern political economy, but it had the effect of staying the rural exodus. It was repealed in 1775 on the ground that it restricted the building of cottages. By that time the modern feeling in favour of allotments had begun to ripen, and it was contended that some compensation should be made to the labourers for depriving them of the advantages of the waste. Up to then the English labouring rustic had been very well off. Food was abundant and cheap, so were clothes and boots; he could graze his cow or pig on the common, and also obtain fuel from it. Now he fell on evil days. Prices rose, wages fell, privileges were lost, and in many cases he had to sell the patch of land whose possession made all the difference between hardship and comfort. All this was seen plainly enough both by statesmen and private philanthropists. One of the first experiments was described by Sir John Sinclair in a note to the report of a select committee of the House of Commons on waste lands in 1795. About 1772 the lord of the manor of some commonable lands near Tewkesbury had with great success set out 25 acres in allotments for the use of some of the poor. Sir John was very much struck with the result, and so heartily applauded the idea that the committee recommended that any general enclosure bill should have a clause in it providing for "the accomodation of land." Sir Thomas Bernard and W. Wilberforce took an active part in advocating the principle of allotments, on the ground, to summarize their argument in language employed later by a witness before the House of Commons, that "it keeps the cottagers buoyant and makes them industrious." In 1806, at the suggestion of the rector, a clause assigning an allotment of half an acre to every cottage was inserted in an enclosure bill then under consideration for the parish of Broad Somerford in Wiltshire. This was done, "and the example was followed by nearly every adjoining parish in that part of Wiltshire." Passing over several praiseworthy establishments of allotments by private persons, we come to 1819, when parliament passed an act akin in spirit to several that came into existence during the later portion of the Victorian era. It empowered the churchwardens and overseers of any parish, with the consent of the vestry, to purchase or hire land not exceeding 25 acres, and to let it in portions to "any poor and industrious inhabitant of the parish." This was amended in 1831 by an act extending the quantity of land to 50 acres, and also conveying an important new power to enable the same authorities to enclose from any waste or common, land not exceeding 50 acres to be devoted to the same purpose. This was followed next year by an act relating to fuel, and in 1834 the Poor Law Commissioners reported favourably on the principle of granting allotments. In 1843 an important inquiry into the subject was made by a committee of the House of Commons, which produced a number of valuable suggestions. One consequence was the bill of 1845, brought into parliament by Mr Cowper. It passed the House of Commons; and there Mr Bright made a remark that probably summarized a general opinion, since it never came to a third reading in the House of Lords. He said that "the voluntary system of arrangement would do all the good that was expected to accrue from the allotment system."

At this point in the history of the movement it may be as well to pause and ask what was the net result of so much legislation and benevolent action. Messrs Tremenheere and Tufnall, who prefixed an admirable epitome of what had been done to the report of the commission "appointed to inquire into the employment of women, young persons and children in agriculture" (1867), expressed considerable disappointment. Between 1710 and 1867, 7,660,413 statute acres were added to the cultivated area of England and Wales, or about one-third of the area in cultivation at the latter date; and of this total, 484,893 acres were enclosed between 1845 and 1867. Of the latter, only 2119 acres were assigned as public allotments for gardens to the labouring poor. It was found to be the case, as it is now, that land was taken up more readily when offered privately and voluntarily than when it came through official sources. Meanwhile competent and thoughtful men saw well that the sullen discontent of the peasantry continued, in Lord Bacon's phrase, to threaten "the might and manhood of the kingdom." It had existed since the beginning of the Napoleonic wars, and had become more articulate with the spread of education. We shall see a consciousness of its presence reflected in the minds of statesmen and politicians as we briefly examine the later phase of the movement. This found expression in the clauses against enclosure introduced by Lord Beaconsfield in 1876, and gave force to the three-acres-and-a-cow agitation, of which the more prominent leaders were Joseph Arch and Jesse Collings. In 1882 the Allotments Extension Act was passed, the object of which was to let the parishioners have charity land in allotments, provided it or the revenue from it was not used for apprenticeship, ecclesiastical or educational purposes. A committee of the House of Commons, appointed in 1885 to inquire into the housing of the working classes, reported strongly in favour of allotments, and this was followed in 1887 by the Allotments Act—the first measure in which the principle of compulsory acquisition was admitted in regard to other than charity lands. Its administration was first given to the sanitary authority, but passed to the district councils when these bodies were established in 1894. The local body is empowered to hire or purchase suitable land, and if they do not find any in the market they are to petition the county council, which after due inquiry may issue a provisional order compelling owners to sell land, and the Local Government Board may introduce a bill into parliament to confirm the order. It was found that the sanitary authority did not carry out the scheme, and in 1890 another act was passed for the purpose of allowing applicants for allotments, when the sanitary authority failed to provide land, to appeal to the county council. Judging from the evidence laid before the commission on agricultural depression (1894), the act of 1887 was not a conspicuous success. Most of the witnesses reported in such terms as these—"the Allotments Act has been quite inoperative in Cornwall"; "the act has been a dead letter in the district (Wigtownshire)"; "the Allotments Act has not been in operation in Flintshire"; "nothing has been done in the district of Pembrokeshire under the act." No evidence whatever was adduced to show that in a single district a different state of things had to be recorded. From a return presented by the Local Government Board to parliament in 1896 we learn that eighty-three rural sanitary authorities had acquired land for allotment prior to the 28th of December 1894, the date at which these authorities ceased to exist under the provisions of the Local Government Act 1894. Land was acquired by compulsory purchase in only one parish; by purchase or agreement in eighteen parishes; by hire by agreement in 132 parishes. The total acreage dealt with was 1836 acres 1 rood 34 poles, and the total number of tenants 4711. The number of county councils that up to the same date had acquired land was twelve, and they had done so by compulsory purchase in one parish, by purchase or agreement in five parishes, by hire by agreement in twenty-four parishes. The total area dealt with was only 413 acres 1 rood 5 poles, and the total number of tenants 825. The complete totals affected at the date of the return (August 21, 1895) by the acts, therefore, were 2249 acres 2 roods 29 poles, and 5536 tenants. A considerable extension has taken place since.

The Small Holdings Act introduced by Mr Henry Chaplin, and passed by parliament in 1892 was an attempt to appease the rural discontent that had been seething for some time past and was silently but most eloquently expressed in a steady migration from the villages. The object of this measure was to help the deserving labouring man to acquire a small holding, that is to say, a portion of land not less than one acre or more than fifty acres in extent and of an annual value not exceeding £50. It is not necessary here to describe the legal steps by which this was to be accomplished. The essence of the bargain was that a fifth of the purchase money should be paid down, and the remainder in half-yearly instalments spread over a period not exceeding fifty years. But if the local authority thought fit a portion of the purchase money, not exceeding one-fourth, might remain unpaid, and be secured by a perpetual rent charge upon the holding. It cannot be said that this act has attained the object for which it was drawn up. From a return made to the House of Commons in 1895 it was shown that eight county councils had acquired land under the Small Holdings Act, which amounted in the aggregate to 483 acres. A further return was made in 1903, which showed that the total quantity of land acquired from the commencement of the act up to the end of 1902 was only 652 acres.

It is, however, an English characteristic to prefer private to public arrangements, and probably a very great majority of the allotments and small holdings cultivated in 1907 were due to individual initiative. There are no means of arriving at the exact figures, but data exist whereby it is at least possible to form some rough idea of them. It is not the custom to give in the annual agricultural returns any statement of the manner in which land is held, and the information is to be found in the returns presented to parliament from time to time. From the following table, which includes both the holdings owned and tenanted, it will be seen that between 1895 and 1904 the tendency was for the holdings to decrease in number; while the holdings of from 50 to 300 acres slightly increased, those from 5 to 50 acres were almost stationary, and there was a decrease in those between 1 and 5 acres.

	1895.		1904.	
	Number.	Per cent.	Number.	Per cent.
1 to 5 acres	117,968	22·68	110,974	21·69
5 to 50 „	235,481	45·28	232,476	45·44
50 to 300 „	147,870	28·43	150,050	29·33
Above 300 „	18,787	3·61	18,084	3·54
Total .	520,106	100	511,584	100

These figures become doubly instructive when considered in connexion with the decline of the strictly rural population. It will, therefore, be useful to place beside them a summary published in a report on the decline of rural population in Great Britain issued by the Board of Agriculture and Fisheries in 1906.

Class.	1881.	1891.	1901.	Increase (+) or Decrease (−).	
				1881–1891.	1891–1901.
	No.	No.	No.	No.	No.
Farmers and Graziers .	279,126	277,943	277,694	−1,183	−249
Farm Bailiffs and Foremen	22,895	21,453	27,317	−1,442	+5,864
Shepherds .	33,125	31,686	35,022	−1,439	+3,336
Agricultural Labourers .	983,919	866,543	689,292	−117,376	−177,251

These figures must of course be approximate. The effect of recent development in methods of travelling and the growing custom for townsmen either to live wholly in the country or to take week-end cottages, has made it impossible to draw a strict line of demarcation between rural and urban populations. Still they are near enough for practical purposes, and they amply justify the efforts of those who are trying to stay the rural exodus.

While legislation had not, up to 1908, achieved any noteworthy result in the creation of small holdings, and still left doubts as to the practicability of re-creating the English yeoman by act of parliament, many successful efforts have been made by individuals. One of the most interesting is that of the earl of Carrington at Sleaford in Lincolnshire. In this case the most noteworthy feature is that between the landlord and the tenants there is a body called the South Lincolnshire Small Holdings Association, which took 650 acres from Lord Carrington on a twenty years' lease. These acres used to be let to four or five tenants. They were in 1905 divided among one hundred and seventy tenants. The Small Holders' Association guaranteed the rent, which works out at about 33s. per acre, to Lord Carrington. They let the men on yearly tenancy have it at about 40s. an acre, the difference being used to meet the expenses of dividing the lands into small holdings, maintaining drains, fences and roads connected with them, and other unavoidable outlays. In this way the landlord is assured of his rent, and the association has lost nothing, as the men were very punctual in their payments. But very great care was bestowed in choosing the men for the holdings. They were in a sense picked men, but men must be picked to work the business satisfactorily. Lincolnshire is preeminently a county of small holdings, and the labouring residents in it have been accustomed to the management of them from their infancy onwards. Here as elsewhere the provision of suitable houses formed a difficulty, some of the tenants having to walk several miles to their holdings. Lord Carrington availed himself as much as possible of the buildings that existed, dividing the old farm houses so as to make them suitable for the small tenants. At Cowbit farm, many of the ordinary labourers' cottages, which were put up at a cost of about £300 a pair, have by the addition of little dairies and other alterations been made suitable for the tenants. From facts collected on the spot we have come to the conclusion that on the small holdings a good tenant makes an average profit of about £4 an acre, but on an allotment cultivated by means of the spade it would probably be at the rate of over £6 an acre. Lord Carrington was also successful in establishing small holdings on the Humberston estate in North Lincolnshire and on his Buckinghamshire estate, near Aylesbury. At Newport Pagnell the attempt failed because the demand was artificial, the ground arable, and the men not capable of dealing with it.

Other examples of the establishment of small holdings can only receive brief reference. The Norfolk Small Holdings Association acquired three farms at Whissonsett, Watton and Swaffham, which are broken up into small lots and let mostly to the village tradespeople. Sir Pearce Edgecumbe established small holdings at Rew, some of which have been purchased by the occupiers, and Mr A. B. Markham created similar ownerships at Twyford (Leicestershire). At Cudworth in Surrey a group was formed, but the owners were actuated more by the desire to lead a simple life than to prove the remunerative value of small holdings. Mr W. J. Harris created small holdings in Devon, each of which is let on a life tenancy. There the rural exodus has been more than arrested. Mr James Tomkinson established in Cheshire a number of graduated holdings, so contrived as to offer the successful holders a chance of stepping upwards.

The earl of Harrowby made an interesting experiment on his Sandon estate in Staffordshire in the midst of a pretty, broken and undulating country. The estate consists of about 6000 acres, one-third of which is laid out in small holdings. These fall naturally into three divisions. First, there are those which belong to men who have regular employment, and would therefore find it impossible to cultivate any great quantity of land. Many of that class are anxious to have a holding of some sort, as it lends a certain elasticity to their incomes and provides them with a never-failing interest. One who may be taken as typical hired six acres with a good cottage and a large garden, paying a rent of £20 a year. When this holding was created it had already a suitable cottage, but £100 was needed to provide outbuildings, and Lord Harrowby's custom is to charge 5% on outlay of this kind. This £5, however, is included in the total rent of £20 paid for cottage, land and garden. The man was not only content, but wished to get some more land. The next class consists of those who have not enough land to live on but eke out their livelihood by casual labour. Usually a man of this sort requires from 35 to 50 acres of land mostly pasture. He can attend to it and yet give a certain number of days to estate work. The third class is that of the small farmer who gains his entire livelihood from the land. The obstacle to breaking up large farms into small lies of course in the expense of providing the necessary equipment. It has been found here that a cottage suitable for a small farmer costs about £400 to build in a substantial manner, and the outbuildings about £200. This makes an addition therefore of about £30 to the rent of the land. The ardour with which these tenancies were sought when vacant formed the best testimony to the soundness of the principle applied by Lord Harrowby.

A nest of small holdings was created at Winterslow, near Salisbury, by Major R. M. Poore. The holders completed the purchase by 1906, and the work may be pronounced a complete success. Major Poore originally conceived the idea when land was cheap in 1892, owing to the depression in agriculture. He purchased an estate that came into the market at the time. The price came to an average of £10 an acre, and the men themselves made the average for selling it out again £15 on a principle of instalments. His object was not to make any profit from the transaction, and he formed what is termed a Landholders' Court, formed of the men themselves, every ten choosing one to represent them. This court was found to act well. It collected the instalments, which are paid in advance; and of course the members of it, down to the minutest detail, knew not only the circumstances but the character of every applicant for land. The result speaks for itself. The owners are, in the true sense of the word, peasants. They do not depend on the land for a living, but work in various callings—many being woodmen—for wages that average about 15s. a week. The holdings vary in size from less than an acre to ten acres, and are technically held on a lease of 1999 years, practically freehold, though by the adoption of a leasehold form a saving was effected in the cost of transfer. On the holdings most of the men have erected houses, using for the purpose chalk dug up from their gardens, it lying only a few inches below the surface. It is not rock, but soft chalk, so that they are practically mud walls; but being as a rule at least 18 inches thick, the houses are very cool in summer and warm in winter. Major Poore calculated that in seven years these poor people—there are not thirty of them altogether—managed to produce for their houses and land a gross sum of not less than £5000. This he attributed to the loyal manner in which even distant members of the family have helped.

The class of holding which owes its existence to the act of 1892 may be illustrated by the history of the Worcestershire small holdings. The inception of the scheme was due to the decline of the nail-making business, which caused a number of the inhabitants to be without occupation. Two candidates for election to the county council looking out for a popular cry found it in the demand for land. They promised to do their best in this direction, and thanks to the energetic action of Mr Willis Bund, the chairman, the act was put in force. Woodrow Farm, adjoining the village of Catshill in the neighbourhood of Birmingham, was purchased on terms that enabled the land to be sold to the peasant cultivator at £40 an acre. They were paying this back at the rate of 4% on the purchase money, a rate that included both interest and sinking fund, so that at the end of forty years they would own the small estates free from encumbrance. The huge population of Birmingham is close to the properties. The men turned their attention mostly to strawberries, to which many acres were devoted. Costermongers would come out from Birmingham and buy the fruit on the spot, selling part of it to the villas on the way back, and part in the Birmingham market. The experience gained in working the act enabled the committee on small holdings to make a number of practical suggestions for future legislation.

It remains to note the passing in 1907 of a new English Small Holdings and Allotments Act, experience of which is too recent for its provisions to be more than indicated here. The act transferred to the Board of Agriculture the duties generally of the Local Government Board, and transferred to parish councils or parish meetings the powers and duties of rural district councils; it required county councils to ascertain the demand for land without previous representation to them, and gave power for its compulsory acquisition; and the maximum holding of an allotment was raised from one acre to five. Both compulsory purchase and compulsory hiring (for not less than 14 nor more than 35 years) were authorized, value and compensation being decided by a single arbitrator. A coercive authority was applied to the county councils in the form of commissioners appointed by the Board of Agriculture, who were to hold inquiries independently and to take action themselves in case of a defaulting county council. They were to ascertain the local demand for small holdings, and to report to the Board, who might then require a county council to prepare a scheme, which, when approved, it was to carry out, the commissioners being empowered to do so in the alternative.

Foreign Countries.—It remains to give a brief outline of what small holdings are like outside Great Britain. From the results of the Belgian Agricultural Inquiry of 1895 the following table has been compiled, assuming that one hectare = 2½ acres:—

Size of Holding.	Occupied by Owner.		Occupied by Tenant.		Total.
	Whole.	More than half.	More than half.	Whole.	
	No.	No.	No.	No.	No.
1¼ acres and under	109,169	8,759	34,779	305,413	458,120
1¼ acres and under 5 acres	27,395	19,544	58,829	70,465	176,233
5 acres and under 10 acres	12,089	13,873	30,340	25,006	81,308
10 acres and under 50 acres	16,690	18,909	33,443	28,387	97,429
50 or 100 acres	2,021	1,497	3,315	4,517	11,350
Over 100 ,,	903	470	1,417	2,395	5,185
Total	168,267	63,052	162,123	436,183	829,625

It will be seen from this table that Belgium is pre-eminently a country of small holdings, more than half of the total number being under 50 acres in extent. Of course it is largely a country of market gardens; but as the holdings are most numerous in Brabant, East and West Flanders and Hainault, the provinces showing the largest number of milch cows, it would seem that dairying and *la petite culture* go together.

There is a slight tendency for the holdings to decrease in number. In Germany the number of small holdings is proportionately much larger than in Great Britain. The returns collected in 1895 showed that there were 3,235,169, or 58·22 % of the total number of holdings under 5 acres in area; and of these no fewer than 11 % are held by servants as part of their wages. The table below compiled for the *Journal of the Board of Agriculture* enables us to compare the other holdings with those of Great Britain. Great Britain, it will be seen, has over 40 % of large farms of between 50 and 500 acres as compared with Germany's 12·6, while the latter has 86·8 of small holdings, compared with England's 58·6.

France also has a far larger proportion of small holdings than Great Britain; its cultivated area of 85,759,000 acres being divided into 5,618,000 separate holdings, of which the size averages a little over 15 acres as against 63 in Great Britain. Of the whole number, 4,190,795 are farmed by the owners, 934,338 are in métayage, and 1,078,184 by tenants. The leading feature is the peasant proprietary. Half of the arable, more than half of the pasture, six-sevenths of the vineyards and two-thirds of the garden lands are farmed by their owners. Comparison with Great Britain is difficult; but it would appear that, whereas only 11 % of British 520,000 agricultural holdings are farmed by the owners, the proportion in France is 75 %. A further point to be noted is that the average agricultural tenancy in France is just one-fourth of what it is in Great Britain, and the average owner-farmed estate only one-sixth.

Size of Holdings.	Germany.		Great Britain.	
	Number.	Per cent.	Number.	Per cent.
5 to 50 acres	2,014,940	86·8	235,481	58·6
50 to 500 ,,	292,982	12·6	161,438	40·1
Over 500 ,,	13,809	0·6	5,219	1·3
Total	2,321,731	100	402,138	100

In France the tendency is for the very small holdings to increase in number owing to subdivision, with a consequent decrease of the size of the average holding. Between the years 1882 and 1892 there was a decrease of 138,237 in the total number of proprietors, the larger properties moving towards consolidation and those of the peasant proprietors towards subdivision.

Those interested in the formation of small holdings in Great Britain will find much to interest them in the history of Danish legislation. British policy for many generations was to preserve demesne land, and there are many devices for insuring that a spendthrift life-owner shall not be able to scatter the family inheritance; but as long ago as 1769 the Danish legislators set an exactly opposite example. They enacted that peasant land should not be incorporated or worked with estate land; it must always remain in the ownership and occupation of peasants. In this spirit all subsequent legislation was conceived, and the allotment law that came into force in October 1899 bears some resemblance to the English Small Holdings Act of 1892. It provides that labourers able to satisfy certain conditions as to character may obtain from the state a loan equal to nine-tenths of the purchase money of the land they wish to acquire. This land should be from 5 to 7 acres in extent and of medium quality, but the limits are from 2¾ to 10¾ acres in the case of better or poorer land. The total value should not exceed 4000 kr. (£222). The interest payable on the loan received from the state is 3 %. The loan itself is repayable after the first five years by annual instalments of 4 % until half is paid off; the remainder by instalments of 3½ %, including interest. Provision is, however, made for cases where the borrower desired to pay off the loan in larger sums. Regulations are laid down regarding the transfer of such properties and also their testamentary disposition. The Treasury was empowered to devote a sum of 2,000,000 kr. (£111,000) to this purpose for five years; after that the land is subject to revision.

Number and Size of Holdings in Denmark in 1901.

Groups.		Number.	Percentage of Number.	Acreage.	Percentage of Area.	Average size in Acres.
Tondeland.	Acres.					
Under 1	Under 1·36	68,380	27·3	23,455	·3	·34
1–3	1·36–4	18,777	7·5	58,553	·7	3·12
3–27	4–36·7	93,060	37·2	1,408,549	15·8	15·14
27–108	36·7–147	60,872	24·4	4,459,077	50·1	73·25
108–216	147–294	6,502	2·6	1,272,398	14·3	195.69
Over 216	Over 294	2,392	1·0	1,674,730	18·8	700·14
	Total.	249,983	100·0	8,896,762	100·0	35·59

Even before this law was passed Denmark was a country of small holdings, the peasant farms amounting to 66 % of the whole, and the number is bound to increase, since the incorporation of farms is illegal, while there is no obstacle to their division. Between 1835 and 1885, the number of small holdings of less than one töndekarthorn increased from 24,800 to 92,856. What gives point to these remarks is, that Denmark seems in the way to arrest its rural exodus, and was one of the first countries to escape from the agricultural depression due to the extraordinary fall in grain prices. The distribution of land in Denmark may be gathered from a glance at the preceding table for the compilation of which we are indebted to Major Craigie.

Authorities.—Walter of Henley's *Husbandry*; *The English Village Community*, by Frederic Seebohm; *Annals of Agriculture*, by Arthur Young; *The Agricultural Labourer*, by T. E. Kebbel; *Report on the Employment of Women and Children in Agriculture*, 1867 (historical sketch by Messrs Tremenheere and Tufnall); *A Study of Small Holdings*, by W. E. Bear; *The Law and the Labourer*, by C. W. Stubbs; "Agricultural Holdings in England and Abroad," by Major Craigie (*Statistical Society's Journal*, vol. i.); *The Return to the Land*, by Senator Jules Méline; *Land Reform*, by the Right Hon. Jesse Collings, M.P.; *Report on the Decline in the Agricultural Population of Great Britain*, issued by the Board of Agriculture and Fisheries; *Report of the Departmental Committee appointed by the Board of Agriculture and Fisheries to enquire into and report upon the subject of Small Holdings in Great Britain*. (P. A. G.)

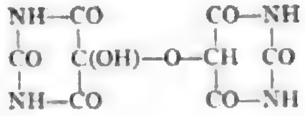
ALLOTROPY (Gr. ἄλλος, other, and τρόπος, manner), a name applied by J. J. Berzelius to the property possessed by certain substances of existing in different modifications. Custom has to some extent restricted its use to inorganic chemistry; the corresponding property of organic compounds being generally termed isomerism (*q.v.*). Conspicuous examples are afforded by oxygen, carbon, boron, silicon, phosphorus, mercuric oxide and iodide.

ALLOWANCE (from "allow," derived through O. Fr. *alouer* from the two Lat. origins *adlaudare*, to praise, and *allocare*, to assign a place; so that the English word combined the general idea of "assigning with approval"), the action of allowing, or the thing allowed; particularly, a certain limited apportionment of money or food and diet (see Dietary).

In commercial usage "allowance" signifies the deduction made from the gross weight of goods to make up for the weight of the box or package, waste, breakages, &c. Allowance, which is customary in most industries, varies according to the trade, district or country; *e.g.* in the coal trade it is customary for the merchant to receive from the pit 21 cwts. of coal for every ton purchased by him, the difference of 1 cwt. being the allowance for the purpose of making good the waste caused through transhipment, screening and cartage (see Tare and Tret.)

ALLOXAN, or Mesoxalyl Urea, $C_4H_2N_2O_4$ or $CO\left\langle{NH—CO \atop NH—CO}\right\rangle CO$. an oxidation product of uric acid, being obtained from it by the action of cold nitric acid, $C_5H_4N_4O_3 + H_2O + O = C_4H_2N_2O_4 + CO(NH_2)_2$. It crystallizes from water in colourless rhombic prisms, containing four molecules of water of crystallization, and possesses a very acid reaction. It serves as the starting-point for the preparation of many related substances. Zinc and hydrochloric acid in the cold convert it into alloxantin (*q.v.*), hydroxylamine gives nitroso-barbituric acid, $C_4H_2N_2O_3:NOH$, baryta water gives alloxanic acid, $C_4H_4N_2O_5$, hot dilute nitric acid oxidizes it to parabanic acid (*q.v.*), hot potassium hydroxide solution hydrolyses it to urea and mesoxalic acid (*q.v.*) and zinc and hot hydrochloric acid convert it into dialuric acid, $C_4H_4N_2O_4$. M. Nencki has shown that alloxan combines with thiourea in alcoholic solution, in the presence of sulphur dioxide to form pseudothiouric acid, $C_5H_6N_4SO_4$. Methyl and dimethylalloxans are also known, the former being obtained on oxidation of methyl uric acid, and the latter on oxidation of caffeine (*q.v.*).

ALLOXANTIN, $C_8H_4N_4O_7 \cdot 3H_2O$, a product obtained by the combination of alloxan and dialuric acid, probably possessing the constitution

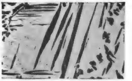


one of the three molecules of water being possibly constitutional. It forms small hard prisms which become red on exposure to air containing ammonia, owing to the formation of murexide (ammonium purpurate), $C_8H_4(NH_4)N_5O_6$. It may also be obtained by the action of sulphuretted hydrogen on alloxan. The tetramethyl derivative, amalic acid, $C_8(CH_3)_4N_4O_7$, has been prepared by oxidizing caffeine (*q.v.*) with chlorine water, and forms colourless crystals which are only slightly soluble in hot water. The formation of murexide is used as a test for the presence of uric acid, which on evaporation with dilute nitric acid gives alloxantin, and by the addition of ammonia to the residue the purple red colour of murexide becomes apparent.

ALLOYS (through the Fr. *aloyer*, from Lat. *alligare*, to combine), a term generally applied to the intimate mixtures obtained by melting together two or more metals, and allowing the mass to solidify. It may conveniently be extended to similar mixtures of sulphur and selenium or tellurium, of bismuth and sulphur, of copper and cuprous oxide, and of iron and carbon, in fact to all cases in which substances can be made to mix in varying proportions without very marked indication of chemical action. The term "alloy" does not necessarily imply obedience to the laws of definite and multiple proportion or even uniformity throughout the material; but some alloys are homogeneous and some are chemical compounds. In what follows we shall confine our attention principally to metallic alloys.

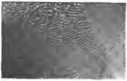
If we melt copper and add to it about 30 % of zinc, or 20 % of tin, we obtain uniform liquids which when solidified are the well-known substances brass and bell-metal. These substances are for all practical purposes new metals. The difference in the appearance of brass and copper is familiar to everyone; brass is also much harder than copper and much more suitable for being turned in a lathe. Similarly, bell-metal is harder, more sonorous and more brittle than either of its components. It is almost impossible by mechanical means to detect the separate ingredients in such an alloy; we may cut or file or polish it without discovering any lack of homogeneousness. But it is not permissible to call brass a chemical compound, for we can largely alter its percentage composition without the substance losing the properties characteristic of brass; the properties change more or less continuously, the colour, for example, becoming redder with decrease in the percentage of zinc, and a paler yellow when there is more zinc. The possibility of continuously varying the percentage composition suggests analogy between an alloy and a solution, and A. Matthiessen (*Phil. Trans.*, 1860) applied the term "solidified solutions" to alloys. Regarded as descriptive of the genesis of an alloy from a uniform liquid containing two or more metals, the term is not incorrect, and it may have acted as a signpost towards profitable methods of research. But modern work has shown that, although alloys sometimes contain *solid solutions*, the solid alloy as a whole is often far more like a conglomerate rock than a uniform solution. In fact the uniformity of brass and bell-metal is only superficial; if we adopt the methods described in the article Metallography, and if, after polishing a plane face on a bit of gun-metal, we etch away the surface layer and examine the new surface with a lens or a microscope, we find a complex pattern of at least two materials. Fig. 1 (Plate) is from a photograph of a bronze containing 23·3 % by weight of tin. The acid used to etch the surface has darkened the parts richest in copper, while those richest in tin remained white. The two ingredients revealed by this process are not pure copper and pure tin, but each material contains both metals. In this case the white tin-rich portions are themselves a complex that can be resolved into two substances by a higher magnification. The majority of alloys, when examined thus, prove to be complexes of two or more materials, and the patterns showing the distribution of these materials throughout the alloy are of a most varied character. It is certain that the structure existing in the alloy is closely connected with the mechanical properties, such as hardness, toughness, rigidity, and so on, that make particular alloys valuable in the arts, and many efforts have been made to trace this connexion. These efforts have, in some cases, been very

ALLOYS



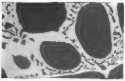
ALLOYS.

FIG. 1.—(Heycock & Neville, *Phil. Trans.*) Bronze containing 23·3% of tin. Slowly cooled. Magnified 18 diameters. Dark parts are rich in copper, light parts in tin.



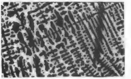
ALLOYS.

FIG. 2.—(Ewing & Rosenhain, *Phil. Trans.*) Lead-tin eutectic. Magnified 750 diameters.



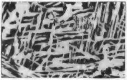
ALLOYS.

FIG. 3.—(F. Osmond.) Silver-copper [copper = 15%, silver = 85%] reheated to purple colour. Magnified 600 diameters.



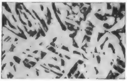
ALLOYS.

FIG. 4.—(Heycock & Neville, *Phil. Trans.*) Copper-tin [tin 27·7%] chilled at 731° C. before complete solidification. Magnified 18 diameters. Blacks rich, whites less rich in copper.



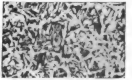
GUN-MAKING.

FIG. 5.—Gun steel, C. = 0·30%. From top of ingot as cast, magnified 29 diameters. Whites, ferrite; blacks, carbide.



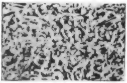
GUN-MAKING.

FIG. 6.—Gun steel, C. = 0·30%. From bottom of ingot as cast, magnified 29 diameters. Whites, ferrite; blacks, carbide.



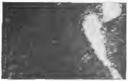
GUN-MAKING.

FIG. 7.—Gun steel, C. = 0·30%. Top of ingot, forged and annealed, magnified 29 diameters. Whites, ferrite; blacks, carbide.



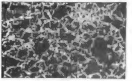
GUN-MAKING.

FIG. 8.—Gun steel, C. = 0·30%. Bottom of ingot, forged and annealed, magnified 29 diameters. Whites, ferrite; blacks, carbide.



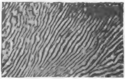
GUN-MAKING.

FIG. 9.—Gun steel, C. = 0·30%. Forged and annealed, magnified 1000 diameters, showing pearlite.



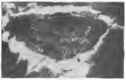
GUN-MAKING.

FIG. 10.—Gun steel, C. = 0·30%. Oil hardened and annealed, magnified 50 diameters.



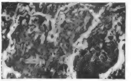
IRON AND STEEL.

FIG. 11.—(Osmond.) Pearlite, steel (carbon about 1%) forged and annealed at 800° C. Magnified 1000 diameters.



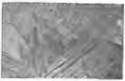
IRON AND STEEL.

FIG. 12.—(Stoughton.) Meshes of pearlite in a network of ferrite, from hypo-eutectoid steel. Magnified 250 diameters.



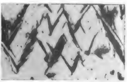
IRON AND STEEL.

FIG. 13.—(Stoughton.) Meshes of pearlite in a network of cementite from hyper-eutectoid steel. Magnified 250 diameters.



IRON AND STEEL.

FIG. 14.—(Osmond & Cartaud.) Martensite. Magnified 250 diameters.



IRON AND STEEL.

FIG. 15.—(Osmond.) Martensite (black) in austenite (white). Steel (carbon about 1·5%) quenched at 1050° C. in ice-cold water. Magnified 250 diameters.

PHOTOMICROGRAPHS OF ALLOYS AND METALS.

(See Articles METALLOGRAPHY, ALLOYS, GUN-MAKING, IRON and STEEL.)

successful; for example, in the case of steel, which is an alloy of iron and carbon, a microscopical examination gives valuable information concerning the suitability of a sample of steel for special purposes.

Mixture by fusion is the general method of producing an alloy, but it is not the only method possible. It would seem, indeed, that any process by which the particles of two metals are intimately mingled and brought into close contact, so that diffusion of one metal into the other can take place, is likely to result in the formation of an alloy. For example, if vapours of the volatile metals cadmium, zinc and magnesium are allowed to act on platinum or palladium, alloys are produced. The methods of manufacture of steel by cementation, case-hardening and the Harvey process are important operations which appear to depend on the diffusion of the carburetting material into the solid metal. When a solution of silver nitrate is poured on to metallic mercury, the mercury replaces the silver in the solution, forming nitrate of mercury, and the silver is precipitated; it does not, however, appear as pure metallic silver, but in the form of crystalline needles of an alloy of silver and mercury. F. B. Mylius and O. Fromm have shown that alloys may be precipitated from dilute solutions by zinc, cadmium, tin, lead and copper. Thus a strip of zinc plunged into a solution of silver sulphate, containing not more than 0·03 gramme of silver in the litre, becomes covered with a flocculent precipitate which is a true alloy of silver and zinc, and in the same way, when copper is precipitated from its sulphate by zinc, the alloy formed is brass. They have also formed in this way certain alloys of definite composition, such as $AuCd_3$, Cu_2Cd, and, more interesting still, Cu_3Sn. A very similar fact, that brass may be formed by electrodeposition from a solution containing zinc and copper, has long been known. W. V. Spring has shown that by compressing a finely divided mixture of 15 parts of bismuth, 8 parts of lead, 4 parts of tin and 3 parts of cadmium, an alloy is produced which melts at 100° C., that is, much below the melting-point of any of the four metals. But these methods of forming alloys, although they suggest questions of great interest, cannot receive further discussion here.

Our knowledge of the nature of solid alloys has been much enlarged by a careful study of the process of solidification. Let us suppose that a molten mixture of two substances A and B, which at a sufficiently high temperature form a uniform liquid, and which do not combine to form definite compounds, is slowly cooled until it becomes wholly solid. The phenomena which succeed each other are then very similar, whether A and B are two metals, such as lead and tin or silver and copper, or are a pair of fused salts, or are water and common salt. All these mixtures when solidified may fairly be termed alloys.[1] If a mixture of A and B be melted and then allowed to cool, a thermometer immersed in the mixture will indicate a gradually falling temperature. But when solidification commences, the thermometer will cease to fall, it may even rise slightly, and the temperature will remain almost constant for a short time. This halt in the cooling, due to the heat evolved in the solidification of the first crystals that form in the liquid, is called the freezing-point of the mixture; the freezing-point can generally be observed with considerable accuracy. In the case of a pure substance, and of a certain small class of mixtures, there is no further fall in temperature until the substance has become completely solid, but, in the case of most mixtures, after the freezing-point has been reached the temperature soon begins to fall again, and as the amount of solid increases the temperature becomes lower and lower. There may be other halts in the cooling, both before and after complete solidification, due to evolution of heat in the mixture. These halts in temperature that occur during the cooling of a mixture should be carefully noted, as they give valuable information concerning the physical and chemical changes that are taking place. If we determine the freezing-points of a number of mixtures varying in composition from pure A to pure B, we can plot the freezing-point curve. In such a curve the percentage composition can be plotted horizontally and the temperature of the freezing-point vertically, as in fig. 5. In such a diagram, a point P defines a particular mixture, both as to percentage, composition and temperature; a vertical line through P corresponds to the mixture at all possible temperatures, the point Q being its freezing-point. In the case of two substances which neither form compounds nor dissolve each other in the solid state, the complete freezing-point curve takes the form shown in fig. 5. It consists of two branches AC and BC, which meet in a lowest point C. It will be seen that as we increase the percentage of B from nothing up to that of the mixture C, the freezing-point becomes lower and lower, but that if we further increase the percentage of B in the mixture, the freezing-point rises. This agrees with the well-known fact that the presence of an impurity in a substance depresses its melting-point. The mixture C has a lower freezing or melting point than that of any other mixture; it is called the eutectic mixture. All the mixtures whose composition lies between that of A and C deposit crystals of pure A when they begin to solidify, while mixtures between C and B in composition deposit crystals of pure B. Let us consider a little more closely the solidification of the mixture represented by the vertical line PQRS. As it cools from P to Q the mixture remains wholly liquid, but when the temperature Q is reached there is a halt in the cooling, due to the formation of crystals of A. The cooling soon recommences and these crystals continue to form, but at lower and lower temperatures because the still liquid part is becoming richer in B. This process goes on until the state of the remaining liquid is represented by the point C. Now crystals of B begin to form, simultaneously with the A crystals, and the composition of the remaining liquid does not alter as the solidification progresses. Consequently the temperature does not change and there is another well-marked halt in the cooling, and this halt lasts until the mixture has become wholly solid. The corresponding changes in the case of the mixture TUVW are easily understood —the first halt at U, due to the crystallization of pure B, will probably occur at a different temperature, but the second halt, due to the simultaneous crystallization of A and B, will always occur at the same temperature whatever the composition of the mixture. It is evident that every mixture except the eutectic mixture C will have two halts in its cooling, and that its solidification will take place in two stages. Moreover, the three solids S, D and W will differ in minute structure and therefore, probably, in mechanical properties. All mixtures whose temperature lies above the line ACB are wholly liquid, hence this line is often called the "liquidus"; all mixtures at temperatures below that of the horizontal line through C are wholly solid, hence this line is sometimes called the "solidus," but in more complex cases the solidus is often curved. At temperatures between the solidus and the liquidus a mixture is partly solid and partly liquid. This general case has been discussed at length because a careful study of it will much facilitate the comprehension of the similar but more complicated cases that occur in the examination of alloys. A great many mixtures of metals have been examined in the above-mentioned way.

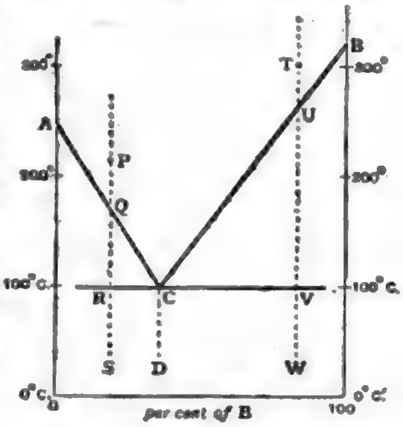


FIG. 5.

Fig. 6 gives the freezing-point diagram for alloys of lead and tin. We see in it exactly the features described above. The two sloping lines cutting at the eutectic point are the freezing-point curves of alloys that, when they begin to solidify, deposit crystals of lead and tin respectively. The horizontal line through the eutectic point gives the second halt in cooling, due to the simultaneous formation of lead crystals and tin crystals. In the case of this pair of metals, or indeed of any metallic alloy, we cannot see the crystals forming, nor can we easily filter them off and examine them apart from the liquid, although this has been done in a few cases. But if we polish the solid alloys, etch them if necessary, and examine them microscopically, we shall find that alloys on the *lead* side of the diagram consist of comparatively large crystals of lead embedded in a minute complex, which is due to the simultaneous crystallization of the two metals during the solidification at the eutectic temperature. If we examine alloys on the *tin* side we shall find large crystals of tin embedded in the same complex. The eutectic alloy itself, fig. 2 (Plate), shows the minute complex of the tin-lead eutectic, photographed by J. A. Ewing and W. Rosenhain, and fig. 3 (Plate), photographed by F. Osmond, shows the structure of a silver-copper alloy containing considerably more silver than the eutectic. Here, the large dark masses are the silver or silver-rich substance that crystallized above the eutectic temperature, and the more minute black and white complex represents the eutectic. It is not safe to assume that the two ingredients we see are pure silver and pure copper; on the contrary, there is reason to think that the crystals of silver contain some copper uniformly diffused through them, and vice versa. It is, however, not possible to detect the copper in the silver by means of the microscope. This uniform distribution of a solid substance throughout the mass of another, so as to form a homogeneous material, is called "solid solution," and we may say that solid silver can dissolve copper. Solid solutions are probably very common in alloys, so that when an alloy of two metals shows two constituents under the microscope it is never safe to infer, without further evidence, that these are the two pure metals. Sometimes the whole alloy *is* a uniform solid solution. This is the case with the copper-tin alloys containing less than 9% by weight of tin; a microscopic examination reveals only one material, a copper-like substance, the tin having disappeared, being in solution in the copper.

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[1] The instructive case of the solidification of a solution of common salt in water is discussed in the article FUSION.

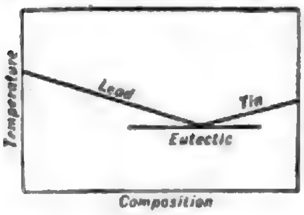

FIG. 6.

Much information as to the nature of an alloy can be obtained by placing several small ingots of the same alloy in a furnace which is above the melting-point of the alloy, and allowing the temperature to fall slowly and uniformly. We then extract one ingot after another at successively lower temperatures and chill each ingot by dropping it into water or by some other method of very rapid cooling. The chilling stereotypes the structure existing in the ingot at the moment it was withdrawn from the furnace, and we can afterwards study this structure by means of the microscope. We thus learn that the bronzes referred to above, although chemically uniform when solid, are not so when they begin to solidify, but that the liquid deposits crystals richer in copper than itself, and therefore that the residual liquid becomes richer in tin. Consequently, as the final solid is uniform, the crystals formed at first must change in composition at a later stage. We learn also that solid solutions which exist at high temperatures often break up into two materials as they cool; for example, the bronze of fig. 1, which in that figure shows two materials so plainly, if chilled at a somewhat higher temperature but when it was already solid, is found to consist of only one material; it is then a uniform solid solution. The difference between softness and hardness in ordinary steel is due to the permanence of a solid solution of carbon in iron if the steel has been chilled or very rapidly cooled, while if the steel is slowly cooled this solid solution breaks up into a minute complex of two substances which is called pearlite. The pearlite when highly magnified somewhat resembles the lead-tin eutectic of fig. 2 (Plate). In the case of steel (see IRON AND STEEL) the solid solution is very hard, while the pearlite complex is much softer. In the case of some bronzes, for example that with about 25% of tin, the solid solution is soft, and the complex into which it breaks up by slow cooling is much harder, so that the same process of heating and chilling which hardens steel will soften this bronze.

If we melt an alloy and chill it before it has wholly solidified we often get evidence of the crystalline character of the solid matter which first forms. Fig. 4 (Plate) is the pattern found in a bronze containing 27·7% of tin when so treated. The dark regularly oriented crystal skeletons were already solid at the moment of chilling; they are rich in copper. The lighter part surrounding them was liquid before the chill; it is rich in tin. This alloy, if allowed to solidify completely before chilling, turns into a uniform solid solution, and at still lower temperatures the solid solution breaks up into a pearlite complex. The analogy between the breaking up of a solid solution on cooling and the formation of a eutectic is obvious. Iron and phosphorus unite to form a solid solution which breaks up on cooling into a pearlite. Other cases could be quoted, but enough has been said to show the importance of solid solutions and their influence on the mechanical properties of alloys. These uniform solid solutions must not be mistaken for chemical compounds; they can, within limits, vary in composition like an ordinary liquid solution. But the occasional or indeed frequent existence of chemical compounds in alloys has now been placed beyond doubt.

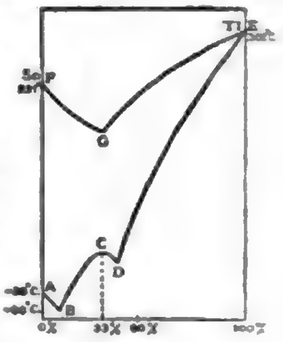

FIG. 7.

We can sometimes obtain definite compounds in a pure state by the action of appropriate solvents which dissolve the rest of the alloy and do not attack the crystals of the compound. Thus, a number of copper-tin alloys when digested with hydrochloric acid leave the same crystalline residue, which on analysis proves to be the compound Cu_3Sn. The bodies $SbNa_3$, $BiNa_3$, $SnNa_4$, compounds of iron and molybdenum and many other substances, have also been isolated in this way. The freezing-point curve sometimes indicates the existence of chemical compounds. The simple type of curve, such as that of lead and tin, fig. 6, consisting of two downward sloping branches meeting in the eutectic point, and that of thallium and tin, the upper curve of fig. 7, certainly give no indication of chemical combination. But the curves are not always so simple as the above. The lower curve of fig. 7 gives the freezing-point curve of mercury and thallium; here A and E are the melting-points of pure mercury and pure thallium, and the branches AB and ED do not cut each other, but cut an intermediate rounded branch BCD. There are thus two eutectic alloys B and D, and the alloys with compositions between B and D have higher melting-points. The summit C of the branch BCD occurs at a percentage exactly corresponding to the formula Hg_2Tl. It is probable that all the alloys of compositions between B and D, when they begin to solidify, deposit crystals of the compound; the lower eutectic B probably corresponds to a solid complex of mercury and the compound. The point B is at −60° C., the lowest temperature at which any metallic substance is known to exist in the liquid state. The higher eutectic D may correspond to a complex of solid thallium and the compound; but the possible existence of solid solutions makes further investigation necessary here. The curves of fig. 7 were determined by N. S. Kurnakow and N. A. Puschin. Sometimes a freezing-point curve contains more than one intermediate summit, so that more than one compound is indicated. For example, in the curve for gold-aluminium, ignoring minor singularities, we find two intermediate summits, one at the percentage Au_2Al, and another at the percentage $AuAl_2$. Microscopic examination fully confirms the existence of these compounds. The substance $AuAl_2$ is the most remarkable compound of two metals that has so far been discovered; although it contains so much aluminium its melting-point is as high as that of gold. It also possesses a splendid purple colour, more remarkable than that of any other metal or alloy. Many other inter-metallic compounds have been indicated by summits in freezing-point curves. For example, the system sodium-mercury has a remarkable summit at the composition $NaHg_2$. This compound melts at 350° C., a temperature far above the melting-point of either sodium or mercury. In the system potassium-mercury, the compound KHg_2 is similarly indicated. In the curve for sodium-cadmium, the compound $NaCd_2$ is plainly shown. These three examples are taken from the work of N. S. Kurnakow. Various compounds of the alkali metals with bismuth, antimony, tin and lead have been prepared in a pure state. Such are the compounds $SbNa_3$, $BiNa_3$, $PbNa_2$, $SnNa_4$. Of these, the first three are well indicated on the freezing-point curves. The intermediate summits occurring in the freezing-point curves of alloys are usually rounded; this feature is believed to be due to the partial decomposition of the compound which takes place when it melts. The formulae of the group of substances last mentioned are in harmony with the ordinary views of chemists as to valency, but the formulae $NaHg_2$, $NaCd_2$, $NaTl_2$, $AuAl_2$ are more surprising. They indicate the great gaps in our present knowledge of the subject of valency. We must not take it for granted, when the freezing-point curve gives no indication of the compound, that the compound does not exist in the solid alloy. For example, the compound Cu_3Sn is not indicated in the freezing-point curve, and indeed a liquid alloy of this percentage does not begin to solidify by the formation of crystals of Cu_3Sn; the liquid solidifies completely to a uniform solid solution, and only at a lower temperature does this change into crystals of the compound, the transformation being accompanied by a considerable evolution of heat. Until recently the vast subject of inter-metallic compounds has been an unopened book to chemists. But the subject is now being vigorously studied, and, apart from its importance as a branch of descriptive chemistry, it is throwing light, and promises to throw more, on obscure parts of chemical theory.

The graphical representation of the properties of alloys can be extended so as to record all the changes, thermal and chemical, which the alloy undergoes after, as well as before, solidification, including the formation and breaking up of solid solutions and compounds. For an example of such a diagram, see the Bakerian Lecture, 1903, *Phil. Trans.*, A. 346. The Phase Rule of Willard Gibbs, especially as developed by Bakhuis Roozeboom, is a most useful guide in such investigations.

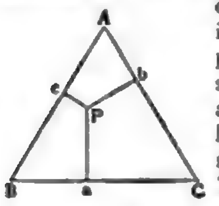

FIG. 8.

So far we have been considering alloys containing two metals; the phenomena they present are by no means simple. But when three or more metals are present, as is often the case in useful alloys, the phenomena are much more complicated. With three component metals the complete diagram giving the variations in any property must be in three dimensions, although by the use of contour lines the essential facts can be represented in a plane diagram. The following method, depending on the constancy of the sum of the perpendiculars from any point on to the sides of an equilateral triangle, can be adopted:—Let ABC (fig. 8) be an equilateral triangle, the angular points corresponding to the three pure metals A, B, C. Then the composition of any alloy can be represented by a point P, so chosen that the perpendicular Pa on to the side BC gives the percentage of A in the alloy, and the perpendiculars Pb and Pc give the percentages of B and C respectively. Points on the side AB will correspond to binary alloys containing only A and B, and so on. If now we wish to represent the variations in some property, such as fusibility, we determine the freezing-points of a number of alloys distributed fairly uniformly over the area of the triangle, and, at each point corresponding to an alloy, we erect an ordinate at right angles to the plane of the paper and proportional in length to the freezing temperature of that alloy. We can then draw a continuous surface through the summits of all these ordinates, and so obtain a freezing-point surface, or liquidus; points above this surface will correspond to wholly liquid alloys. The ternary alloys containing bismuth, tin and lead have been studied in this way by F. Charpy and by E. S. Shepherd. We have here a comparatively simple case, as the metals do not form compounds. The solid alloy consists of crystals of pure tin in juxtaposition with crystals of almost pure lead and bismuth, these two metals dissolving each other in solid solution to the extent of a few per cent only. If now we cut the freezing-point surface by planes parallel to the base ABC we get curves giving us all the alloys whose freezing-point is the same; these isothermals can be projected on to the plane of the triangle and are seen as dotted lines in fig. 9. The freezing surface, in this case, consists of three sheets each starting from an angular point of the surface, that is, from the freezing-point of a pure metal. The sheets meet in pairs along three lines which themselves meet in a point. In fig. 9, due to F. Charpy, these lines are projected on to the plane of the triangle as Ec, E′c and E″c. The area of the triangle is thus divided into three regions. The region PbEcE′ contains all the alloys that commence their solidification by the crystallization of lead; similarly, the other two regions correspond to the initial crystallization of bismuth and tin respectively; these areas are the projections of the three sheets of the freezing-point surface. The points E, E′, E″ are the eutectics of binary alloys. Alloys represented by points on Ec, when they begin to solidify, deposit crystals of lead and bismuth simultaneously; Ec is a eutectic line, as also are E′c and E″c. The alloy of the point c is the ternary eutectic; it deposits the three metals simultaneously during the whole period of its solidification and solidifies at a constant temperature. As the lines of the surface which correspond to Ec, &c., slope downwards to their common intersection it follows that the alloy c has the lowest freezing-point of any mixture of the three metals; this freezing-point is 96° C., and the alloy c contains about 32% of lead, 15·5% of tin and 52·5% of bismuth.

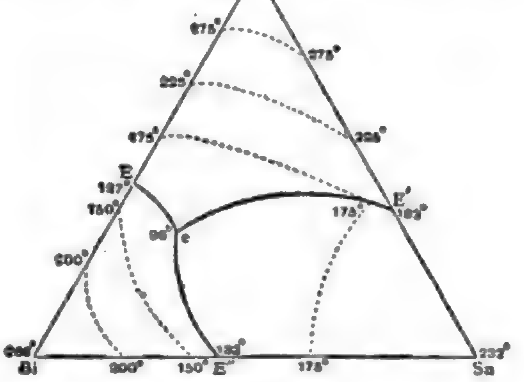

FIG. 9.

It is evident that any other property can be represented by similar diagrams. For example, we can construct the curve of conductivity of alloys of two metals or the surface of conductivity of ternary alloys, and so on for any measurable property.

The electrical conductivity of a metal is often very much decreased by alloying with it even small quantities of another metal. This is so when gold and silver are alloyed with each other, and is true in the case of alloys of copper. When a pure metal is cooled to a very low temperature its electrical conductivity is greatly increased, but this is not the case with an alloy. Lord Rayleigh has pointed out that the difference may arise from the heterogeneity of alloys. When a current is passed through a solid alloy, a series of Peltier effects, proportional to the current, are set up between the particles of the different metals, and these create an opposing electromotive force which is indistinguishable experimentally from a resistance. If the alloy were a true chemical compound the counteracting electromotive force should not occur; experiments in this direction are much needed.

Sir William Chandler Roberts-Austen has shown that in the case of molten alloys the conduction of electricity is apparently metallic, no transfer of matter attending the passage of the current. A group of bodies may, however, be yet discovered between alloys and electrolytes in which evidence may be found of some gradual change from wholly metallic to electrolytic conduction. A. P. Laurie has determined the electromotive force of a series of copper-zinc, copper-tin and gold-tin alloys, and as the result of his experiments he points to the existence of definite compounds. Explosive alloys have been formed by H. St Claire Deville and H. J. Debray in the case of rhodium, iridium and ruthenium, which evolve heat when they are dissolved in zinc. When the solution of the rhodium-zinc alloy is treated with hydrochloric acid, a residue is left which undergoes a change with explosive violence if it be heated *in vacuo* to 400°. The alloy is then insoluble in "aqua regia." The metals have therefore passed into an insoluble form by a comparatively slight elevation of temperature.

Surfusion.

Metals do not appear to have been studied from the point of view of surfusion until 1880, when A. D. van Riemsdijk showed that gold and silver would both pass below their actual freezing-points without becoming solid. Roberts-Austen pointed out that surfusion might be easily measured in metals and in alloys by the sensitive method of recording pyrometry perfected by him. He also showed that the crossing of curves of solubility, which had already been observed by H. le Chatelier and by A. C. A. Dahms in the case of salts, could be measured in the lead-tin alloys. The investigation of the mutual relations of partially miscible liquids, due to P. Alexejew, D. P. Konovalow, and to P. E. Duclaux, was extended to alloys by Alder Wright. The addition of a third metal will sometimes render the mixture of two other metals homogeneous. C. T. Heycock and F. H. Neville proved that when one metal is alloyed with a small quantity of some other metal, the solidification obeys the law of F. M. Raoult. Their experiments, although not conclusive, appear to indicate that the molecule of a metal when in dilute solution often consists of one atom. There are, however, numerous exceptions to this rule. In the cases of aluminium dissolved in tin and of mercury or bismuth in lead, it is at least probable that the molecules in solution are Al_2, Hg_2 and Bi_2 respectively, while tin in lead appears to form a molecule of the type Sn_4.

Industrial applications.

Since 1875 increased attention has been devoted to the applications of the rarer metals. Thus nickel, which was formerly used in the manufacture of "German silver" as a substitute for silver, is now widely employed in naval construction and in the manufacture of steel armour-plate and projectiles. Alloyed with copper, it is used for the envelopes of bullets. A nickel steel containing 36% of nickel has the property of retaining an almost constant volume when heated or cooled through a considerable range of temperature; it is therefore useful for the construction of pendulums and for measures of length. Another steel containing 45% of nickel has, like platinum, the same coefficient of expansion as glass. It can therefore be employed, instead of that costly metal, in the construction of incandescent lamps where a wire has to be fused into the glass to establish electric connexion between the inside and the outside of the bulb. Manganese not only forms with iron several alloys of great interest, but alloyed with copper it is used for electrical purposes, as an alloy can thus be obtained with an electrical resistance that does not alter with change of temperature; this alloy, called manganin, is used in the construction of resistance-boxes. Chromium also, in comparatively small quantities, is taking its place as a constituent of steel axles and tires, and in the manufacture of tool-steel. Steels containing as much as 12% of tungsten are now used as a material for tools intended for turning and planing iron and steel. The peculiarity of these steels is that no quenching or tempering is required. They are normally hard and remain so, even at a faint red heat; much deeper cuts can therefore be taken at a high speed without blunting the tool. Vanadium, molybdenum and titanium may be expected soon to play an important part in the constitution of steel. Titanium is alloyed in small quantities with aluminium for use in naval architecture. Aluminium, when alloyed with a few per cent of magnesium, gains greatly in rigidity while remaining very light; this alloy, under the name of magnalium, is coming into use for small articles in which lightness and rigidity have to be combined. One of the most interesting amongst recent alloys is Conrad Heusler's alloy of copper, aluminium and manganese, which possesses magnetic properties far in excess of those of the constituent metals.

The importance is now widely recognized of considering the mechanical properties of alloys in connexion with the freezing-point curves to which reference has already been made, but the subject is a very complicated one, and all that need be said here, is that when considered in relation to their melting-points the pure metals are consistently weaker than alloys. The presence in an alloy of a eutectic which solidifies at a much lower temperature than the main mass, implies a great reduction in tenacity, especially if it is to be used above the ordinary temperature as in the case of pipes conveying super-heated steam. It has also been stated that alloys of metals with similar melting-points have higher tenacity when the atomic volumes of the constituent metals differ than when they are nearly the same.

References.—Alloys have formed a subject of reports to several scientific societies. Sir W. C. Roberts-Austen's six *Reports* (1891 to 1904) to the Alloys Research Committee of the Institution of Mechanical Engineers, London, the last report being concluded by William Gowland; the *Cantor Lectures on Alloys delivered at the Society of Arts* and the *Contribution à l'étude des alliages* (1901), published by the *Société d'encouragement pour l'industrie nationale* under the direction of the *Commission des alliages* (1896–1900), should be consulted. The theoretical aspect is discussed in Léon Guillet's *Étude théorique des alliages métalliques* (1904). W. T. Brannt's *The Metallic Alloys* (1896); Roberts-Austen's *Introduction to the Study of Metallurgy* (1902); and R. G. Thurston's *Materials of Engineering*, should be consulted for the more practical details.

Recent progress is reported in the scientific periodicals, especially in *The Iron and Steel Metallurgist*, formerly *The Metallographist* (Boston, Mass.), and *Metallurgie* (Halle). Important memoirs by Ewing and Rosenhain, and by C. T. Heycock and F. H. Neville in the *Philosophical Transactions*, by N. S. Kurnakow in the *Zeitschrift für anorganische Chemie*, and by E. S. Shepherd in the *Journal of Physical Chemistry*, may also be consulted. (W. C. R.-A.; F. H. Ne.)

ALLPORT, SIR JAMES JOSEPH (1811–1892), English railway manager, born on the 27th of February 1811, was a son of William Allport, of Birmingham, and was associated with railways from an early period of his life. In 1843 he became general manager of the Birmingham and Derby railway, and in the following year succeeded to the same position on the Newcastle and Darlington line. Six years later he assumed the charge of the Manchester, Sheffield and Lincolnshire (now the Great Central) railway, and finally, in 1853, was appointed to the general managership of the Midland railway—an office which he held continuously, with the exception of a few days between 1857 and 1860, when he was managing director to Palmer's Shipbuilding Company at Jarrow, until his retirement in 1880, when he became a director. During these twenty-seven years the Midland grew to be one of the most important railway systems in England, partly by the absorption of smaller lines and partly by the construction of two main extensions—on the south to London and on the north to Carlisle—whereby it obtained an independent through-route between the metropolis and the north. In the railway world Sir James Allport was known as a keen tactician and a vigorous fighter, and he should be remembered as the pioneer of cheap and comfortable railway travelling. He was the first to appreciate the importance of the third-class passenger as a source of revenue, and accordingly, in 1872, he inaugurated the policy—subsequently adopted more or less completely by all the railways of Great Britain—of carrying third-class passengers in well-fitted carriages at the uniform rate of one penny a mile on all trains. The diminution in the receipts from second-class passengers, which was one of the results, was regarded by some authorities as a sign of the unwisdom of his action, but to him it appeared a sufficient reason for the abolition of second-class carriages, which therefore disappeared from the Midland system in 1875, the first-class fares being at the same time substantially reduced.

He was also the first to introduce the Pullman car on British railways. Allport received the honour of knighthood in 1884. He died in London on the 25th of April 1892.

ALLPORT, SAMUEL (1816–1897), English petrologist, brother of the above, was born in Birmingham on the 23rd of January 1816, and educated in that city. Although occupied in business during the greater portion of his life, his leisure was given to geological studies, and when residing for a short period in Bahia, S. America, he made observations on the geology, published by the Geological Society in 1860. His chief work was in microscopic petrology, to the study of which he was attracted by the investigations of Dr H. C. Sorby; and he became one of the pioneers of this branch of geology, preparing his own rock-sections with remarkable skill. The basalts of S. Staffordshire, the diorites of Warwickshire, the phonolite of the Wolf Rock (to which he first directed attention), the pitchstones of Arran and the altered igneous rocks near the Land's End were investigated and described by him during the years 1869–1879 in the *Quarterly Journal of the Geological Society* and in the *Geological Magazine*. In 1880 he was appointed librarian in Mason College, a post which he relinquished on account of ill-health in 1887. In that year the Lyell medal was awarded to him by the Geological Society. A few years later he retired to Cheltenham, where he died on the 7th of July 1897.

ALL-ROUND ATHLETICS. Specialization in athletic sports, although always existent, is to a great extent a modern product. In ancient times athletes were encouraged to excel in several branches of sport, often quite opposite in character. Thus the athlete held in highest honour at the Olympic Games (see GAMES, CLASSICAL) was the winner of the *pentathlon*, which consisted of running, jumping, throwing the javelin and the discus, and wrestling. All-round championships have existed for many years both in Scotland and Ireland, and in America there are both national and sectional championships. The American national championship was instituted in 1884, the winner being the athlete who succeeds in obtaining the highest marks in the following eleven events; 100 yards run; putting 16 lb shot; running high jump; half-mile walk; throwing 16 lb hammer; 120 yards hurdle race; pole vault; throwing 56 lb weight; one mile run; running broad jump; quarter-mile run. In each event 1000 points are allowed for equalling the "record," and an increasing number of points is taken off for performances below "record," down to a certain "standard," below which the competitor scores nothing. For example, in the 100 yards run the time of 9⅘ seconds represents 1000 points; that of 10 seconds scores 958, or 42 points less; 10⅕ seconds scores 916, &c.; and below 14⅕ seconds the competitor scores nothing. Should the record be broken 42 points are added for each ⅕ second. (See also ATHLETIC SPORTS.)

ALL SAINTS, FESTIVAL OF (*Festum omnium sanctorum*), also formerly known as ALL HALLOWS, or HALLOWMAS, a feast of the Catholic Church celebrated on the 1st of November in honour of all the saints, known or unknown. In the Roman Catholic Church it is a festival of the first rank, with a vigil and an octave. Common commemorations, by several churches, of the deaths of martyrs began to be celebrated in the 4th century. The first trace of a general celebration is in Antioch on the Sunday after Pentecost, and this custom is also referred to in the 74th homily of St Chrysostom (407). The origin of the festival of All Saints as celebrated in the West is, however, somewhat doubtful. In 609 or 610 Pope Boniface IV. consecrated the Pantheon at Rome to the Blessed Virgin and all the martyrs, and the feast of the *dedicatio Sanctae Mariae ad Martyres* has been celebrated at Rome ever since on the 13th of May. The idea, based on the medieval liturgiologists, that this festival was the origin of that of All Saints has now been abandoned. The latter is possibly traceable to the foundation by Gregory III. (731–741) of an oratory in St Peter's for the relics "of the holy apostles and of all saints, martyrs and confessors, of all the just made perfect who are at rest throughout the world." So far as the Western Church generally is concerned, though the festival was already widely celebrated in the days of Charlemagne, it was only made of obligation throughout the Frankish empire in 835 by a decree of Louis the Pious issued "at the instance of Pope Gregory IV. and with the assent of all the bishops," which fixed its celebration on the 1st of November. The festival was retained at the Reformation in the calendar of the Church of England, and also in that of many of the Lutheran churches. In the latter, in spite of attempts at revival, it has fallen into complete disuse.

ALL SOULS' DAY (*Commemoratio omnium fidelium defunctorum*), the day set apart in the Roman Catholic Church for the commemoration of the faithful departed. The celebration is based on the doctrine that the souls of the faithful which at death have not been cleansed from venial sins, or have not atoned for past transgressions, cannot attain the Beatific Vision, and that they may be helped to do so by prayer and by the sacrifice of the mass. The feast falls on the 2nd of November; or on the 3rd if the 2nd is a Sunday or a festival of the first class. The practice of setting apart a special day for intercession for certain of the faithful departed is of great antiquity; but the establishment of a feast of general intercession was in the first instance due to Odilo, abbot of Cluny (d. 1048). The legend connected with its foundation is given by Peter Damiani in his *Life of St Odilo*. According to this, a pilgrim returning from the Holy Land was cast by a storm on a desolate island where dwelt a hermit. From him he learned that amid the rocks was a chasm communicating with purgatory, from which rose perpetually the groans of tortured souls, the hermit asserting that he had also heard the demons complaining of the efficacy of the prayers of the faithful, and especially of the monks of Cluny, in rescuing their victims. On returning home the pilgrim hastened to inform the abbot of Cluny, who forthwith set apart the 2nd of November as a day of intercession on the part of his community for all the souls in purgatory. The decree ordaining the celebration is printed in the Bollandist *Acta Sanctorum* (*Saec. VI.*, pt. i. p. 585). From Cluny the custom spread to the other houses of the Cluniac order, was soon adopted in several dioceses in France, and spread thence throughout the Western Church. At the Reformation the celebration of All Souls' Day was abolished in the Church of England, though it has been renewed in certain churches in connexion with the "Catholic revival." Among continental Protestants its tradition has been more tenaciously maintained. Even Luther's influence was not sufficient to abolish its celebration in Saxony during his lifetime; and, though its ecclesiastical sanction lapsed before long even in the Lutheran Church, its memory survives strongly in popular custom. Just as it is the custom of French people, of all ranks and creeds, to decorate the graves of their dead on the *jour des morts*, so in Germany the people stream to the grave-yards once a year with offerings of flowers.

Certain popular beliefs connected with All Souls' Day are of pagan origin and immemorial antiquity. Thus the dead are believed by the peasantry of many Catholic countries to return to their former homes on All Souls' night and partake of the food of the living. In Tirol cakes are left for them on the table and the room kept warm for their comfort. In Brittany the people flock into the cemeteries at nightfall to kneel bare-headed at the graves of their loved ones, and to fill the hollow of the tombstone with holy water or to pour libations of milk upon it, and at bedtime the supper is left on the table for the soul's refreshment.

ALLSTON, WASHINGTON (1779–1843), American historical painter and poet, was born on the 5th of November 1779 at Waccamaw, South Carolina, where his father was a planter. He graduated at Harvard in 1800, and for a short time pursued his artistic studies at Charleston with Edward Greene Malbone (1777–1807) the miniature painter, and Charles Fraser (1782–1860). With the former, in 1801, he went to London, and entered the Royal Academy as a student of Benjamin West, with whom he formed a lifelong friendship. In 1804 he went to Paris, and, after a few months' residence there, to Rome, where he spent the greater part of the next four years. During this period he became intimate with Coleridge and Thorwaldsen. From 1809 to 1811 he resided in his native country, and from 1811 to 1817 he painted in England. After visiting Paris a second time, he returned to the United States, and practised his profession at Boston (1818–1830), and afterwards at Cambridge, Massachusetts, where he died on the 9th of July 1843. He was elected an associate of the Royal Academy in 1819. In colour and the management of light and shade Allston closely imitated the Venetian school, and he has hence been styled the "American Titian." Many of his pictures have Biblical subjects, and Allston himself had a profoundly religious nature. His first considerable painting, "The Dead Man Revived," executed shortly after his second visit to England, and now at the Pennsylvania Academy of Fine Arts in Philadelphia, gained a prize of 200 guineas. In England he also painted his "St Peter Liberated by the Angel," "Uriel in the Sun" (at Stafford House), "Jacob's Dream" (at Petworth) and "Elijah in the Wilderness." To the period of his residence in America belong "The Prophet Jeremiah" (at Yale), "Saul and the Witch of Endor," "Miriam," "Beatrice," "Rosalie," "Spalatro's Vision of the Bloody Hand," and the vast but unfinished "Belshazzar's Feast" (in the Boston Athenaeum), at which he was working at the time of his death. As a writer, Allston shows great facility of expression and imaginative power. His friend Coleridge (a portrait of whom by Allston is in the National Gallery) said of him that he was surpassed by no man of his age in artistic and poetic genius. His literary works are—*The Sylphs of the Seasons and other Poems* (1813), where he displays true sympathy with nature and deep knowledge of the human heart; *Monaldi* (1841), a tragical romance, the scene of which is laid in Italy; and *Lectures on Art*, edited by his brother-in-law, R. H. Dana the novelist (1850).

See J. B. Flagg's *Life and Letters of Washington Allston* (New York, 1892).

ALLUVION (Lat. *alluvio*, washing against), a word taken from Roman law, in which it was one of the examples of *accessio*, that is, acquisition of property without any act being done by the acquirer. It signifies the gradual accretion of land or formation of an island by imperceptible degrees. If the accretion or formation be by a torrent or flood, the property in the severed portion or new island continues with the original owner until the trees, if any, swept away with it take root in the ground. Alluvion never attached at all in the case of *agri limitati*, that is, lands belonging to the state and leased or sold in plots. Dig. xli. 1, 7, is the main authority. English law is in general agreement (except as to *agri limitati*) with Roman, as appears from the judgment in *Foster* v. *Wright*, 1878, 4 C.P.D. 438. The Scottish law, as laid down by the House of Lords in *Earl of Zetland* v. *Glover Incorporation*, 1872, L.R. 2 H.L., Sc., 70, is in accordance with the English. (See WATER RIGHTS.)

ALLUVIUM, soil or land deposited by running water. All streams, from the tiniest rill to the greatest river, are continually engaged in transporting downstream solid particles of rock, the product of weathering agencies in the area which they drain. Since the capacity of a stream to carry matter in suspension is proportional to its velocity, it follows that any circumstance tending to retard the rate of flow will induce deposition. Thus a fall in the gradient at any point in the course of a stream; any snag, projection or dam, impeding the current; the reduced velocity caused by the overflowing of streams in flood and the dissipation of their energy where they enter a lake or the sea, are all contributing causes to alluviation, or the deposition of stream-borne sediment. It is evident from the foregoing remarks, that while even the smallest stream may make deposits of alluvial character it is in the flood-plains and deltas of large rivers that the great alluvial deposits are to be found. The finer material constituting alluvium, often described as "silt," is sand and mud. Although it may be exceedingly fine-grained, there is usually very little clay in alluvium. The larger materials include gravel of all degrees of coarseness; carbonaceous matter is often an important element. The amount of solid matter borne by large streams is enormous; many rivers derive their names from the colour thereby imparted to the water, *e.g.* Hwang Ho = Yellow river, Missouri = Big Muddy, the Red river, &c. It has been estimated that the Mississippi annually carries 406½ million tons of sediment to the sea; the Hwang Ho 796 million tons; the Po 67 million tons. Many shallow lakes have been completely filled with alluvium and their sites are now occupied by fertile plains; this process may be seen in operation almost anywhere; a good illustration is the delta of the Rhone in Lake Geneva. Alluvial deposits may be of great size. The flood-plain of the Mississippi has an area of 50,000 sq. m.; the great delta of the Ganges and Brahmaputra has an area of about 60,000 sq. m.; that of the Hwang Ho reaches out 300 m. into the sea and has a coastal border of about 400 m. Old alluvial deposits are left high above the existing level of many rivers, in the form of "terraces" of gravel and loam, the streams to which these owe their existence having modified their courses and cut deeper channels; such are the alluvial gravels and brick-earths upon which much of "greater London" is built. In some regions alluvial deposits are the resting places of gemstones and gold, platinum, &c.; it is from these deposits that the largest nuggets of gold have been obtained. Alluvial soils are almost invariably of great fertility; it is due to the alluvial mud annually deposited by the Nile that the dwellers in Egypt have been able to grow their crops for over 4000 years without artificial fertilization.

ALLYL ALCOHOL, C_3H_5OH or $CH_2{:}CH{\cdot}CH_2OH$, a compound which occurs in very small quantities in wood spirit. It may be prepared from allyl iodide by the action of moist silver oxide; by the reduction of acrolein; or by heating glycerin with oxalic acid and a little ammonium chloride to 260° C. In this last reaction glycerol monoformin is produced as an intermediate product, but is decomposed as the temperature rises:—

$$C_3H_5(OH)_3 + H_2C_2O_4 = \underset{\text{glycerol monoformin}}{C_3H_5(OH)_2{\cdot}O{\cdot}CHO} + CO_2 + H_2O$$

$$C_3H_5(OH)_2{\cdot}O{\cdot}CHO = C_3H_5OH + CO_2 + H_2O$$

It is a colourless mobile liquid of pungent smell, boiling at 97° C. Being an unsaturated compound it combines readily with the halogens. Oxidation by strong oxidizing agents converts it successively into its aldehyde, acrolein, and into acrylic acid. By gentle oxidation with potassium permanganate it may be converted into glycerin.

ALMA, a river of Russia, in the S.W. of the Crimea, entering the Black Sea 17 m. N. of Sevastopol. It gives its name to a famous victory gained over the Russians, on the 20th of September 1854, by the allied armies in the Crimean War (*q.v.*). The south bank of the river is bordered by a long ridge, which becomes steeper as it approaches the sea, and upon this the Russians, under Prince Menshikov, were drawn up, to bar the Sevastopol road to the allies, who under General Lord Raglan and Marshal St Arnaud approached from the north over an open plain. The Russian commander massed his troops in heavy columns after the fashion of 1813, and drew in his left wing so that it should as far as possible be out of range of the allied men-of-war, which were sailing down the coast in line with their land forces. The allied generals decided that the French (right wing) and the Turks should attack Menshikov's left, while the British, further inland, were to assault the front of the Russian position. The forces engaged are stated by Hamley (*War in the Crimea*) as, French and Turks, 35,000 infantry, with 68 guns; British, 23,000 infantry, 1000 cavalry and 60 guns; Russians, 33,000 infantry, 3800 cavalry and 120 guns; by the Austrian writer Berndt (*Zahl im Kriege*) the allied forces are reckoned at 57,000 men with 108 guns, and the Russians at 33,600 men with 96 guns. The French advance met at first with little opposition, and several divisions scaled the cliffs of the lower Alma without difficulty. Menshikov relied apparently on being able to detach his reserves to cope with them, but the assailants moved with a rapidity which he had not counted upon, and the Russians only came into action piecemeal in this quarter. Opposite the British, who as usual deployed at a distance and then advanced in long continuous lines, the Russians were posted on the crest of a long glacis-like slope, which offered but little dead ground to an assailant. The village of Burliuk, and the vineyards which bordered the river, were quickly cleared by the British skirmishers, and the line of battle behind them crossed, though with some difficulty. On emerging from the cover afforded by the river-bed the British divisions, now crowded together, but still preserving their general line, came under a terrible fire from heavy guns and musketry. The enemy's artillery was three hundred yards away, yet the British pressed on in spite of their losses, and as some of the Light Division troops reached the "Great Battery" the Russians hurried their guns away to safety. In the meantime, on both sides of this battery, the assailants had come to close quarters with the Russian columns, which were aided by their field guns. A brave counter-attack was made by the Russian Vladimir regiment, 3000 strong, against the troops which had stormed the great battery, and for want of support the British were driven out again. But they soon rallied, and now the second line had crossed and formed for attack. The Guards brigade attacked the Vladimir regiment, and on the left the Highland brigade and the cavalry moved forward also. Some of the field artillery, which had now crossed the Alma, fired steadily into the closed masses of the Russian reserve, and the Vladimir regiment lost half of its numbers under the volleys of the Guards. The French were now severely pressing the Russian left, and one-third of Menshikov's forces was drawn into the fight in that quarter. The success of the frontal assault had dispirited the remainder of the defenders, and Menshikov drew off his forces southwards. He had lost 5700 men (Berndt and Hamley). The British had about 2000 killed and wounded; the French stated their losses at 1340 men.

ALMACANTAR (from the Arabic for a sun-dial), an astronomical term for a small circle of the sphere parallel to the horizon; when two stars are in the same almacantar they have the same altitude. The term was also given (1880) to an instrument invented by S. C. Chandler to determine the latitude or correct the timepiece, of great value because of its freedom from instrumental errors.

ALMACK'S, formerly the name of a famous London club and assembly rooms. The founder, known as William Almack, is usually said to have been one Macall, or McCaul, of which name Almack is an anagram. In 1764 he founded a gentlemen's club in Pall Mall, where the present Marlborough Club stands. It was famous for its high play. In 1778 it was taken over by one Brooks, and established as Brooks's Club in St James's Street, where it still exists. In 1765 Almack built a suite of assembly rooms in King's Street, St James's. Here for a ten-guinea subscription a series of weekly balls was given for twelve weeks. They were managed by a committee of ladies of rank, and admission was exceedingly difficult. At Almack's death in 1781 they were left to his niece Mrs Willis. As "Willis's Rooms" they lasted till 1890, when they became a restaurant, but as "Almack's" they ceased in 1863. Several clubs, including a mixed club for ladies and gentlemen, held meetings at Almack's during the 18th and beginning of the 19th centuries. A new London social club (1904) has also adopted the name of Almack's.

ALMADÉN, or ALMADÉN DEL AZOGUE, a town of Spain, in the province of Ciudad Real; situated in mountainous country 55 m. W.S.W. of the city of Ciudad Real. Pop. (1900) 7375. Almadén, the *Sisapon* of the Romans, is celebrated for its mercury mines, which were extensively wrought by the Romans and Moors, and are still productive, the ore increasing in richness with the depth of the descent. The mines ranked with those of Adria, in South Austria, as the most valuable in the world, until the great development of the mercury deposits at New Almaden, in California, U.S.A., between 1853 and 1857. They were long worked by convict labour, owing to their unhealthy atmosphere; and exemption from military service is granted to miners who have worked at Almadén for two years. The annual yield is about 1,400,000 lb. Lead and sulphur are obtained in the neighbourhood. The nearest railway station is that of Chillón, 3 m. S. on the Madrid-Badajoz-Lisbon line.

ALMAGRO, DIEGO DE (1475–1538), Spanish commander, the companion and rival of Pizarro (*q.v.*), was born at Aldea del Rey in 1475. According to another account he was a foundling in the village from which he derived his name. In 1525 he joined Pizarro and Hernando de Luque at Panama in a scheme for the conquest of Peru (see PERU: *History*). He was executed by order of Pizarro in 1538 in consequence of a dispute as to their respective territories.

ALMANAC, a book or table containing a calendar of the days, weeks and months of the year, a register of ecclesiastical festivals and saints' days, and a record of various astronomical phenomena &c. The derivation of the word is doubtful. The word almanac was used by Roger Bacon (*Opus Majus*, 1267) for tables of the apparent motions of the heavenly bodies. The Italian form is *almanacco*, French *almanach*, and the Spanish is *almanaque*; all of which, according to the *New English Dictionary*, are probably connected with the Arabic *al-manākh*, a combination of the definite article *al*, and *manākh*, a word of uncertain origin. An Arabic-Castilian vocabulary (1505) gives *manākh*, a calendar, and *manaḥ*, a sun-dial; *manākh* has also been connected with the Latin *manacus*, a sun-dial.

The attention given to astronomy by Eastern nations probably led to the early construction of such tables as are comprised in our almanacs; of these we know little or nothing. The *fasti* (*q.v.*) of the Romans are far better known and were similar to modern almanacs. Almanacs of a rude kind, known as *clogg almanacs*, consisting of square blocks of hard wood, about 8 in. in length, with notches along the four angles corresponding to the days of the year, were in use in some parts of England as late as the end of the 17th century. Dr Robert Plot (1640–1696), keeper of the Ashmolean Museum and professor of chemistry at Oxford, describes one of these in his *Natural History of Staffordshire* (Oxford, 1686); and another is represented in Gough's edition of Camden's *Britannia* (1806, vol. ii. p. 499).

The earliest almanac regarding which J. J. L. de Lalande (*Bibliographie astronomique*, Paris, 1803) could obtain any definite information belongs to the 12th century. Manuscript almanacs of considerable antiquity are preserved in the British Museum and in the libraries of Oxford and Cambridge. Of these the most remarkable are a calendar ascribed to Roger Bacon (1292), and those of Peter de Dacia (about 1300), Walter de Elvendene (1327) and John Somers (1380). It is to be remembered that early calendars (such as the *Kalendarium Lincolniense* of Bishop Robert Grosseteste) frequently bear the names, not of their compilers, but of the writers of the treatises on ecclesiastical computation on which the calendars are based. The earliest English calendar in the British Museum is one for the year 1431. The first printed almanac known was compiled by Pürbach, and appeared between the years 1450 and 1461; the first of importance is that of Regiomontanus, which appears to have been printed at Nuremberg in 1472. In this work the almanacs for the different months embrace three Metonic cycles, or the 57 years from 1475 to 1531 inclusive. The earliest almanac printed in England was *The Kalendar of Shepardes*, a translation from the French, printed by Richard Pynson about 1497.

Early almanacs had commonly the name of "prognostications" in addition, and what they professed to show may be gathered from titles like the following, which is quoted by J. O. Halliwell: "Pronostycacyon of Mayster John Thybault, medycyner and astronomer of the Emperyall Majestie, of the year of our Lorde God MCCCCCXXXIIJ., comprehending the iiij. partes of this yere, and of the influence of the mone, of peas and warre, and of the sykenesses of this yere, with the constellacions of them that be under the vij. planettes, and the revolucions of kynges and princes, and of the eclipses and comets." Among almanacs of this class published in England, and principally by the Stationers' Company, are Leonard Digges's *Prognostication Everlasting of Right Good Effect*, for 1553, 1555, &c.; William Lilly's *Merlinus Anglicus Junior* for 1644, &c., and other almanacs and "*prognostications*"; John Booker's *Bloody Almanac* and *Bloody Irish Almanac* for 1643, 1647, &c.—the last attributed erroneously to Richard Napier; John Partridge's *Mercurius Coelestis* for 1681, *Merlinus Redivivus*, &c. The name of Partridge has been immortalized in Pope's *Rape of the Lock*; and his almanacs were very cleverly burlesqued by Swift, who predicted Partridge's own death, in genuine prognosticator's style. The most famous of all the Stationers' Company's predicting almanacs was the *Vox Stellarum* of Francis Moore (1657–1715?), the first number of which was completed in July 1700, and contained predictions for 1701.

Its publication has been continued under the title of *Old Moore's Almanac.* Of a different but not a better sort was *Poor Robin*, dating from 1663, and published by the company down to 1828, which abounded in coarse, sometimes extremely coarse, humour.

The exclusive right to sell "almanacs and prognostications" in England, enjoyed in the time of Elizabeth by two members of the Company of Stationers, was extended by James I. to the two universities and the Stationers' Company jointly; but the universities commuted their privilege for an annuity from the company. This monopoly was challenged by Thomas Carnan, a bookseller, who published an almanac for three successive years, after having been thrice imprisoned on that account by the company. The case came, in 1775, before the court of common pleas, and was decided in Carnan's favour, the question argued being, "Whether almanacs were such public ordinances, such matters of state, as belonged to the king by his prerogative, so as to enable him to communicate an exclusive right of printing them to a grantee of the crown?" In 1779 Lord North attempted to reverse this decision by a parliamentary enactment, but the bill was thrown out. In consequence of this the universities lost their title to their annuity, and in lieu of it they received a parliamentary grant. The company, however, virtually retained its monopoly for many years, by buying up as much as possible all the almanacs issued by other publishers, but in more recent times this power has altogether ceased, although a considerable proportion of the almanacs published in England still issue from the hall of the Stationers' Company. A description of "Almanac Day" at Stationers' Hall will be found in Knight's *Cyclopaedia of London* (1851), p. 588.

On the 1st of January 1828 the Society for the Diffusion of Useful Knowledge issued the *British Almanac* for that year—a publication greatly superior in every way to the almanacs of the time. The success of the *British Almanac*, with its valuable supplement, the *Companion to the Almanac*, led to a great improvement in this class of publications. The Stationers' Company issued the *Englishman's Almanac*, a work of a similar kind. The entire repeal in 1834, by the 3rd and 4th Will. IV. c. 57, of the heavy stamp duty, first imposed in 1710, on all almanacs of fifteenpence per copy, gave an additional stimulus to the publication of almanacs of a better class, and from that time the number has greatly increased. Since 1870, the *British Almanac* and *Companion* have been the principal almanacs published by the Stationers' Company. *Whitaker's Almanac*, commenced in 1868 by Joseph Whitaker (1820–1895), is perhaps the best known of modern almanacs.

In Scotland, almanacs containing much astrological matter appeared to have been published at about the beginning of the 16th century; and about a century later those published at Aberdeen enjoyed considerable reputation. In 1683, the *Edinburgh's True Almanack, or a New Prognostication*, appeared; a publication which improved with years and was issued after 1837 as *Oliver and Boyd's New Edinburgh Almanac*, a standard book of reference for Scottish affairs. *Thom's Irish Almanac* (since 1843) deals mainly with Ireland.

The earliest almanac published in the United States is probably to be ascribed to Bradford's press in Philadelphia, for the year 1687. *Poor Richard's Almanac*, commenced in 1732 by Benjamin Franklin under the pseudonym of "Richard Saunders," and continued by him for twenty-five years, gained a high reputation for its wise and witty sayings; it may have been suggested by a somewhat similar publication by Thomas, of Dedham, Massachusetts. *The American Almanac and Repository of Useful Knowledge* was published at Boston from 1828 to 1861; a continuation, *The National Almanac*, was published only twice, for 1863 and 1864. *The Old Farmer's Almanac* enjoys considerable popularity and has been published for many years. At the present time nearly every religious denomination, trade and newspaper have almanacs or year-books.

In France prophetic almanacs circulated very freely among the poorer and rural classes, although an *ordonnance* of Charles IX. required the seal of a diocesan bishop on all almanacs. In 1579 Henry III. prohibited the publication of predictions relating to political events, a prohibition renewed by Louis XIII. Of such almanacs, the most famous was the *Almanach Liégeois* first published in 1625 at Liége by Matthieu Laensbergh, a person of very problematic existence. Publications of this class subsequently increased in number to such an extent that, in 1852, their circulation was forcibly checked by the government. The most important French almanac is the *Almanach Royal*, afterwards *Impérial*, and now *National*, first published in 1679.

A number of publications, issued in Germany, from the middle of the 18th to the middle of the 19th century, under such titles as *Musenalmanach*, modelled on the *Almanach des Muses*, a contemporary almanac published at Paris, contain some of the best works of some of the most celebrated German poets. The *Almanach de Gotha*, which has existed since 1763, published since 1871 both in French and German, gives a particular account of all the royal and princely families of Europe, and ample details concerning the administration and the statistics of the different states of the world.

For the *Nautical Almanac* and similar publications, see EPHEMERIS.

ALMANDINE, or ALMANDITE, a name applied to certain kinds of precious garnet, being apparently a corruption of alabandicus, which is the name applied by Pliny to a stone found or worked at Alabanda, a town in Caria in Asia Minor. Almandine is an iron alumina garnet, of deep red colour inclining to purple. It is frequently cut with a convex face, or *en cabochon*, and is then known as carbuncle. Viewed through the spectroscope in a strong light, it generally shows three characteristic absorption bands, as first pointed out by Prof. A. H. Church.

Almandine occurs rather abundantly in the gem-gravels of Ceylon, whence it has sometimes been called Ceylon-ruby. When the colour inclines to a violet tint, the stone is often called Syrian garnet, a name said to be taken from Syriam, an ancient town of Pegu. Large deposits of fine almandine-garnets were found, some years ago, in the Northern Territory of South Australia, and were at first taken for rubies, whence they were known in trade for some time afterwards as Australian rubies.

Almandine is widely distributed. Fine rhombic dodecahedra occur in the schistose rocks of the Zillerthal, in Tyrol, and are sometimes cut and polished. An almandine in which the ferrous oxide is replaced partly by magnesia is found at Luisenfeld in German East Africa. In the United States there are many localities which yield almandine. Dr G. F. Kunz has figured a crystal of coarse almandine weighing 9¾ lb. from New York city. Fine crystals of almandine embedded in mica-schist occur near Fort Wrangell in Alaska. The coarse varieties of almandine are often crushed for use as an abrasive agent. (See GARNET.)

ALMANSA, or ALMANZA, a town of eastern Spain, in the province of Albacete; 35 m. E.S.E. of Albacete, on the Madrid-Alicante railway. Pop. (1900) 11,180. Almansa is built at the foot of a white limestone crag, which is surmounted by a Moorish castle, and rises abruptly in the midst of a fertile and irrigated plain. About 1 m. S. stands an obelisk commemorating the battle fought here on the 25th of April 1707, in which the French under the duke of Berwick, a natural son of James II. of Great Britain, routed the allied British, Portuguese and Spanish troops. (See SPANISH SUCCESSION, WAR OF THE.)

ALMA-TADEMA, SIR LAURENCE (LAURENS) (1836–   ), British artist, was born on the 8th of January 1836, at Dronrijp, a Frisian village near Leeuwarden, the son of Pieter Tadema, a notary, who died when he was four years old. Alma was the name of his godfather. His mother (d. 1863) was his father's second wife, and was left with a large family. It was designed that the boy should follow his father's profession; but he had so great a leaning towards art that he was eventually sent to Antwerp, where in 1852 he entered the academy under Gustav Wappers. Thence he passed to the *atelier* of Henri (afterwards Baron) Leys. In 1859 he assisted Leys in the latter's frescoes in the hall of the hôtel de ville at Antwerp. In the exhibition of Alma-Tadema's collected works at the Grosvenor Gallery in London in the winter of 1882–1883 were two pictures which may be said to mark the beginning and end of his first period. These were a portrait of himself, dated 1852, and "A Bargain," painted in 1860. His first great success was a picture of "The Education of the Children of Clovis" (1861), which was exhibited at Antwerp. In the following year he received his first gold medal at Amsterdam. The "Education of the Children of Clovis" (three young children of Clovis and Clotilde practising the art of hurling the axe in the presence of their widowed mother, who is training them to avenge the murder of their own parent) was one of a series of Merovingian pictures, of which the finest was the "Fredegonda" of 1878 (exhibited in 1880), where the dejected wife or mistress is watching from behind her curtain window the marriage of Chilperic I. with Galeswintha. It is perhaps in this series that we find the painter moved by the deepest feeling and the strongest spirit of romance. One of the most passionate of all is "Fredegonda at the Death-bed of Praetextatus," in which the bishop, stabbed by order of the queen, is cursing her from his dying bed. Another distinct series is designed to reproduce the life of ancient Egypt. One of the first of this series, "Egyptians 3000 Years Ago," was painted in 1863. A profound depth of pathos is sounded in "The Death of the Firstborn," painted in 1873. Among Alma-Tadema's other notable Egyptian pictures are "An Egyptian at his Doorway" (1865), "The Mummy" (1867), "The Chamberlain of Sesostris" (1869), "A Widow" (1873), and "Joseph, Overseer of Pharaoh's Granaries" (1874). On these scenes from Frankish and Egyptian life Alma-Tadema spent great energy and research; but his strongest art-impulse was towards the presentation of the life of ancient Greece and Rome, especially the latter. Amongst the best known of his earlier pictures of scenes from classical times are "Tarquinius Superbus" (1867), "Phidias and the Elgin Marbles" (1868), and "The Pyrrhic Dance" and "The Wine Shop" (1869). "The Pyrrhic Dance," though one of the simplest of his compositions, stands out distinctly from them all by reason of its striking movement. "Phidias and the Elgin Marbles" is the first of those glimpses of the art-life of classical times, of which "Hadrian in England," "The Sculpture Gallery," and "The Picture Gallery" are later examples. "The Wine Shop" is one of his many pictures of historical *genre*, but marked with a more robust humour than usual. In 1863 Alma-Tadema married a French lady, and lived at Brussels till 1869, when she died, leaving him a widower with two daughters, Laurence and Anna, both of whom afterwards made reputations—the former in literature, the latter in art. In 1869 he sent from Brussels to the Royal Academy two pictures, "Un Amateur romain" and "Une Danse pyrrhique," which were followed by three pictures, including "Un Jongleur," in 1870, when he came to London. By this time, besides his Dutch and Belgian distinctions, he had been awarded medals at the Paris Salon of 1864 and the Exposition Universelle of 1867. In 1871 he married Miss Laura Epps, an English lady of a talented family, who, under her married name, also won a high reputation as an artist. After his arrival in England Alma-Tadema's career was one of continued success. Amongst the most important of his pictures during this period were "The Vintage Festival" (1870), "The Picture Gallery" and "The Sculpture Gallery" (1875), "An Audience at Agrippa's" (1876), "The Seasons" (1877), "Sappho" (1881), "The Way to the Temple" (1883), his diploma work, "Hadrian in Britain" (1884), "The Apodyterium (1886), "The Woman of Amphissa" (1887), "The Roses of Heliogabalus" (1888), "An Earthly Paradise" (1891), and "Spring" (1895). Most of his other pictures have been small canvasses of exquisite finish, like the "Gold-fish" of 1900. These, as well as all his works, are remarkable for the way in which flowers, textures and hard reflecting substances, like metals, pottery, and especially marble, are painted. His work shows much of the fine execution and brilliant colour of the old Dutch masters. By the human interest with which he imbues all his scenes from ancient life he brings them within the scope of modern feeling, and charms us with gentle sentiment and playful humour. He also painted some fine portraits. Alma-Tadema became a naturalized British subject in 1873, and was knighted on the occasion of Queen Victoria's eighty-first birthday, 1899. He was made an associate of the Royal Academy in 1876, and a Royal Academician in 1879. In 1907 he was included in the Order of Merit. He became a knight of the order Pour le Mérite of Germany (Arts and Science Division); of Léopold, Belgium; of the Dutch Lion; of St Michael of Bavaria; of the Golden Lion of Nassau; and of the Crown of Prussia; an officer of the Legion of Honour, France; a member of the Royal Academies of Munich, Berlin, Madrid and Vienna. He received a gold medal at Berlin in 1872 and a grand medal at Berlin in 1874; a first class medal at the Paris International Exhibitions of 1889 and 1900. He also became a member of the Royal Society of Water-colours.

See also Georg Ebers, "Lorenz Alma-Tadema," *Westermann's Monatshefte*, November and December 1885, since republished in volume form; Helen Zimmern, "L. Alma-Tadema, his Life and Work," *Art Annual*, 1886; C. Monkhouse, *British Contemporary Artists* (London, 1899).

ALME or Almai (from *ālim*, wise, learned), the name of a class of singing girls in Egypt who are present at festivals and entertainments, and act as hired mourners at funerals. They are to be distinguished from the ghawazee, or dancing girls, who perform in the public streets and are of a lower order.

ALMEIDA, DOM FRANCISCO DE (*c.* 1450–1510), the first viceroy of Portuguese India, was born at Lisbon about the middle of the 15th century. He was the seventh son of the second count of Abrantes, and thus belonged to one of the most distinguished families in Portugal. In his youth he took part under Ferdinand of Aragon in the wars against the Moors (1485–1492). In March 1505, having received from Emmanuel I. the appointment of viceroy of the newly conquered territory in India, he set sail from Lisbon in command of a large and powerful fleet, and arrived in July at Quiloa (Kilwa), which yielded to him almost without a struggle. A much more vigorous resistance was offered by the Moors of Mombasa, but the town was taken and destroyed, and its large treasures went to strengthen the resources of Almeida. At other places on his way, such as the island of Angediva, near Goa, and Cannanore, he built forts, and adopted measures to secure the Portuguese supremacy. On his arrival in India he took up his residence at Cochin, where a Portuguese fort had been built by Alphonso d'Albuquerque in 1503. The most important events of Almeida's brief but vigorous administration were the conclusion of a commercial treaty with Malacca, and the discoveries made by his son Lorenzo, who acted as his lieutenant. Lorenzo was probably the first Portuguese who visited Ceylon, where he established a settlement, and Fernando Soares, a captain commanding a squadron of his fleet, appears to have been the first European to sight Madagascar. In 1508 he was killed at Dabul in a naval engagement with the Egyptians, who at this time endeavoured to dispute Portuguese supremacy in the Indian Ocean. His father was preparing to avenge his death when Albuquerque (*q.v.*) arrived in Cochin, and presented a commission empowering him to supersede Almeida in the government. It was probably Almeida's unwillingness to be thwarted in his scheme of vengeance that chiefly induced him to refuse to recognize Albuquerque's commission, and to cast him into prison. The punishment he inflicted on the Arabs and their Egyptian allies was speedy and terrible. Sailing along the coast he pillaged and burned various ports, including Goa and Dabul, and finally, encountering the enemy's combined fleet off Diu in February 1509, he completely destroyed it. Returning immediately to Cochin, he held out for a few months against the claims of Albuquerque, but in November 1509 he was compelled to yield. On the 1st of December he set sail for Europe with an escort of three vessels. On the voyage the fleet called at Table Bay, then known as Saldanha Bay, to procure water, and here Almeida was killed (on the 1st of March 1510) in an attack upon the Hottentot natives, during which he showed great personal courage. In this fight, which took place on the site of Cape Town, 65 Portuguese perished, including 12 captains. Almeida's body was recovered on the following day and buried on the spot where he fell.

ALMEIDA, a town of north-eastern Portugal, in the district of Guarda and formerly included in the province of Beira; situated in hilly country between the river Côa, a tributary of the Douro, and the river Turones, a branch of the Agueda. Pop. (1900) 2330. Almeida was long one of the principal frontier fortresses of Portugal. It was captured by the Spaniards in 1762. During the Peninsular War (*q.v.*), the country between the Côa and the Spanish fortress of Ciudad Rodrigo, 25 m. E.S.E., was the scene of hard fighting. Almeida was taken by the French in 1810, and its recapture, by the allied British and Portuguese forces under Lord Wellington, was only effected after a relieving force under Marshal Masséna had been defeated at Fuentes d'Onor (or Fuentes de Oñoro), 13 m. S.S.E. The battle was fought on the 5th of May 1811 and the fortress fell five days later.

ALMELO, a town in the province of Overysel, Holland, 12 m. by rail N.W. of Hengelo, at the junction of the Overysel and Almelo canals. Pop. (1900) 9957. It is a place of considerable antiquity, having been the seat of an independent lordship before the 14th century. But it first rose into importance in the second half of the 19th century owing to its share in the extraordinary industrial development of the Twente district, and now possesses numerous cotton and damask factories. Among the public buildings are a town hall, court house, corn exchange, and churches of various denominations, as well as a synagogue.

The lordship of Almelo belonged to the lords of Heeckeren, who acquired the barony of Rechteren by marriage in 1350 and the countship of Limpourg in 1711. The elder branch of the mediatized house of Rechteren-Limpourg is still established at Almelo; the younger, German branch, at Markt Einersheim in Bavaria.

ALMENDRALEJO, a town of western Spain, in the province of Badajoz; situated 27 m. E.S.E. of Badajoz, on the Merida-Seville railway. Pop. (1900) 12,587. Almendralejo is a thriving town, with broad streets and good modern houses; including the palace of the marquesses of Monsalúd, which contains a museum of Roman antiquities discovered in the neighbourhood. Local prosperity was greatly enhanced during the period 1875–1905 by the improvement of communications, which enabled the grain, fruit and wine of the Guadiana valley, on the north, and of the upland known as the Tierra de Barros, on the south, to be readily exported by the Merida-Seville railway. Brandy is produced in large quantities.

ALMERÍA, a maritime province of southern Spain, formed in 1833, and comprehending the eastern territories of the ancient kingdom of Granada. Pop. (1900) 359,013; area, 3360 sq. m. Almería is bounded on the N. by Granada and Murcia, E. and S. by Murcia and the Mediterranean Sea, and W. by Granada. It is traversed by mountain ridges, with peaks of 6000 to 8000 ft. in altitude; and it is seamed with valleys of great fertility. The chief *sierras*, or ranges, are those of Maria, in the north; Estancias and Oria, north of the Almanzora river; Filabres, in the middle of the province; Cabrera and Gata, along the south-east coast; Alhamilla, east of the city of Almería; Gádor in the south-west; and, in the west, some outlying ridges of the Sierra Nevada. Three small rivers, the Adra, or Río Grande de Adra, in the west, the Almería in the centre, and the Almanzora in the north and east, flow down from the mountains to the sea. On the south coast is the Gulf of Almería, 25 m. wide at its entrance, and terminating, on the east, in the Cabo de Gata, the southernmost point of eastern Spain. The climate is mild, except among the higher mountains. The valleys near the sea are well adapted for agriculture; oranges, lemons, almonds and other fruit trees thrive; silk is produced in the west; and the vine is extensively cultivated, less for the production of wine than to meet the foreign demand for white Almería grapes. Although the cost of transport is very heavy, the exportation of grapes is a flourishing industry, and more than 2,000,000 barrels are annually sent abroad. The cattle of the central districts are celebrated for size and quality. Almería is rich in minerals, especially iron and lead; silver, copper, mercury, zinc and sulphur are also obtained. At the beginning of the 20th century the mines at work numbered more than two hundred, and proved very attractive to foreign as well as native capitalists. Garnets are found in the Sierra de Gata and in the Sierra Nevada fine marble is quarried. The development of mining was facilitated by the extension of the railway system between 1895 and 1905. The main line from Madrid to Almería conveys much ore from Granada and Jaén to the sea; while the railway from Baza to Lorca skirts the Almanzora valley and transports the mineral products of eastern Almería by a branch line from Huércal-Overa to the Murcian port of Águilas. Light railways and aerial cables among the mountains supplement these lines. The chief imports comprise coal, timber, especially oak staves, and various manufactured goods. The exports are minerals, esparto, oil, grain, grapes and farm produce generally. The principal seaports are Almería, the capital, pop. (1900) 47,326, Adra (11,188), and Garrucha (4661), which, with Berja (13,224), Cuevas de Vera (20,562), Huércal-Overa (15,763) and Níjar (12,497), are described in separate articles. Other towns, important as mining or agricultural centres, are Albox (10,040), Dalías (7136), Lubrin (6593), Sorbas (7306), Tabernas (7629), Vélez Blanco (6825), Vélez Rubio (10,109) and Vera (8446). Education is backward and the standard of comfort low. A constant annual loss of 2000 or 3000 emigrants to Algeria and elsewhere prevents any rapid increase of population, despite the high birth-rate and low mortality.

ALMERÍA, the capital of the province of Almería, and one of the principal seaports on the Mediterranean coast of southern Spain; in 36° 5′ N. and 2° 32′ W., on the river Almería, at its outflow into the Gulf of Almería, and at the terminus of a railway from Madrid. Pop. (1900) 47,326. The city occupies part of a rich alluvial valley enclosed by hills. It is an episcopal see, and possesses a Gothic cathedral, dating from 1524, and constructed with massive embattled walls and belfry so as to resemble a fortress. A dismantled castle, the Castillo de San Cristobál, overlooks the city, which contains four Moorish towers rising conspicuously above its modern streets. Two long piers shelter the harbour, and vessels drawing 25 ft. can lie against the quays. About 1400 ships, of nearly 1,000,000 tons, enter the port every year, bringing fuel and timber, and taking cargoes of iron, lead, esparto and fruit. White grapes are exported in very large quantities.

Under its ancient name of Urci, Almería was one of the chief Spanish harbours after the final conquest of Spain by the Romans in 19 B.C. It reached the summit of its prosperity in the middle ages, as the foremost seaport of the Moorish kingdom of Granada. At this time its population numbered 150,000; its cruisers preyed upon the fleets of the neighbouring Christian states; and its merchant ships traded with countries as distant as Egypt and Syria. Almería was captured in 1147 by King Alphonso VII. of Castile and his Genoese troops, but speedily retaken and held by the Moors until 1489, when it was finally secured by the Spaniards.

See D. F. Margall, *Almería*, (Barcelona, 1886).

ALMERY, AUMERY, AUMBRIE, or AMBRY (from the medieval form *almarium*, cf. Lat. *armarium*, a place for keeping tools; cf. O. Fr. *aumoire* and mod. *armoire*), in architecture, a recess in the wall of a church, sometimes square-headed, and sometimes arched over, and closed with a door like a cupboard—used to contain the chalices, basins, cruets, &c., for the use of the priest; many of them have stone shelves. They are sometimes near the piscina, but more often on the opposite side. The word also seems in medieval times to be used commonly for any closed cupboard and even bookcase.

ALMODÓVAR DEL CAMPO, or ALMODÓVAR, a town of Spain, in the province of Ciudad Real, 18 m. S.S.W. of Ciudad Real, on the northern side of the Sierra de Alcúdia. Pop. (1900) 12,525. Almodóvar was a Moorish fortress in the middle ages, but contains little of antiquarian interest. It owes its modern prosperity to the nearness of the valuable Puertollano coal-field, 3 m. S. by a branch of the Madrid-Badajoz-Lisbon railway. Its manufactures are lace and linen and it has a brisk trade in live-stock, oil and wine. South of the Sierra lies the Alcúdia valley, owned by the crown, and used as pasture for immense flocks of sheep.

ALMOGÁVARES (from the Arab. *Al-Mugavari*, a scout), the name of a class of Spanish soldiers, well known during the

Christian reconquest of Spain, and much employed as mercenaries in Italy and the Levant, during the 13th and 14th centuries. The Almogávares (the plural of Almogávar) came originally from the Pyrenees, and were in later times recruited mainly in Navarre, Aragon and Catalonia. They were frontiersmen and foot-soldiers who wore no armour, dressed in skins, were shod with brogues (*abarcas*), and carried the same arms as the Roman legionaries—two heavy javelins (Spanish *azagaya*, the Roman pilum), a short stabbing sword and a shield. They served the king, the nobles, the church or the towns for pay, and were professional soldiers. When Peter III. of Aragon made war on Charles of Anjou after the Sicilian Vespers—30th of March 1282—for the possession of Naples and Sicily, the Almogávares formed the most effective element of his army. Their discipline and ferocity, the force with which they hurled their javelins, and their activity, made them very formidable to the heavy cavalry of the Angevin armies. When the peace of Calatabellota in 1302 ended the war in southern Italy, the Almogávares followed Roger di Flor (Roger Blum) the unfrocked Templar, who entered the service of the emperor of the East, Andronicus, as condottieri to fight against the Turks. Their campaign in Asia Minor, 1303 and 1304, was a series of romantic victories, but their greed and violence made them intolerable to the Christian population. When Roger di Flor was assassinated by his Greek employer in 1305, they turned on the emperor, held Gallipoli and ravaged the neighbourhood of Constantinople. In 1310 they marched against the duke of Athens, of the French house of Brienne. Walter of Brienne was defeated and slain by them with all his knights at the battle of Cephissus, or Orchomenus, in Boeotia in March. They then divided the wives and possessions of the Frenchmen by lot and summoned a prince of the house of Aragon to rule over them. The foundation of the Aragonese duchy of Athens was the culmination of the achievements of the Almogávares. In the 16th century the name died out. It was, however, revived for a short time as a party nickname in the civil wars of the reign of Ferdinand VII.

Authorities.—The Almogávares are admirably described by one who fought with them, Ramon de Muntaner, whose *Chronicle* has been translated into French by J. A. Buchon, *Chroniques étrangères* (Paris, 1860). The original test was reprinted and edited by K. Lanz at Stuttgart, 1844. See also the *Expédition des "Almugávares" ou routiers catalans en orient, de l'an 1302 à l'an 1311*, by G. Schlumberger (Paris, 1902). (D. H.)

ALMOHADES (properly *Muwāḥḥadis*, *i.e.* "Unitarians," the name being corrupted through the Spanish), a Mahommedan religious power which founded the fifth Moorish dynasty in the 12th century, and conquered all northern Africa as far as Egypt, together with Moslem Spain. It originated with Mahommed ibn Tūmart, a member of the Maṣmūda, a Berber tribe of the Atlas. Ibn Tūmart was the son of a lamplighter in a mosque and had been noted for his piety from his youth; he was small, ugly, and misshapen and lived the life of a devotee-beggar. As a youth he performed the pilgrimage to Mecca, whence he was expelled on account of his severe strictures on the laxity of others, and thence wandered to Bagdad, where he attached himself to the school of the orthodox doctor al Ashāri. But he made a system of his own by combining the teaching of his master with parts of the doctrines of others, and with mysticism imbibed from the great teacher Ghazāli. His main principle was a rigid unitarianism which denied the independent existence of the attributes of God, as being incompatible with his unity, and therefore a polytheistic idea. Mahommed in fact represented a revolt against the anthropomorphism of commonplace Mahommedan orthodoxy, but he was a rigid predestinarian and a strict observer of the law. After his return to Morocco at the age of twenty-eight, he began preaching and agitating, heading riotous attacks on wine-shops and on other manifestations of laxity. He even went so far as to assault the sister of the Murābṭi (Almoravide) amir 'Ali III., in the streets of Fez, because she was going about unveiled after the manner of Berber women. 'Ali, who was very deferential to any exhibition of piety, allowed him to escape unpunished.

Ibn Tūmart, who had been driven from several other towns for exhibitions of reforming zeal, now took refuge among his own people, the Maṣmūda, in the Atlas. It is highly probable that his influence would not have outlived him, if he had not found a lieutenant in 'Abd-el-Mūmin el Kūmi, another Berber, from Algeria, who was undoubtedly a soldier and statesman of a high order. When Ibn Tūmart died in 1128 at the monastery or *ribāṭ* which he had founded in the Atlas at Tīnmāl, after suffering a severe defeat by the Murābṭis, 'Abd-el-Mūmin kept his death secret for two years, till his own influence was established. He then came forward as the lieutenant of the Mahdi Ibn Tūmart. Between 1130 and his death in 1163, 'Abd-el-Mūmin not only rooted out the Murābṭis, but extended his power over all northern Africa as far as Egypt, becoming amir of Morocco in 1149. Mahommedan Spain followed the fate of Africa, and in 1170 the Muwāḥḥadis transferred their capital to Seville, a step followed by the founding of the great mosque, now superseded by the cathedral, the tower of which they erected in 1184 to mark the accession of Ya'ḳūb el Manṣūr. From the time of Yūsef II., however, they governed their co-religionists in Spain and Central North Africa through lieutenants, their dominions outside Morocco being treated as provinces. When their amirs crossed the Straits it was to lead a *jehad* against the Christians and to return to their capital, Marrākesh.

The Muwāḥḥadi princes had a longer and a more distinguished career than the Murābṭis or "Almoravides" (*q.v.*). Yūsef II. or "Abu Ya'ḳub" (1163–1184), and Ya'ḳub I. or "El Manṣūr" (1184–1199), the successors of Abd-el-Mūmin, were both able men. They were fanatical, and their tyranny drove numbers of their Jewish and Christian subjects to take refuge in the growing Christian states of Portugal, Castile and Aragon. But in the end they became less fanatical than the Murābṭis, and Ya'ḳub el Manṣūr was a highly accomplished man, who wrote a good Arabic style and who protected the philosopher Averroes. His title of El Manṣur, "The Victorious," was earned by the defeat he inflicted on Alphonso VIII. of Castile at Alarcos in 1195. But the Christian states in Spain were becoming too well organized to be overrun by the Mahommedans, and the Muwāḥḥadis made no permanent advance against them. In 1212 Mahommed III., "En-Nāṣir" (1199–1214), the successor of El Manṣūr, was utterly defeated by the allied five Christian princes of Spain, Navarre and Portugal, at Las Navas de Tolosa in the Sierra Morena. All the Moorish dominions in Spain were lost in the next few years, partly by the Christian conquest of Andalusia, and partly by the revolt of the Mahommedans of Granada, who put themselves under the protection of the Christian kings and became their vassals.

The fanaticism of the Muwāḥḥadis did not prevent them from encouraging the establishment of Christians even in Fez, and after the battle of Las Navas de Tolosa they occasionally entered into alliances with the kings of Castile. In Africa they were successful in expelling the garrisons placed in some of the coast towns by the Norman kings of Sicily. The history of their decline differs from that of the Murābṭis, whom they had displaced. They were not assailed by a great religious movement, but destroyed piecemeal by the revolt of tribes and districts. Their most effective enemies were the Beni Marīn ("Merinides") who founded the next Moroccan dynasty, the sixth. The last representative of the line, Idris IV., "El Wāthik," was reduced to the possession of Marrākesh, where he was murdered by a slave in 1269.

The amirs of the Muwāḥḥadi Dynasty were as follows:—'Abd-el-Mūmin (1145); Yūsef II., "Abu Ya'ḳūb" (1163); Ya'ḳūb I., "Abu Yūsef el Manṣūr" (1184); Mahommed III., "En-Nāṣir" (1190); Yūsef III., "Abu Ya'ḳub el Mustanṣir" (1214); 'Abd-el-Wāhid, "El Makhlūwi" (1223); 'Abd-Allah II., "Abu Mahommed" (1224); Yaḥya V., "El Mu'tāṣim" (1226); Idrīs III., "El Māmūn" (1229); Rashīd I., "'Abd-el-Wāhid II." (1232); 'Ali IV., "Es-Sa'id el Mu tadid" (1242); Omar I., "El Mortaḍa" (1248); Idrīs IV., "El Wāthik" (1266–1269). (B. M.*; D. H.)

ALMON, JOHN (1737–1805), English political pamphleteer and publisher, was born at Liverpool on the 17th of December

1737. In early life he was apprenticed to a printer in his native town, and he also spent two years at sea. He came to London in 1758 and at once began a career which, if not important in itself, had a very important influence on the political history of the country. The Whig opposition, hampered and harassed by the Government to an extent that threatened the total suppression of independent opinion, were in great need of a channel of communication with the public, and they found what they wanted in Almon. He had become personally known to the leaders through various publications of his own which had a great though transient popularity; the more important of these being *The Conduct of a late Noble Commander* [Lord George Sackville] *Examined* (1759); a *Review of his late Majesty's Reign* (1760); a *Review of Mr Pitt's Administration* (1761); and a number of letters on political subjects. The review of Pitt's administration passed through four editions, and secured for its author the friendship of Earl Temple, to whom it was dedicated. Brought thus into the counsels of the Whig party, he was persuaded in 1763 to open a bookseller's shop in Piccadilly, chiefly for the publication and sale of political pamphlets. This involved considerable personal risk, and though he generally received with every pamphlet a sum sufficient to secure him against all contingencies, he deserves the credit of having done much to secure the freedom of the press. The government strengthened his influence by their repressive measures. In 1765 the attorney-general moved to have him tried for the publication of the pamphlet entitled *Juries and Libels*, but the prosecution failed; and in 1770, for merely selling a copy of the *London Museum* containing Junius's celebrated "Letter to the King," he was sentenced by Lord Mansfield to pay a fine of ten marks and give security for his good behaviour. It was this trial that called forth the letter to Lord Mansfield, one of the bitterest of the Junius series. Almon himself published an account of the trial, and of course did not let slip the opportunity of reprinting the matter that had been the ground of indictment; but no further proceedings were taken against him. In 1774 Almon commenced the publication of his *Parliamentary Register*, a monthly report of the debates in parliament, and he also issued an abstract of the debates from 1742, when Richard Chandler's Reports ceased, to 1774. About the same time, having earned a competency, he retired to Boxmoor in Hertfordshire, though he still continued to write on political subjects. He became proprietor in 1784 of the *General Advertiser*, in the management of which he lost his fortune and was declared insolvent. To these calamities was added an imprisonment for libel. The claims of his creditors compelled him to leave the country, but after some years in France he was enabled to return to Boxmoor, where he continued a career of undiminished literary activity, publishing among other works an edition of Junius. His last work was an edition of Wilkes's correspondence, with a memoir (1805). He died on the 12th of December 1805. Almon's works, most of which appeared anonymously, have no great literary merit, but they are of very considerable value to the student of the political history of the period.

ALMOND (from the O. Fr. *almande* or *alemande*, late Lat. *amandola*, derived through a form *amingdola* from the Gr. ἀμυγδάλη, an almond; the *al-* for *a-* is probably due to a confusion with the Arabic article *al*, the word having first dropped the *a-* as in the Italian form *mandola*; the English pronunciation ā-mond and the modern French *amande* show the true form of the word). The almond is the fruit of *Amygdalus communis*, a plant belonging to the tribe Pruneae of the natural order Rosaceae. The genus *Amygdalus* is very closely allied to *Prunus* (Plum, Cherry), in which it is sometimes merged; the distinction lies in the fruit, the soft pulp attached to the stone in the plum being replaced by a leathery separable coat in the almond. The tree appears to be a native of western Asia, Barbary and Morocco; but it has been extensively distributed over the warm-temperate region of the Old World. It ripens its fruit in the south of England. It is a tree of moderate size; the leaves are lanceolate, and serrated at the edges; and it flowers early in spring. The fruit is a drupe, having a downy outer coat, called the epicarp, which encloses the reticulated hard stony shell or endocarp. The seed is the kernel which is contained within these coverings. The shell-almonds of trade consist of the endocarps enclosing the seeds. The tree grows in Syria and Palestine; and is referred to in the Bible under the name of *Shaked*, meaning "hasten." The word Luz, which occurs in Genesis xxx. 37, and which has been translated hazel, is supposed to be another name for the almond. In Palestine the tree flowers in January, and this hastening of the period of flowering seems to be alluded to in Jeremiah i. 11, 12, where the Lord asks the prophet, "What seest thou?" and he replies, "The rod of an almond-tree"; and the Lord says, "Thou hast well seen, for I will hasten my word to perform it." In Ecclesiastes xii. 5 it is said the "almond-tree shall flourish." This has often been supposed to refer to the resemblance of the hoary locks of age to the flowers of the almond; but this exposition is not borne out by the facts of the case, inasmuch as the flowers of the almond are not white but pink. The passage is more probably intended to allude to the hastening or rapid approach of old age. The application of Shaked or *hasten* to the almond is similar to the use of the name "May" for the hawthorn, which usually flowers in that month in Britain. The rod of Aaron, mentioned in Numbers xvii., was taken from an almond-tree; and the Jews still carry rods of almond-blossom to the synagogues on great festival days. The fruit of the almond supplied a model for certain kinds of ornamental carved work (Exodus xxv. 33, 34; xxxvii. 19, 20).

There are two forms of the plant, the one (with pink flowers) producing sweet, the other (with white flowers) bitter almonds. The kernel of the former contains a fixed oil and emulsin. It is used internally in medicine, and must not be adulterated with the bitter almond. The *Pulvis Amygdalae Compositus* of the British Pharmacopoeia consists of sweet almonds, sugar and gum acacia. It may be given in any dose. The *Mistura Amygdalae* contains one part of the above to eight of water; the dose is ½ to 1 oz.

The bitter almond is rather broader and shorter than the sweet almond and has a bitter taste. It contains about 50% of the fixed oil which also occurs in sweet almonds. It also contains a ferment *emulsin* which, in the presence of water, acts on a soluble glucoside, amygdalin, yielding glucose, prussic acid and the essential oil of bitter almonds or benzaldehyde (*q.v.*), which is not used in medicine. Bitter almonds may yield from 6 to 8% of prussic acid.

Oleum Amygdalae, the fixed oil, is prepared from either variety of almond. If intended for internal use, it must, however, be prepared only from sweet almonds. It is a glyceryl oleate, with slight odour and a nutty taste. It is almost insoluble in alcohol but readily soluble in chloroform or ether. It may be used as a pleasant substitute for olive oil. The pharmacopoeial preparations of the sweet almond are used only as vehicles for other drugs. The sweet almond itself, however, has a special dietetic value. It contains practically no starch and may therefore be made into flour for cakes and biscuits for patients suffering from *diabetes mellitus* or any other form of glycosuria. It is a nutritious and very pleasant food.

There are numerous commercial varieties of sweet almond, of which the most esteemed is the Jordan almond, imported from Malaga. Valentia almonds are also valued. Fresh sweet almonds are nutritive and demulcent, but as the outer brown skin sometimes causes irritation of the alimentary canal, they are blanched by removal of this skin when used at dessert.

ALMONER (from Lat. *eleemosynarius*, through med. Lat. *almosynarius*, *almonarius*, and Fr. *almosnier*, *aumosnier*, &c., mod. Fr. *aumônier*), in the primitive sense, an officer in religious houses to whom belonged the management and distribution of the alms of the house. By the ancient canons all monasteries were to spend at least a tenth part of their income in alms to the poor, and all bishops were required to keep almoners. Almoners, as distinct from chaplains, appear early as attached to the court of the kings of France; but the title of grand almoner of France first appears in the reign of Charles VIII.

He was an important court official whose duties comprised the superintendence of the Chapel Royal and all the religious ceremonies of the court. He was a director of the great hospital for the blind (*Quinze-Vingts*), and nominated the regius professors and readers in the Collège de France. The office was revived by Napoleon I., was abolished in 1830, and again created by Napoleon III.; it existed till 1870. In England, the royal almonry still forms a part of the sovereign's household, the officers being the hereditary grand almoner (the marquess of Exeter), the lord high almoner, the sub-almoner, and the secretary to the lord high almoner. The office of hereditary grand almoner is now merely titular. The lord high almoner is an ecclesiastical officer, usually a bishop, who had the rights to the forfeiture of all deodands (*q.v.*) and the goods of a *felo de se*, for distribution among the poor. He had also, by virtue of an ancient custom, the power of giving the first dish from the king's table to whatever poor person he pleased, or, instead of it, alms in money, which custom is kept up by the lord high almoner distributing as many silver pennies as the sovereign has years of age to poor men and women on Maundy Thursday (*q.v.*).

ALMONRY (Lat. *eleemosynarium*, Fr. *aumônerie*, Ger. *Almosenhaus*), the name for the place or chamber where alms were distributed to the poor in churches or other ecclesiastical buildings. At Bishopstone church, Wiltshire, it is a sort of covered porch attached to the south transept, but not communicating with the interior of the church. At Worcester Cathedral the alms are said to have been distributed on stone tables, on each side, within the great porch. In large monastic establishments, as at Westminster, it seems to have been a separate building of some importance, either joining the gatehouse or near it, that the establishment might be disturbed as little as possible.

ALMORA, a town and district of British India, the chief town and administrative headquarters of the Kumaon division of the United Provinces, situated on a mountain-ridge of the Himalayas 5494 ft. above the sea. Pop. (1901) 8596. The town has a college called after Sir Henry Ramsay; a government high school; a Christian girls' school; and a large cantonment. The town was captured by the Gurkhas in 1790, who constructed a fort on the eastern extremity of the ridge. Another citadel, Fort Moira, is situated on the other extremity of the ridge. Almora is also celebrated as the scene of the British victory which terminated the war with Nepal in April 1815, and which resulted in the evacuation of Kumaon by the Gurkhas and the annexation of the province by the British.

The DISTRICT OF ALMORA was constituted in 1891, together with Naini Tal, by a redistribution of the two former districts of Kumaon and the Tarai. It lies among the mountains of Kumaon, between the upper waters of the Ganges and the Gogra, here called the Kali. Area, 5419 sq. m.; pop. (1901) 465,893, showing an increase of 13% during the decade. Tea is grown in the district, which includes the military sanatorium of Ranikhet. The nearest railway via Naini Tal is the extension of the Oudh and Rohilkhand line from near Bareilly to Kathgodam.

ALMORAVIDES (properly *Murābiṭis*, the name being corrupted through the Spanish), a Berber horde from the Sahara which, in the 11th century, founded the fourth dynasty in Morocco. By this dynasty the Moorish empire was extended over Tlemçen and a great part of Spain and Portugal. The name is derived from the Arab. *Murābit*, a religious ascetic (see MARABOUT). The most powerful of the invading tribes was the Lamṭūna ("veiled men") from the upper Niger, whose best-known representatives now are the Tuareg. They had been converted to Mahommedanism in the early times of the Arab conquest, but their knowledge of Islām did not go much beyond the formula of the creed—"there is no god but God, and Mahomet is the apostle of God,"—and they were ignorant of the law. About the year 1040 or a little earlier, one of their chiefs, Yaḥya ibn Ibrāhīm, made the pilgrimage to Mecca. On his way home he attended the teachers of the mosque at Ḳairawān, in Tunisia, who soon learnt from him that his people knew little of the religion they were supposed to profess, and that though his will was good, his own ignorance was great. By the good offices of the theologians of Ḳairawān, one of whom was from Fez, Yaḥya was provided with a missionary, 'Abd-Allah ibn Yāzīn, a zealous partisan of the Mālekis, one of the four orthodox sects of Islām. His preaching was for long rejected by the Lamṭūnas, so on the advice of his patron Yaḥya, who accompanied him, he retired to an island in the Niger, where he founded a *ribāṭ* or Moslem monastery, from which as a centre his influence spread. There was no element of heresy in his creed, which was mainly distinguished by a rigid formalism and strict obedience to the letter of the Koran and the orthodox tradition or Sunna. 'Abd-Allah imposed a penitential scourging on all converts as a purification, and enforced a regular system of discipline for every breach of the law, even on the chiefs. Under such directions the Murābṭis were brought to excellent order. Their first military leader, Yaḥya ibn Omar, gave them a good military organization. Their main force was infantry, armed with javelins in the front ranks and pikes behind, formed into a phalanx and supported by camelmen and horsemen on the flanks. From the year 1053 the Murābṭis began to impose their orthodox and puritanical religion on the Berber tribes of the desert, and on the pagan negroes. Yaḥya was killed in battle in 1056, but 'Abd-Allah, whose influence as a religious teacher was paramount, named his brother Abu Bakr as chief. Under him the Murābṭis soon began to spread their power beyond the desert, and subjected the tribes of the Atlas. They then came in contact with the Berghwāta, a Berber people of central Morocco, who followed a heresy founded by Salaḥ ibn Tārif 300 years previously. The Berghwāta made a fierce resistance, and it was in battle with them that 'Abd-Allah ibn Yāzīn won the crown of martyrdom. They were, however, completely conquered by Abu Bakr, who espoused the defeated chief's widow, Zaīnāb.

In 1061 Abu Bakr made a division of the power he had established, handing over the more settled parts to his cousin Yūsef ibn Tashfīn, as viceroy, resigning to him also his favourite wife Zaīnāb, who had the reputation of a sorceress. For himself he reserved the task of suppressing the revolts which had broken out in the desert, but when he returned to resume control he found his cousin too powerful to be superseded, so he had to go back to the Sahara, where in 1087 he too attained martyrdom, having been wounded with a poisoned arrow in battle with the pagan negroes.

Ibn Tashfīn, who was largely guided by Zaīnāb, had in the meantime brought what is now known as Morocco to complete subjection, and in 1062 had founded the city of Marrākesh ("Morocco City"). He is distinguished as Yūsef I. In 1080 he conquered the kingdom of Tlemçen and founded the present city of that name, his rule extending as far east as Oran. In 1086 he was invited by the Mahommedan princes in Spain to defend them against Alphonso VI., king of Castile and Leon. In that year Yūsef passed the straits to Algeciras, and on the 23rd of October inflicted a severe defeat on the Christians at Sacralias, or in Arabic, Zallāka, near Badajoz. He was debarred from following up his victory by trouble in Africa which he had to settle in person. When he returned to Spain in 1090 it was avowedly for the purpose of deposing the Mahommedan princes and annexing their states. He had in his favour the mass of the inhabitants, who were worn out by the oppressive taxation imposed by their spendthrift rulers. Their religious teachers detested the native Mahommedan princes for their religious indifference, and gave Yūsef a *fetwa*—or legal opinion—to the effect that he had good moral and religious right to dethrone the heterodox rulers who did not scruple to seek help from the Christians whose bad habits they had adopted. By 1094 he had removed them all, and though he regained little from the Christians except Valencia, he reunited the Mahommedan power and gave a check to the reconquest of the country by the Christians. After friendly correspondence with the caliph at Bagdad, whom he acknowledged as Amīr el Mūminīn, "Prince of the Faithful," Yūsef in 1097 assumed the title of "Prince of the Resigned"— Amīr el Muslimīn. He died in 1106, when he was reputed to have reached the age of 100.

The Murābṭi power was at its height at Yūsef's death, and the Moorish empire then included all North-West Africa as far as Algiers, and all Spain south of the Tagus, with the east coast as far as the mouth of the Ebro, and the Balearic Islands. Three years afterwards, under Yūsef's son and successor, 'Ali III. of Morocco, Madrid, Lisbon and Oporto were added, and Spain was again invaded in 1119 and 1121, but the tide had turned, the French having assisted the Aragonese to recover Saragossa. In 1138 'Ali III. was defeated by Alphonso VII. of Castile and Leon, and in 1139 by Alphonso I. of Portugal, who thereby won his crown, and Lisbon was recovered by the Portuguese in 1147. 'Ali III. was a pious nonentity, who fasted and prayed while his empire fell to pieces under the combined action of his Christian foes in Spain and the agitation of the Muwāḥḥadis or "Almohades" (*q.v.*) in Morocco. After 'Ali's death in 1142, his son Tashfīn lost ground rapidly before the Muwāḥḥadis, and in 1145 he was killed by a fall from a precipice while endeavouring to escape after a defeat near Oran. His two successors Ibrāhīm and Isḥāk are mere names. The conquest of the city of Marrākesh by the Muwāḥḥadis in 1147 marked the fall of the dynasty, though fragments of the Murābṭis continued to struggle in the Balearic Islands, and finally in Tunisia.

The amirs of the Murābṭi dynasty were as follows:—Yūsef I., bin Tashfīn (1061); 'Ali III. (1106); Tashfīn I. (1143); Ibrāhim II. (1145); Isḥāk (1146).

See Budgett Meakin, *The Moorish Empire* (London, 1899); the anonymous *Raōḍ el Karṭās* (Fez, 1326), translated by Baymier as *Roudh el-Kartas* (Paris, 1860); Ibn Khaldūn, *Kitāb el 'Aibr . . . fi Aīyām el Maghrib, &c.* (*cir.* 1405), partly translated by de Slane as *Histoire des Berbers*, vol. ii. (Algiers, 1852–1856); Makkāri, *History of the Mahommedan Dynasties in Spain*, translated by Gayangos (London, 1840); *Histoire des Mussulmans d'Espagne*, by R. Dozy, vol. iv. (Leiden, 1861). (B. M.*; D. H.)

ALMQVIST, KARL JONAS LUDWIG (1793–1866), Swedish writer, was born at Stockholm in 1793. He became a student at Upsala, where his father was professor of theology, in 1808, and took his degree in 1815. He began life under highly favourable auspices; but becoming tired of a university career, in 1823 he threw up the position he held in the capital to lead a colony of friends to the wilds of Wermland. This ideal Scandinavian life soon proved a failure; Almqvist found the pen easier to wield than the plough, and in 1828 he returned to Stockholm as a teacher in the new Elementary School there, of which he became rector in 1829. Now began his literary life; and after bringing out several educational works, he made himself suddenly famous by the publication of his great series of novels, called *The Book of the Thorn-Rose* (1832–1835). The career so begun developed with extraordinary rapidity; few writers have equalled Almqvist in productiveness and versatility; lyrical, epic and dramatic poems; romances; lectures; philosophical, aesthetical, moral, political and educational treatises; works of religious edification, studies in lexicography and history, in mathematics and philology, form the most prominent of his countless contributions to modern Swedish literature. So excellent was his style, that in this respect he has been considered the first of Swedish writers. His life was as varied as his work. Unsettled, unstable in all his doings, he passed from one lucrative post to another, at last subsisting entirely on the proceeds of literary and journalistic labour. More and more vehemently he espoused the cause of socialism in his brilliant novels and pamphlets; friends were beginning to leave him, foes beginning to triumph, when suddenly all minor criticism was silenced by the astounding news that Almqvist, convicted of forgery and charged with murder, had fled from Sweden. This occurred in 1851. For many years no more was heard of him; but it is now known that he went over to America and settled in St Louis. During a journey through Texas he was robbed of all his manuscripts, among which are believed to have been several unprinted novels. He is said to have appealed in person to President Lincoln, but the robbers could not be traced. The American adventures of Almqvist remain exceedingly obscure, and some of the most remarkable have been proved to be fabulous. In 1865 he returned to Europe, and his strange and sinister existence came to a close at Bremen on the 26th of September 1866. It is by his romances, undoubtedly the best in Swedish, that his literary fame will mainly be supported; but his singular history will always point him out as a remarkable figure even when his works are no longer read. He was another Eugene Aram, but of greater genius, and so far more successful that he escaped the judicial penalty of his crimes. (E. G.)

ALMS, the giving of relief, and the relief given, whether in goods or money, to the poor, particularly applied to the charity bestowed under a sense of religious obligation (see CHARITY AND CHARITIES). The word in O. Eng. was *aelmysse*, and is derived through the Teutonic adaptation (cf. the modern Ger. *almosen*) of the Latinized form of the Gr. ἐλεημοσύνη, compassion or mercy, from ἔλεος, pity. The English word "eleemosynary," that which is given in the way of alms, charitable, gratuitous, derives direct from the Greek. "Alms" is often, like "riches," wrongly taken as a plural word.

ALMSHOUSE, a house built and endowed by private charity for the residence of poor and usually aged people. The greater portion were built after the Reformation. Two interesting examples are the Hospital of St Cross, near Winchester, founded in 1136, and Coningsby Hospital at Hereford, founded in 1614.

ALMUCE, or AMICE (O. Fr. *aumuce*, O. Eng. *aumuce*, *amys*, *amess*, &c., from late Lat. *almucia*, *almucium*, *armucia*, &c.), a hooded cape of fur, or fur-lined, worn as a choir vestment by certain dignitaries of the Western Church. The origin of the word *almucium* is a philological mystery. The *al-* is probably the Arabic article, since the word originated in the south (Sicilian *almusiu*, Prov. *almussa*, Span. *almucio*, &c.), but the derivation of the second part of the word from a supposed old Teutonic term for cap—Ger. *Mütze*, Dutch *Mutsche*, Scot. *mutch* (*New Eng. Dict. s.* "Amice"; Diez, *Wörterbuch der rom. Spracken*)—is the exact reverse of the truth. The almuce was originally a head-covering only, worn by the clergy, but adopted also by the laity, and the German word *Mütze*, "cap," is later than the introduction of the almuce in church, and is derived from it (M. H. G., 13th century, *almutz*; 14th century, *armus*, *aremus*, &c.; 15th century, *mutz*, *mütze*, &c.). The word *mutzen*, to dock, cut off, which first appears in the 14th century, does not help much, though the name of another vestment akin to the almuce—the *mozzetta*—has been by some traced to it through the Ital. *mozzare* and *mozzo* (but see below).

In numerous documents from the 12th to the 15th century the *almucium* is mentioned, occasionally as identical with the hood, but more often as a sort of cap distinct from it, *e.g.* in the decrees of the council of Sens (1485)—*non caputia, sed almucia vel bireta tenentes in capite.* By the 14th century two types of *almucium* were distinguished: (1) a cap coming down just over the ears; (2) a hood-like cap falling over the back and shoulders. This latter was reserved for the more important canons, and was worn over surplice or rochet in choir. The introduction of the biretta (*q.v.*) in the 15th century tended to replace the use of the almuce as a head-covering, and the hood now became smaller, while the cape was enlarged till in some cases it fell below the elbows. Another form of almuce at this period covered the back, but was cut away at the shoulders so as to leave the arms free, while in front it was elongated into two stole-like ends. Almuces were occasionally made of silk or wool, but from the 13th century onward usually of fur, the hem being sometimes fringed with tails. Hence they were known in England as "grey amices" (from the ordinary colour of the fur), to distinguish them from the liturgical amice (*q.v.*). By the 16th century the almuce had become definitely established as the distinctive choir vestment of canons; but it had ceased to have any practical use, and was often only carried over the left arm as a symbol of office. The almuce has now been almost entirely superseded by the mozzetta, but it is still worn at some cathedrals in France, *e.g.* Amiens and Chartres, at three churches in Rome, and in certain cathedrals elsewhere in Italy. The "grey amice" of the canons of St Paul's at London was put down in 1549, the academic hood being substituted. It was again put down in 1559, and was finally forbidden to the clergy of the English Church by the unratified canons of 1571 (*Report* of the sub-committee of Convocation, 1908).

See du Cange, *Glossarium*, *s.* "Almucia"; Joseph Braun, *Die liturgische Gewandung*, p. 359, &c. (Freiburg im Breisgau, 1907); also the bibliography to the article VESTMENTS.

ALNAGE, or AULNAGE (from Fr. *aune*, ell), the official supervision of the shape and quality of manufactured woollen cloth. It was first ordered in the reign of Richard I. that "woollen cloths, wherever they are made, shall be of the same width, to wit, of two ells within the lists, and of the same goodness in the middle and sides." This ordinance is usually known as the Assize of Measures or the Assize of Cloth. Article 35 of Magna Carta re-enacted the Assize of Cloth, and in the reign of Edward I. an official called an "alnager" was appointed to enforce it. His duty was to measure each piece of cloth, and to affix a stamp to show that it was of the necessary size and quality. As, however, the diversity of the wool and the importation of cloths of various sizes from abroad made it impossible to maintain any specific standard of width, the rules as to size were repealed in 1353. The increased growth of the woollen trade, and the introduction of new and lighter drapery in the reign of Queen Elizabeth, compelled a revision of the old standards. A statute was passed in 1665 creating the office of alnager of the new drapery, and defining the sizes to which cloth should be woven. The object of the statute was to prevent people being deceived by buying spurious woollen cloth, and to provide against fraud and imposition. Owing to the introduction of the alternative standard, a distinction arose between "broadcloth" (cloth of two yards) and "streit" or "strait" (narrow cloth of one yard). The meaning now attached to broadcloth, however, is merely that of material of superior quality. Alnage duties and the office of alnager were abolished in 1699.

See W. J. Ashley, *Economic History*; and W. Cunningham, *Growth of English Industry and Commerce*.

ALNWICK, a market-town and the county-town of Northumberland, England, in the Berwick-upon-Tweed parliamentary division, 309 m. N. by W. from London, on a branch of the North Eastern railway. Pop. of urban district (1901) 6716. It is beautifully situated on the small river Aln, in a hilly district. Its history has left many marks. Dominating the town from an eminence above the south bank of the river stands the castle, held by the Percys since 1309, and long before this an important border stronghold. A gateway of *c.* 1350, a fine Norman arch of the middle of the 12th century, and the ancient well in the keep, are among noteworthy ancient portions; but the castle was extensively renovated and altered in the second half of the 18th century, while in 1854, when the lofty Prudhoe tower was built, a scheme of decoration in Italian style was adopted in the interior; so that the castle, though magnificent, has largely lost its historic character. It contains numerous fine examples of the works of Italian and other artists, and collections of British and Roman and Egyptian antiquities. In the beautiful park are a monument commemorating the capture of William the Lion of Scotland when besieging the town in 1174, two memorial towers, and a British stone chamber. Remains of the wall which formerly surrounded Alnwick are visible, and one of the four gates, the Bondgate, stands, dating from the early part of the 15th century. The church of St Michael has Norman remains, but is principally Perpendicular; it contains several ancient monuments and incised slabs. The modern church of St Paul has a fine east window of German stained glass. Within the confines of the park are ruins of two abbeys. Alnwick Abbey was a Premonstratensian foundation of 1147; only a gateway tower stands, but the ground-plan was excavated in 1884 and is outlined on the surface. At 3 m. from the town are more extensive remains of Hulne Abbey (1240), an early Carmelite monastery. The long narrow church remains unroofed; there are also a gateway tower, and portions of the chapter-house and cloisters. The Norman chapel of the hospital of St Leonard, which, as well as Alnwick Abbey, was founded by Eustace Fitz John, completes the series of antiquities in Alnwick. In this interesting locality, however, there must be mentioned the mansion of Howick, built in the 18th century, in a fine situation near the coast to the N.E. Not far from this, overlooking the sea from a rocky cliff pierced by deep gullies, are the ruins of Dunstanborough Castle; it dates from the 14th century, though the site was probably occupied as a stronghold from earlier times.

The chief industries are brewing, tobacco, snuff and fishing-tackle making, and corn milling. Alnwick is under an urban district council, but is a borough by prescription, and its freemen form a body corporate without authority over the affairs of the town. It is, however, required to pay, under an act of 1882, a sum not less than £500 out of the corporate property towards the upkeep of corporation schools. An ancient peculiar ceremony was attached until modern times to the making of freemen; those elected were required to ride in procession to a large pool called Freemen's Well and there rush through the water According to tradition the observance of this custom was enjoined by King John to punish the inhabitants, the king having lost his way and fallen into a bog owing to the neglected condition of the roads in the neighbourhood.

According to the Chronicle of Alnwick Abbey, the barony of Alnwick belonged before the Conquest to Gilbert Tyson, whose son and heir William was killed at Hastings, and whose estates with his daughter were granted by the king to Ivo de Vescy, although this theory does not seem probable since Gilbert Tyson was certainly not a Saxon. In 1297 William de Vescy, a descendant of Ivo, dying without issue, left the barony to the bishop of Durham, who in 1309 sold it to Sir Henry Percy, in whose family it still continues. The town evidently grew up round the castle, which is said to have been built by Eustace FitzJohn about 1140. Tradition states that it received its borough charter from King John. However, Alnwick is first definitely mentioned as a borough in a charter given by William de Vescy in the reign of Henry II., by which the burgesses were to have common of pasture on Haydon Moor and to hold of him "as freely and quietly as the burgesses of Newcastle hold of the king." This charter was confirmed by his grandson, William de Vescy, in an undated charter, and again by William, son of the latter William, in 1290. According to an inquiry of 1291 a market and fair were held in Alnwick from time immemorial. In 1297 Edward I., in addition, granted the bishop of Durham a market on Saturday, and a fair on the 17th of March and six following days. By charters of Henry VI. the burgesses received licence to enclose their town with a wall, to have a free port at Alnmouth, a market on Wednesday as well as Saturday, and two new fairs on the feasts of SS Philip and James and St Lucy, and eight days following each. Tanning and weaving were formerly the principal industries carried on in Alnwick, and in 1646 there were twenty-two tanneries there. Alnwick has never been represented in parliament.

See George Tate, *The History of the Borough, Castle, and Barony of Alnwick*, 2 vols. (Alnwick, 1866–1869); *Victoria County History, Northumberland.*

ALOE, a genus of plants belonging to the natural order Liliaceae, with about 90 species growing in the dry parts of Africa, especially Cape Colony, and in the mountains of tropical Africa. Members of the closely allied genera *Gasteria* and *Haworthia*, with a similar mode of growth, are also cultivated and popularly known as aloes. The plants are apparently stemless, bearing a rosette of large, thick, fleshy leaves, or have a shorter or longer (sometimes branched) stem, along which, or towards the end of which and its branches, the generally fleshy leaves are borne. They are much cultivated as ornamental plants, especially in public buildings and gardens, for their stiff, rugged habit. The leaves are generally lance-shaped with a sharp apex and a spiny margin; but vary in colour from grey to bright green, and are sometimes striped or mottled. The rather small tubular yellow or red flowers are borne on simple or branched leafless stems, and are generally densely clustered. The juice of the leaves of certain species yields *aloes* (see below). In some cases, as in *Aloe venenosa*, the juice is poisonous. The plant called American aloe, *Agave americana* (*q.v.*), belongs to a different order, viz. Amaryllidaceae.

Aloes is a medicinal substance used as a purgative and produced from various species of aloe, such as *A. vera*, *vulgaris*, *socotrina*, *chinensis*, and *Perryi*. Several kinds of aloes are distinguished in commerce—Barbadoes, Socotrine, hepatic, Indian, and Cape aloes. The first two are those commonly used for medicinal purposes. Aloes is the expressed juice of the leaves of the plant. When the leaves are cut the juice flows out, and is collected and evaporated. After the juice has been obtained, the leaves are sometimes boiled, so as to yield an inferior kind of aloes.

From these plants active principles termed *aloins* are extracted by water. According to W. A. Shenstone, two classes are to be recognized: (1) Nataloins, which yield picric and oxalic acids with nitric acid, and do not give a red coloration with nitric acid; and (2) Barbaloins, which yield aloetic acid, $C_7H_2N_2O_5$, chrysammic acid, $C_7H_2N_2O_6$, picric and oxalic acids with nitric acid, being reddened by this reagent. This second group may be divided into α-Barbaloins, obtained from Barbadoes aloes, and reddened in the cold, and β-Barbaloins, obtained from Socotrine and Zanzibar aloes, reddened by ordinary nitric acid only when warmed, or by fuming acid in the cold. Nataloin, $2C_{17}H_{13}O_7 \cdot H_2O$, forms bright yellow scales, melting at 212°–222°; barbaloin, $C_{17}H_{18}O_7$, forms yellow prismatic crystals. Aloes also contain a trace of volatile oil, to which its odour is due.

The dose is 2 to 5 grains, that of aloin being ½ to 2 grains. Aloes can be absorbed from a broken surface and will then cause purging. When given internally it increases the actual amount as well as the rate of flow of the bile. It hardly affects the small intestine, but markedly stimulates the muscular coat of the large intestine, causing purging in about fifteen hours. There is hardly any increase in the intestinal secretion, the drug being emphatically not a hydragogue cathartic. There is no doubt that its habitual use may be a factor in the formation of haemorrhoids; as in the case of all drugs that act powerfully on the lower part of the intestine, without simultaneously lowering the venous pressure by causing increase of secretion from the bowel. Aloes also tends to increase the menstrual flow and therefore belongs to the group of emmenagogues. Aloin is preferable to aloes for therapeutic purposes, as it causes less, if any, pain. It is a valuable drug in many forms of constipation, as its continual use does not, as a rule, lead to the necessity of enlarging the dose. Its combined action on the bowel and the uterus is of especial value in chlorosis, of which amenorrhoea is an almost constant symptom. The drug is obviously contraindicated in pregnancy and when haemorrhoids are already present. Many well-known patent medicines consist essentially of aloes.

The *lign-aloes* is quite different from the medicinal aloes. The word is used in the Bible (Numb. xxiv. 6), but as the trees usually supposed to be meant by this word are not native in Syria, it has been suggested that the LXX. reading in which the word does not occur is to be preferred. Lign-aloe is a corruption of the Lat. *lignum-aloe*, a wood, not a resin. Dioscorides refers to it as *agallochon*, a wood brought from Arabia or India, which was odoriferous but with an astringent and bitter taste. This may be *Aquilaria agallochum*, a native of East India and China, which supplies the so-called eagle-wood or aloes-wood, which contains much resin and oil.

ALŌIDAE, or ALŌADAE, *i.e.* Otus and Ephialtes, in ancient Greek legend, the twin-sons of Poseidon by Iphimedeia, wife of Aloeus. They were celebrated for their extraordinary stature and strength. According to Homer (*Od.* xi. 305), they made war upon the Olympian gods and endeavoured to pile Pelion upon Ossa in order to storm heaven itself; had they reached the age of manhood, their attempt would have been successful, but Apollo destroyed them before their beards began to grow. In the *Iliad* (v. 365) Ares is imprisoned by them, but delivered by Hermes. Apollodorus says that they succeeded in piling Pelion upon Ossa. Another story is that they were presumptuous enough to seek Artemis and Hera in marriage, and that Artemis caused them to slay each other unintentionally on the island of Naxos, where they were afterwards worshipped as heroes. In punishment for their offences they were bound back to back with snakes to a pillar in the lower world (Hyginus, *Fab.* 28). The Alōidae (here connected with ἀλωή, threshing-floor) represent the spirits of the fertile earth and agriculture, conceived of by the Greeks as engaged in combat with the Olympian gods. In contrast to these legends, Pausanias tells us that they were regarded as the first to worship the Muses on Mt. Helicon, while Diodorus represents them as historical personages, princes of Thessaly, who defeated the Thracians in Strongyle, *i.e.* Naxos, where they made themselves rulers, and subsequently slew one another in a quarrel.

ALOMPRA, ALOUNG P'HOURA (1711–1760), founder of the last Burmese dynasty, was born in 1711 at Mōtshobo, a small village 50 m. north-west of Ava. Of humble origin, he had risen to be chief of his native village when the invasion of Burma by the king of Pegu in 1752 gave him the opportunity of attaining to the highest distinction. The whole country had tamely submitted to the invader, and the leading chiefs had taken the oaths of allegiance. Alompra, however, with a more independent spirit, not only contrived to regain possession of his village, but was able to defeat a body of Peguan troops that had been sent to punish him. Upon this the Burmese, to the number of a thousand, rallied to his standard and marched with him upon Ava, which was recovered from the invaders before the close of 1753. For several years he prosecuted the war with uniform success. In 1754 the Peguans, to avenge themselves for a severe defeat at Keoum-nuoum, slew the king of Burma, who was their prisoner. The son of the latter claimed the throne, and was supported by the tribe of Quois; but Alompra resisted, being determined to maintain his own supremacy. In 1755 Alompra founded the city of Rangoon. In 1757 he had established his position as one of the most powerful monarchs of the East by the invasion and conquest of Pegu. Before a year elapsed the Peguans revolted; but Alompra, with his usual promptitude, at once quelled the insurrection. The Europeans were suspected of having instigated the rising, and the massacre of the English at Negrais in October 1759 is supposed to have been approved by Alompra after the event, though there is no evidence that he ordered it. Against the Siamese, who were also suspected of having abetted the Peguan rebels, he proceeded more openly and severely. Entering their territory, he was just about to invest the capital when he was seized with an illness which proved fatal on the 15th of May 1760. Alompra is one of the most remarkable figures in modern Oriental history. To undoubted military genius he added considerable political sagacity, and he deserves particular credit for his efforts to improve the administration of justice. His cruelty and deceitfulness were faults common to all Eastern despots.

ALONE. This adjective or adverb requires no definition for its meaning of "by oneself" or "solitary"; but its etymological history, as simply a combination of the words "all" and "one" is rather curious (compare the Ger. *allein*). "Lone" is merely a clipped form of the word, and so "lonely." The *New English Dictionary* traces the English word back to the year 1300.

ÁLORA, a town of southern Spain in the province of Málaga; 17 m. W.N.W. of Málaga, on the right bank of the river Guadalhorce, and on the Cordova-Málaga railway. Pop. (1900) 10,525. Álora, which is an ancient and picturesque town, with several Moorish ruins, occupies an outlying hill of the Sierra de Tolox, and overlooks a fertile valley where maize, sugar-cane and date-palms are cultivated. There are hot sulphurous springs in the town, which has also a fine climate; and many of the wealthy families from Málaga reside here in summer. Brandy distilling is, after agriculture, the chief local industry.

ALOST (Flem. *Aalst*), a town of Belgium, in the province of East Flanders, situated on the left bank of the Dender; the ancient capital of what was called Imperial Flanders. Pop. (1897) 28,771; (1904) 31,655. Flanders in the feudal period was a fief of the king of France—the count of Flanders being the first of the twelve peers of France; but there was a small strip extending from Alost to the isles of Zeeland, designated Imperial Flanders, of which the count was the vassal of the Holy Roman emperor. Attached to the hôtel de ville is a fine belfry of the 15th century, but unfortunately it was seriously damaged by fire in 1879. In the church of St Martin, dating from 1498 but unfinished, is a fine Rubens. The subject is St Roch, the patron saint of lepers, and the colouring of the scaly skin of the leper in the forefront of the picture is generally regarded as one of the master's most striking effects. The work was painted to the order of the Brewers' Gild in (it is said) eight days. It was outside Alost that William Clito, grandson of William the Conqueror, who was then endeavouring to establish his claims as count of Flanders, was mortally wounded in 1128. Of all the claims Alost possesses to fame perhaps the most remarkable is that Thierry Maartens (*c.* 1474) set up there one of the first printing presses in Europe. Alost is famous to-day for its hop gardens and linen-bleaching establishments. The meadows south of Alost are often covered with the linen undergoing the process of bleaching, which makes them assume the aspect of a whitish-blue carpet.

ALP. To the Swiss dwellers in the plains the term "the Alps" (*q.v.*) signifies the high snowy mountains which they see on the horizon, but to the dwellers in the valleys which nature has carved in the sides of those high mountains, the word alp means exclusively the summer pastures situated on the slopes above the valley, though below the snow-line. In fact such pastures are essential to the inhabitants of pastoral alpine districts, for the fodder to be obtained in the valley itself would not suffice to support the number of cattle which are required to afford sustenance to the inhabitants. Such mountain pastures, made use of only during the summer months, are of almost immemorial antiquity, cases occurring in 739, 868 and 999, while they are found in all parts of the Alpine chain. In France and Italy the system is badly managed, as also in Tirol (where the local name is *Almen*), where, too, these pastures have in the course of years been largely alienated by the valley inhabitants, and belong to large villages or small towns almost in the plains. But in Switzerland, and especially in the German-speaking mountain districts, the alps are the centre round which the entire pastoral life of the inhabitants turns. It is reckoned that in that country there are now about 4778 alps in all, the capital value of which is put at rather over £3,000,000. Of these alps about 45% are owned by the communes (exclusively or jointly) and 54% by individuals, the remaining 1% being the property of the state or a few great monasteries. In the case of the alps belonging to the Swiss communes, it must be borne in mind that "commune" here does not signify either *Einwohnergemeinden* or *Bürgergemeinden*, but a special class called *Alpgemeinden* (for instance in the well-known valley of Grindelwald there is one *Einwohnergemeinde*, but seven *Alpgemeinden*). These *Alpgemeinden* are composed of the persons who have a right to send cattle up to any particular alp in summer, this right being attached (in different places) either to certain plots of ground in the valley or certain houses in the village, or to certain persons. In any case the owners of an alp fix the greatest number of cows which it can support during the summer without being permanently damaged. The plot of ground which can support a single cow (or 2 heifers, 3 calves or sheep, 4 pigs or 8 goats) is called a *Kuhstoss* (of which there are 270,389 in Switzerland), and it is in these terms that the productiveness of the alp is reckoned. Sometimes a particular alp, or a portion of it, is reserved exclusively to heifers and calves, or to goats (in this case it is the loftier portion). On each alp there are several sets of huts wherein live the cow-herds and cheese-makers (the latter are called *Sennen* or *Fruitiers*), the cattle being generally left in the open. The cattle, with their attendants, shift from one to the other of these sets of huts, between the end of June and the end of September, making but one sojourn at the highest huts, but two at the lower. The proper name for these nuts is *Sennhütten* or *chalets*, but the latter term is incorrectly applied also to houses in the village below. The milk given each day by each cow is entered in a book, and then made into butter and cheese, the cow-herds and cheese-makers having the right to a certain proportion of milk, butter and cheese for their own sustenance, and receiving a small sum per head of cattle for looking after them. At the end of the season the net amount of cheese produced by milk from each cow is handed over to the owner of that particular cow, and is carried down by him to his home in the valley from the hut (a small building on four stone legs to secure the contents from mice) wherein the cheeses have been stored since they were made—this hut is called a *Speicher*. As the owners of *Kuhstössen* may exchange them provisionally for others on another alp, or may hire them out (they can only sell them with the plot or house to which they are attached), the persons who in any given summer actually send cows up to an alp (these form the *Besetzerschaft*) need not necessarily be absolutely identical with the true owners of these rights or *Besitzerschaft*. Hay is never mown on the true alps save in spots which are not easily accessible to cattle (in very high spots it belongs to the mower, and is then called *Wildheu*), but hay-crops are made on the Mayens or *Voralpen*, the lowest pastures, situated between the homesteads and the true alps; these *Voralpen* are individual (not communal) property, though probably in olden days cut out of the true *Alpen*. In the winter the cattle consume the hay mown on these *Voralpen* (which, to a certain extent, are grazed in late spring and early autumn, that is, before and after the summer sojourn on the alps), either living in the huts on the *Voralpen* while they consume it, or in the stable attached to the dwelling-houses in the village; in the barn is stored the hay mown on the homestead and on the meadows near the village, which may belong to the owner of the cattle. The whole system is well organized and is well understood by the natives, though not always by strangers who visit the Alps in summer.

See John Ball, *Hints and Notes for Travellers in the Alps* (article x., especially pp. lvii.-lxv.); new edition, London, 1899; Felix Anderegg, *Illustriertes Lehrbuch für die gesamte schweiz. Alpwirtschaft* (Bern, 1897–1898); the *Schweiz-Alpstatistik* (each volume devoted to the alps of a single Swiss canton); and A. v. Miaskowski's two books, *Die schweiz. Allmend* (Leipzig, 1879), and *Die Verfassung der Land-, Alpen- und Forstwirtschaft der Schweiz* (Basel, 1878). (W. A. B. C.)

ALPACA, one of two domesticated breeds of South American camel-like ungulates, derived from the wild huanaco or guanaco. Alpacas are kept in large flocks which graze on the level heights of the Andes of southern Peru and northern Bolivia, at an elevation of from 14,000 to 16,000 ft. above the sea-level, throughout the year. They are not used as beasts of burden like llamas, but are valued only for their wool, of which the Indian blankets and ponchos are made. The colour is usually dark brown or black and the coat of great length, reaching nearly to the ground. In stature the alpaca (*Lama huanacos pacos*) is considerably inferior to the llama, but has the same unpleasant habit of spitting.

In the textile industries "alpaca" is a name given to two distinct things. It is primarily a term applied to the wool, or rather hair, obtained from the Peruvian alpaca. It is, however, more broadly applied to a style of fabric originally made from the alpaca wool but now frequently made from an allied type of wool, viz. mohair, Iceland, or even from lustrous English wool. In the trade, distinctions are made between alpacas and the several styles of mohairs and lustres, but so far as the general purchaser is concerned little or no distinction is made.

The four species of indigenous South American wool-bearing animals are the llama, the alpaca, the guanaco and the vicuña. The llama and the alpaca are domesticated; the guanaco and the vicuña run wild. Of the four the alpaca and the vicuña are the most valuable wool-bearing animals: the alpaca on account of the quality and quantity, the vicuña on account of the softness, fineness and quality of its wool. In the early days of the 19th century, the usual length of alpaca staples appears to have been about 12 in., this being a three years' growth; but to-day the length is little more than about half this, *i.e.* a one to two years' growth, although from time to time longer staples are to be found. The fleeces are sorted for colour and quality by skilled native women. The colour of the greater proportion of alpaca imported into the United Kingdom is black and brown, but there is also a fair proportion of white, grey and fawn. It is customary to mix these colours together, thus producing a curious ginger-coloured yarn, which upon being dyed black in the piece takes a fuller and deeper shade than can be obtained by piece-dyeing a solid-coloured wool. In physical structure alpaca is somewhat akin to hair, being very glossy, but its softness and fineness enable the spinner to produce satisfactory yarns with comparative ease.

The history of the manufacture of this wool into cloth is one of the romances of commerce. Undoubtedly the Indians of Peru employed this fibre in the manufacture of many styles of fabrics for centuries before its introduction into Europe as a commercial product. The first European importations would naturally be into Spain. Spain, however, transferred the fibre to Germany and France. Apparently alpaca yarn was spun in England for the first time about the year 1808. It does not appear to have made any headway, however, and alpaca wool was condemned as an unworkable material. In 1830 Benjamin Outram, of Greetland, near Halifax, appears to have again attempted the spinning of this fibre, and for the second time alpaca was condemned. These two attempts to use alpaca were failures owing to the style of fabric into which the yarn was woven—a species of camlet. It was not until the introduction of cotton warps into the Bradford trade about 1836 that the true qualities of alpaca could be developed in the fabric. Where the cotton warp and mohair or alpaca weft plain-cloth came from is not known, but it was this simple yet ingenious structure which enabled Titus Salt (*q.v.*), then a young Bradford manufacturer, to utilize alpaca successfully. Bradford is still the great spinning and manufacturing centre for alpacas, large quantities of yarns and cloths being exported annually to the continent and to the United States, although the quantities naturally vary in accordance with the fashions in vogue, the typical "alpaca-fabric" being a very characteristic "dress-fabric."

The following statistics, taken from Hooper's *Statistics of the Woollen and Worsted Trades of the United Kingdom*, give an idea of the extent of the trade in yarns and fabrics of the alpaca type; unfortunately statistics for alpaca alone are not published.

Alpaca, Vicuña, and Llama Wool imported into the United Kingdom.

Year.	Peru.		Chile.[1]	
	lb	£	lb	£
1854	1,247,015	124,946	15,573	1,557
1860	2,334,048	263,635	520,402	58,443
1870	3,324,454	388,969	563,782	65,996
1880	1,412,365	98,644	890,627	64,621
1890	3,114,336	190,703	564,606	30,694
1900	4,236,566	205,839	1,148,694	51,116
1902	5,038,998	259,927	1,028,171	47,610
1905	2,301,522	119,321	2,302,650	112,367

Note.—In 1840 the imports into, exports from, and consumed in the United Kingdom of mohair, alpaca, vicuña, &c., amounted to £50,000.

Exports of Mohair and Alpaca Yarns for 1905.

Russia . . .	1,288,800 lb .	£168,596
Germany . . .	9,851,200 ,, .	1,145,795
Belgium . . .	316,400 ,, .	40,409
France . . .	2,006,700 ,, .	223,605

Exports of Alpaca from the United Kingdom to the United States.

1881 . .	£1,256	1900 . .	£30,631
1890 . .	—	1905 . .	4,954

Owing to the success in the manufacture of the various styles of alpaca cloths attained by Sir Titus Salt and other Bradford manufacturers, a great demand for alpaca wool arose, and this demand could not be met by the native product, for there never seems to have been any appreciable increase in the number of alpacas available. Unsuccessful attempts were made to acclimatize the alpaca goat in England, on the European continent and in Australia, and even to cross certain English breeds of sheep with the alpaca. There is, however, a cross between the alpaca and the llama—a true hybrid in every sense—producing a material placed upon the Liverpool market under the name "Huarizo." Crosses between the alpaca and vicuña have not proved satisfactory.

The preparing, combing, spinning, weaving and finishing of alpacas and mohairs are dealt with under WOOL. (A. F. B.)

ALP ARSLAN, or AXAN, **MAHOMMED BEN DA'UD** (1029–1072), the second sultan of the dynasty of Seljuk, in Persia, and great-grandson of Seljuk, the founder of the dynasty, was born in the year A.D. 1029 (421 of the Hegira). He assumed the name of Mahommed when he embraced the Mussulman faith; and on account of his military prowess he obtained the surname *Alp Arslan*, which signifies "a valiant lion." He succeeded his father Da'ud as ruler of Khorasan in 1059, and his uncle Togrul Bey as sultan of Oran in 1063, and thus became sole monarch of Persia from the river Oxus to the Tigris. In consolidating his empire and subduing contending factions he was ably assisted by Nizām ul-Mulk, his vizier, one of the most eminent statesmen in early Mahommedan history. Peace and security being established in his dominions, he convoked an assembly of the states and declared his son Malik Shah his heir and successor. With the hope of acquiring immense booty in the rich church of St Basil in Caesarea, the capital of Cappadocia, he placed himself at the head of the Turkish cavalry, crossed the Euphrates and entered and plundered that city. He then marched into Armenia and Georgia, which, in 1064, he finally subdued. In 1068 Alp Arslan invaded the Roman empire. The emperor Romanus Diogenes, assuming the command in person, met the invaders in Cilicia. In three arduous campaigns, the two first of which were conducted by the emperor himself while the third was directed by Manuel Comnenus, the Turks were defeated in detail and finally (1070) driven across the Euphrates. In 1071 Romanus again took the field and advanced with 100,000 men, including a contingent of the Turkish tribe of the Uzes and of the French and Normans, under Ursel of Baliol, into Armenia. At Manzikert, on the Murad Tchai, north of Lake Van, he was met by Alp Arslan; and the sultan having proposed terms of peace, which were scornfully rejected by the emperor, a battle took place in which the Greeks, after a terrible slaughter, were totally routed, a result due mainly to the rapid tactics of the Turkish cavalry. Romanus was taken prisoner and conducted into the presence of Alp Arslan, who treated him with generosity, and terms of peace having been agreed to, dismissed him, loaded with presents and respectfully attended by a military guard. The dominion of Alp Arslan now extended over the fairest part of Asia; 1200 princes or sons of princes surrounded his throne and 200,000 warriors were at his command. He now prepared to march to the conquest of Turkestan, the original seat of his ancestors. With a powerful army he advanced to the banks of the Oxus. Before he could pass the river with safety it was necessary to subdue certain fortresses, one of which was for several days vigorously defended by the governor, Yussuf Kothual, a Kharizmian. He was, however, obliged to surrender and was carried a prisoner before the sultan, who condemned him to a cruel death. Yussuf, in desperation, drew his dagger and rushed upon the sultan. Alp Arslan, the most skilful archer of his day, motioned to his guards not to interfere and drew his bow, but his foot slipped, the arrow glanced aside and he received the assassin's dagger in his breast. The wound proved mortal, and Alp Arslan expired a few hours after he received it, on the 15th of December 1072.

See Gibbon, *Decline and Fall of the Roman Empire*, edited by J. B. Bury (1898), vi. pp. 235 et seq., and authorities there cited.

ALPENA, a city and the county seat of Alpena county, Michigan, U.S.A., on Thunder Bay, a small arm of Lake Huron, at the mouth of Thunder Bay river, in the N.E. part of the lower peninsula. Pop. (1890) 11,283; (1900) 11,802, of whom 4103 were foreign-born; (1906 estimate) 12,715. It is served by the Detroit & Mackinac railway and by steamboat lines to Detroit and other ports. The city is built on sandy ground on both sides of the river and has a good harbour, which has been considerably improved by the Federal government; in 1907 the maximum draft that could be carried over the shallowest part of the channel was 14 ft. There is good farming land in the vicinity and Alpena has lumber and shingle mills, pulp works, Portland cement manufactories and tanneries; in 1905 the city's factory products were valued at $2,905,263. In 1906 the commerce of the port, chiefly in lumber, cement, coal, cedar posts and ties, fodder and general merchandise, was valued at $3,018,804. Alpena occupies the site of an Indian burying-ground. A trading-post was established here in 1835, but the permanent settlement dates from 1858; in 1871 Alpena was chartered as a city.

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[1] Grown in Peru but shipped from Valparaiso.

ALPENHORN, ALPHORN, a musical instrument, consisting of a natural wooden horn of conical bore, having a cup-shaped mouthpiece, used by mountaineers in Switzerland and elsewhere. The tube is made of thin strips of birchwood soaked in water until they have become quite pliable; they are then wound into a tube of conical form from 4 to 8 ft. long, and neatly covered with bark. A cup-shaped mouthpiece carved out of a block of hard wood is added and the instrument is complete. The alpenhorn has no lateral openings and therefore gives the pure natural harmonic series of the open pipe. The harmonics are the more readily obtained by reason of the small diameter of the bore in relation to the length. An alpenhorn made at Rigi-Kulm, Schwytz, and now in the South Kensington Museum, measures 8 ft. in length and has a straight tube. The well-known *Rans des Vaches* is the traditional melody of the alpenhorn, which has been immortalized by Beethoven in the finale of the *Pastoral Symphony*, where the music is generally rendered by a *cor anglais* (*q.v.*). Rossini has introduced the melody into his opera *William Tell*. Wagner, in the third act of *Tristan and Isolde*, was not entirely satisfied with the tone quality of the *cor anglais* for representing the natural pipe of the peasant. Having in his mind the timbre of the alpenhorn, he had a wooden horn made for him with one valve only and a small pear-shaped bell, which is used at Bayreuth (see HOLZTROMPETE). The Swiss alpenhorn varies in shape according to the locality, being curved near the bell in the Bernese Oberland. Michael Praetorius mentions the alpenhorn under the name of *holzern trummet* in *Syntagma Musicum* (Wittenberg, 1615–1619). (K. S.)

ALPES MARITIMES, a department in the S.E. of France, formed in 1860 out of the county of Nice, to which were added the districts of Grasse (formerly in the department of the Var) and of Mentone (purchased from the prince of Monaco). Pop. (1906) 334,007. It is bounded N.E. and E. by Italy, S. by the Mediterranean Sea, and W. by the departments of the Var and the Basses Alpes, while its northern extremity forms a sharp angle between France and Italy. Its area is 1444 sq. m., its greatest length is 59 m. and its greatest breadth 48½ m. It is composed of the valley of the Var river (which is all but completely within this department), together with those of its chief affluents, the Tinée and the Vésubie. The region of Grasse is hilly, but the rest of the department is mountainous, its loftiest point being the Mont Tinibras (9948 ft.) at the head of the Tinée valley. Two singular features of the frontier of the department towards the east are only to be explained by historical reasons. One is that the central bit of the Roja valley is French, while the upper and lower bits of this valley are Italian; the reason is that those bits which are now Italian formed part of the county of Ventimiglia, and the central bit part of the county of Nice, which alone became French in 1860. The result is that the Italians are now unable to build a railway from Cuneo by the Col de Tenda and down the Roja valley direct to Ventimiglia. The other strange feature is that from near Isola in the upper Tinée valley southwards the political frontier does not coincide with the physical frontier, or the main watershed of the Alpine chain; the reason (it is said) is that in 1860 all the higher valleys of the Maritime Alps (on both sides of the watershed) were expressly excepted from the treaty of cession, in order that Victor Emmanuel II. might retain his right of chamois hunting in these parts. The department is divided into three arrondissements (Nice, Grasse and Puget Théniers), 27 cantons and 155 communes. It forms the bishopric of Nice (the first bishop certainly known is mentioned at the end of the 4th century), which till 1792 was in the ecclesiastical province of Embrun, then (1802) in that of Aix en Provence, next in that of Genoa (1814), and finally (1860) in that of Aix again. Its chief town is Nice. The broad-gauge railways in the department cover 56 m., including the line along the coast, while there are also 82 m. of narrow-gauge railways. The chief industries are distilleries for perfumes and manufacture of olive oil, of pottery and of tiles, besides a great commerce in cut flowers. To foreigners the department is best known for its health resorts, Nice, Cannes, Mentone, Antibes and Beaulieu, while other important towns are Grasse and Puget Théniers. (W. A. B. C.)

ALPHA and OMEGA (A and Ω), the first and last letters of the Greek alphabet, corresponding to the *Aleph* and *Taw* of the Hebrew. They are used as a designation of Himself by the speaker in Rev. i. 8; xxi. 6; xxii. 13. The first and last letters of the Hebrew alphabet are used in Rabbinic writings in a similar way. We find also "the seal of God is Emeth," Emeth (truth) being composed of the first, middle and last letters of the Hebrew alphabet. God is thus represented as the beginning, middle and end of all things (see the *Jewish Encyclopaedia*, s.v.).

ALPHABET (see also WRITING). By the word *alphabet*, derived from the Greek names for the first two letters—*alpha* and *beta*—of the Greek alphabet, is meant a series of conventional symbols each indicating a single sound or combination of sounds. The ideal alphabet would indicate one sound by one symbol, and not more than one sound by the same symbol. Symbols for a combination of sounds are not necessary, though they may be convenient as abbreviations. In the writing of some languages, *e.g.* Sanskrit, such abbreviations are carried to an extreme; in most Greek MSS. also they are of very frequent occurrence. These contractions, however, may prove too great a strain upon the eyesight or the memory, and thus become a hindrance instead of a help. This was apparently the case in Greek, for though the early printers cast types for all the contractions of the Greek MSS. these have now with one consent been given up. A consonant like *x* can only be regarded as an abbreviation; it expresses nothing that cannot as well be expressed by *ks* or *gz*, both of which combinations in different situations it may represent (see **X**). No alphabet corresponds exactly to the ideal which we have postulated, nor if it did, would it continue long so to do, as the sounds of most languages are continually changing. Hence in the case of dead languages or past forms of living languages, it is often very difficult to define with precision what the sounds of the past epoch were. The study of the history of English pronunciation occupied the late Dr A. J. Ellis for a large part of his life, and the results fill five large volumes. The sounds which are most difficult to define exactly are the vowels; a great variety may be indicated by the same symbol. In the New English Dictionary no fewer than thirteen different *nuances* of vowel sound are distinguished under the symbol **A** alone. In English, moreover, the vowel sounds tend to become diphthongs, so that the symbol for the simple sound tends to become the symbol for that combination which we call a diphthong. Thus the long *ī* in *ride*, *wine*, &c., has become the diphthong *ai*, and the name of the symbol **I** is itself so pronounced. In familiar, if vulgar, dialects, **A** tends in the same direction. In the "cockney" dialect, really the dialect of Essex but now no less familiar in Cambridge and Middlesex, the *ai* sound of *ī* is represented by *oi* as in *toime*, "time," while *ā* has become *ai* in *Kate*, *pane*, &c. In all southern English *ō* becomes more rounded while it is being pronounced, so that it ends with a slight *u* sound. In the vulgar dialect already mentioned, the sound begins as a more open sound than in the cultivated pronunciation, so that *no* is really pronounced as *naou*. It is clear, therefore, that the best alphabet would not long indicate very precisely the sounds which it was intended to represent. See PHONETICS.

But the history of the alphabet shows that at no time has it represented any European language with much precision, because it was an importation adapted in a somewhat rough and ready fashion to represent sounds different from those which it represented outside Europe. Wherever the alphabet may have originated, there seems no doubt that its first importation in a form closely resembling that with which we are familiar in modern times was from the Phoenicians to the Greeks. The Phoenicians were certainly using it with freedom in the 9th century B.C.; with so much freedom, indeed, that they must have been in possession of it for a considerable time before we can trace it. With the materials available up to August 1910 it would be idle here to attempt to trace its earlier history. Great discoveries in Cappadocia, Assyria and Egypt were then only at their beginning, and any statement was liable to be quickly disproved by the appearance of new evidence. The prevalent theory, universally accepted till a few years ago, was that of Vicomte Emmanuel de Rougé, first propounded to the Académie des Inscriptions in 1859, but unnoticed by the world at large till republished, after de Rougé's death, by his son in 1874. According to this view the alphabet was borrowed by the Phoenicians from the cursive (hieratic) form of Egyptian hieroglyphics. The resemblances between some Egyptian symbols and some symbols of the Phoenician alphabet are striking; in other cases the differences are no less remarkable. As a matter of fact the Egyptians might have passed about thirty-five centuries B.C. from the picture writing of hieroglyphs to genuine alphabetic signs.[1] They did not, however, profit by their discovery, because, amongst the Egyptians, writing was clearly a mystery in both senses—only possible at that period for masters in the craft, and also something, like the writing of medical prescriptions at the present day in Latin, which was not to be made too easily intelligible to the common people. At all periods, moreover, hieroglyphic writing was a branch of decorative art, and it may have been that the ancient Egyptian, like the modern Turk, resented too much lucidity, and liked his literary compositions to be veiled in a certain obscurity. The alphabet devised by the Egyptians consisted of twenty-four letters. Egyptologists are at variance on the question whether this alphabet was the original, or had any influence upon the development of the Phoenician alphabet. "With the papyrus paper," says Professor Breasted,[2] "the hand customarily written upon it in Egypt now made its way into Phoenicia, where before the 10th century B.C. it developed into an alphabet of consonants, which was quickly transmitted to the Ionian Greeks and thence to Europe." On the other hand, Professor Spiegelberg,[3] writing soon after Professor Breasted, says that investigation has not as yet furnished proof that the Phoenician alphabet is of Egyptian origin, though he admits that in some respects the development of the two alphabets, both without vowel signs, is curiously parallel.

The most recent view is that of Dr A. J. Evans, who argues ingeniously that the alphabet was taken over from Crete by the "Cherethites and Pelethites" or Philistines, who established for themselves settlements on the coast of Palestine.[4] From them it passed to the Phoenicians, who were their near neighbours, if not their kinsfolk. Symbols like the letters of the alphabet have been found in European soil painted upon pebbles belonging to a stratum between the Palaeolithic and Neolithic age.[5] This was in France at Mas d'Azil on the left bank of the Arize. Elsewhere several series of such symbols resembling inscriptions have been found scratched on bones of the same period.[6] For the history of writing these may be important, but for the history of the alphabet, as we know it, they are not in question. The alphabet may have originated as Dr Evans thinks, but at present the proof is not conclusive. The Greek names of the letters, their forms, and the order of the symbols show that the Greek alphabet as we know it must have been imported by or from a Semitic people, and there is no evidence to contradict ancient tradition that this people was the Phoenicians. The view propounded by Deecke[7] in 1877, that the Phoenician alphabet had developed out of the late Assyrian cuneiform, never met with much acceptance and has really no evidence in its favour.

The earliest alphabetic document which can be dated with comparative certainty is the famous Moabite stone, which was discovered in 1868, and after a controversy between rival claimants which led to its being broken in pieces by the Arabs, ultimately reached the Louvre, where in a restored form it remains. The long inscription upon it celebrates the achievements of Mesha, king of Moab, who had been a tributary of Ahab, king of Israel, and rebelled after his death (1 Kings iii. 4, 5). Though the chronology of the period is somewhat uncertain, the date must be in the first half of the 9th century B.C. It is to be remembered, however, that important as this monument is for the development of the alphabet, and because it can be dated with tolerable accuracy, the dialect and alphabet of Moab are not in themselves proof for the Phoenician forms which influenced the peoples of the Aegean, and through them Western Europe. The fragment of a bronze bowl discovered in Cyprus in 1876, which bears round its edge an inscription dedicating it to Baal-Lebanon as a gift from a servant of Hiram, king of the Sidonians, is probably the oldest Phoenician document which we possess. This bowl, though perhaps a little earlier than the Moabite stone, in all probability is not more than a century older, while some authorities think it is even later. The earliest alphabet consisted of twenty-two letters, and bears a very close resemblance to the earliest Greek alphabet from A to T. The symbols in the Greek alphabet from Y to Ω, or in the numerical alphabet to ϡ, are not found in the Phoenician alphabet.

As already mentioned, the twenty-two symbols of the Phoenician alphabet indicate consonantal sounds only. Greek did not possess so many consonants. The Phoenician alphabet possessed many more aspirates than were required in Greek, which tended more and more to drop all its aspirates. Before history begins it had also lost, except sporadically in out-of-the-way dialects, the semi-vowel *i* (approximately English *y*). It therefore made the aspirates A, E, O and the semi-vowel I into vowels, and apparently converted the semi-vowel Y = *w* into the vowel Y = *u*, which it placed at the end of the alphabet and substituted for it as the sixth symbol of the alphabet the letter F with the old value of *w*. The superfluous sibilants were also adapted in various ways (see below).

Relationship of Greek to Phoenician.

The discovery of a large number of very archaic inscriptions in the island of Thera, which was made by Freiherr Hiller von Gärtringen in 1896, has shown that the earliest Greek alphabet was even more like the Phoenician than had been heretofore believed. The symbol for *β* in Thera (∂) is nearer than any previously known to the Semitic letter (𐤁) though, as not infrequently happens in the transference of a symbol from one people to another, its position is inverted—a fate which in this alphabet has befallen also λ (Semitic 𐤋, Thera ⅂), and possibly *σ* (Semitic 𐤔, Thera M). The era of excavation initiated by Dr Schliemann on the grand scale has increased our knowledge of Greek inscriptions beyond anything that was earlier dreamt of. Besides the excavations of Athens, Delos, Epidaurus and Delphi, the results of which are most important for the 5th century B.C. and later, the exploration of the sites of Olympia, of the Heraeum near Argos, of Naucratis in Egypt, and of various Cretan towns (above all the ancient Gortyn), has revolutionized our knowledge of the archaic alphabets of Greece. We can now see how long and laborious was the process by which the Greeks attained to uniformity in writing and in numeration. In no field, perhaps, was the centrifugal tendency of the Greeks more persistent than in such matters. In numeration, indeed, uniformity was not attained till at least the 2nd century of the Christian era. The differentiation of the local alphabets is found from the very beginning of our records. Unfortunately, as yet no record is preserved which can with any probability be dated earlier than the 7th century B.C., and the Phoenician influence had by then nearly ceased. How long this influence lasted we cannot tell. If in Crete a system of writing of an entirely different nature had been developed seven or eight centuries before, there must have been some very important reason for the entire abandonment of the old method and the adoption of a new. In Crete, at least, the excavations show that the old civilization must have ended in a social and political cataclysm. The magnificent palace of Minos—there seems no reason to withhold from it the name of the great prince whom Thucydides recognized as the first to hold the empire of the sea—perished by the flames, and it evidently had been plundered beforehand of everything that a conqueror would regard as valuable. The only force in Greek history which we know that could have produced this change was that of the Dorian conquest. As everywhere in the Peloponnese, except at Argos, there seems to have been a sudden break with the earlier civilization, which can have been occasioned only by the semi-barbarous Dorian tribes, so the same result seems to have followed from the same cause in Thera. The Dorians apparently were without an alphabet, and consequently when Phoenician traders and pirates occupied the place left vacant by the downfall of Minos's empire, the people of the island, and of the sea coasts generally, adopted from them the Phoenician alphabet.[1] The Greeks who migrated to Cyprus, possibly as the result of the Dorian invasion, adopted a syllabary, not an alphabet (see Plate; also WRITING). That the alphabet was borrowed and adapted independently by different places not widely separated, and that the earliest Greek alphabets did not spread from one or a few centres in Greek lands, seem clear (*a*) from the different Greek sounds for which the Phoenician symbols were utilized; (*b*) from the different symbols which were employed to represent sounds which the Phoenicians did not possess, and for which, therefore, they had no symbols. The Phoenician alphabet was an alphabet of consonants only, but all Greek alphabets as yet known agree in employing A, E, I, O, Y as vowels. On the other hand, a table of Greek alphabets[2] will show how widely different the symbols for the same sound were. Except for a single Attic inscription (see Plate), the alphabets of Thera and of Corinth are the oldest Greek alphabets which we possess. Yet at Corinth alongside E Ǝ, which is found for the so-called spurious diphthong ει (*i.e.* the Attic ει, which does not represent an Indo-European ει, but arises by contraction, as in φιλεῖτε, or through the lengthening of the vowel sound as the result of the loss of a consonant, as in *εἰρημένος* for *ϝεϝρημένος*) the short ε sound is represented by B; ι is found at Corinth in its oldest form Ƹ, and also as Σ, while in Thera it is ϟ. In Thera the *w* sound of digamma (*F*) was entirely lost, and therefore is not represented. Both Thera and Corinth employ in the earliest inscriptions ǂ for ζ, not ξ, though in both alphabets the ordinary use as ξ is adopted, no doubt through the influence of trade with other states. On the other hand, at Cleonae, which is distant not more than 8 or 9 m. from Corinth, an ancient inscription written *βουστροφηδόν* has recently been discovered, which shows that though Cleonae for B wrote ⅃, like the Corinthian ᒍ, and, as at Corinth, wrote B for a vowel sound, the vowel thus represented was not short and long e (ε and η) as at Corinth, but η only, as in XPBMA MB (*χρῆμα μή*). Here Ǝ represents ε, and the spurious diphthong is represented by ει, as in ЧƎMIƎ (*εἶμεν*, Doric infinitive = *εἶναι*), a form which shows that ι has at Cleonae the more modern form I as distinguished from the Corinthian Ƹ.[3]

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[1] Breasted, *History of Egypt* (1906), p. 45.

[2] *Op. cit.* p. 484.

[3] *Die Schrift und Sprache der alten Ägypter* (1907), p. 24.

[4] *Scripta Minoa*, i. (1909), § 10, pp. 77 ff.

[5] E. Piette, *L'Anthropologie*, vii. (1896) pp. 384 ff.

[6] E. Piette, *L'Anthropologie*, xvi. (1905) pp. 8-9. The apparent inscriptions of this period are conveniently collected and figured together in Dechelette's *Manuel d'archéologie préhistorique celtique et gallo-romaine*, i. (1908) p. 235.

[7] *Der Ursprung des alt-semitischen Alphabets aus der neu-assyrischen Keilschrift* (*ZDMG.* xxxi. pp. 102 ff.). A still more sweeping theory of the same nature is propounded by the Rev. C. J. Ball in the *Proceedings of the Society of Biblical Archaeology*, xv. (1893) pp. 392 ff.

Regarding three other questions controversy still rages. These are: (*a*) how Greek utilized the four sibilants (Shin, Samech, Zain and Zade), which it took over from the Phoenician; (*b*) what was the history of development in the symbols for φ, χ, ψ, ω (the history of ξ belongs to both heads); (*c*) the history of the symbol for the digamma *F*.

Greek use of Phoenician sibilants.

In the Phoenician alphabet Zain was the seventh letter, occupying the same position and having the same form approximately (I) as the early Greek Z, while in pronunciation it was a voiced *s*-sound; Samech (ǂ) followed the symbol for *n* and was the ordinary *s*-sound, though, as we have seen, it is in different Greek states at the earliest period ζ as well as ξ; after the symbol for *p* came Ẓade (ϻ), which was a strong palatal *s*, though in name it corresponds to the Greek *ζῆτα*; while lastly Shin (W) follows the symbol for *r*, and was an *sh*-sound. The Greek name for the sibilant (*σίγμα*) may simply mean the hissing letter and be a derivative from *σίζω*; many authorities, however, hold that it is a corruption of the Phoenician Samech. Unfortunately, it is not clear how many sibilants were distinguished in Greek pronunciation, nor over what areas a particular pronunciation extended. There is, however, considerable evidence in support of the view that Greek *σσ* representing the sound arising from *κy, χy, τy, θy* was pronounced as *sh* (*ș*), while ζ representing *gy, dy* was pronounced in some districts *zh* (*ẓ*).[4]

On an inscription of Halicarnassus, a town which stood in ancient Carian territory, the sound of *σσ* in *'Αλικαρνασσεῦσιν* is represented by Ͳ, as it is also in the Carian name Panyassis (*ΠανυάͲιος*, genitive), though the ordinary ƸƸ is also found in the same inscription. The same variation occurs at the neighbouring Teos and at Ephesus, while the coins of Mesembria in Thrace show regularly ΜΕΤΑ and ΜΕΤΑΜΒΡΙΑΝΩΝ, where Ͳ represents the sound which resulted from the fusion of *θy*, and which appears in Homer as *σσ* in *μέσσος*, while in later Greek it becomes *μέσος*.[5] This symbol Ͳ is in all probability the early form of the letter which was known to the Greeks as San (*σάν*) and in modern times as Sampi, and which is utilized as the numeral for 900 in the shape ϡ. According to Herodotus (i. 139), San was only the Dorian name for the letter which the Ionians called Sigma. This would bring it into connexion with the Phoenician W (Shin), which, turned through a right angle, is possibly the Greek Σ, though some forms of Ẓade on old Hebrew coins and gems (Ʒ Σ) equally resemble the Greek letter. From other forms of Sade, however, the other early form of σ, viz. Ϻ, is probably derived. The confusion is thus extreme: the name Ẓade assimilated in Greek to the names *ἦτα* and *θῆτα* becomes *ζῆτα*, though the form is that of Zain; the name of Samech is possibly the origin of Sigma, while the form of Samech is that of Ξ which has not taken over a Phoenician name. It is probable that the form Ч is an abbreviation in writing from right to left of the earlier Ϻ, and ϟ of the four stroke Ƹ. That the confusion of the sibilants was not confined to the Greeks only, but that pronunciation varied within a small area even among the Semitic stock, is shown by the difficulty which the Ephraimites found in pronouncing "shibboleth" (Judges xii. 6).

History of the digamma.

For the history of the additional symbols which are not Phoenician, we must begin with Y. There is no Greek alphabet in which the symbol is not represented. But the Phoenician form corresponding to it is the consonant *w*, and occupies the position of the Greek digamma as sixth in the series. Whence did the Greeks obtain the digamma? The point is not clear, but probably the Greeks acted here as they did in the case of the vowel *i* and the consonant *y*, adopting the consonant symbol for the vowel sound. As, however, except in Cyprus, Pamphylia and Argos, the only *y* sound which survived in Greek—

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[1] In an excellent summary of the different views held as to the origin of the alphabet (*Journal of the American Oriental Society*, vol. xxii., first half, 1901), Dr J. P. Peters agrees (pp. 191 ff.) that the best test is the etymology of the names of the letters. He shows that "twelve of the letter-names are words with meanings [in the northern dialects of Semitic], all of them indicating simple objects, six of the twelve being parts of the body. The objects denoted by the other six names—ox, house, valve of a door, water, fish and mark or cross—clearly do not belong to any people in a nomadic state, but to a settled, town-abiding population. . . . Six of the letter-names are not words in any known tongue, and appear to be syllables only. Four letter-names are triliterals, and resemble in their form Semitic words." As 11 of the 12 which have meanings are to be found in the Assyrian-Babylonian syllabaries, he suggests a possible Babylonian origin. Different views with regard to some of these symbols are expressed by Lidzbarski, *Ephemeris für semitische Epigraphik*, ii. pp. 125 ff. (1906). The earliest tradition of the names is discussed by Nöldeke in his *Beiträge zur semitischen Sprachwissenschaft* (1904), pp. 124 ff.

[2] See, for example, the tables at the end of Roberts's *Introduction to Greek Epigraphy* (1887); or Kirchhoff's *Studien zur Geschichte des griechischen Alphabets* (4th ed. 1887); or Larfeld's *Handbuch der griechischen Epigraphik*, vol. i. (1907).

[3] Cp. Fränkel, *Corpus inscriptionum Graecarum Peloponnesi*, i., No. 1607.

[4] See Witton, in *American Journal of Philology*, xix. pp. 420 ff., and Lagercrantz, *Zur griechischen Lautgeschichte* (Upsala, 1898).

[5] See Foat, "Tsade and Sampi" (*Journal of Hellenic Studies*, xxv. pp. 338 ff., xxvi. p. 286). A number of ingenious points often uncertain are raised by A. Gercke, "Zur Geschichte des ältesten griechischen Alphabets" (*Hermes*, xli., 1906, pp. 540 ff.).

the glide between *i* and another vowel as in διά = *diya*—is never represented, there was no occasion to use the Phoenician Jod in a double function. With Vau it was different; the *u*-sound existed in some form in all dialects, the *w*-sound survived in many far into historical times. The Phoenician symbol having been adopted for the vowel sound, whence came the new symbol Ϝ or ⊏ for the digamma? Hitherto there have been two views. Most authorities have held that the new form was derived from E by dropping the lowermost crossbar; some have held that it developed out of the old Vau, a view which is not impossible in itself and has the similar development in Aramaic (Tema) in its favour. But as Dr Evans has found a form like the digamma among his most recent types of symbols, and as we have no intermediate forms which will prove the development of Ϝ from Y, though the form found at Oaxos in Crete, viz. N, shows a form sufficiently unlike Ϝ, it is necessary to suspend judgment.

Greek aspirates, &c.

The Greek aspirates were not the sounds which we represent by *ph*, *th*, *ch* (Scotch), but corresponded rather to the sound of the final consonants in such words as *lip*, *bit*, *lick*, the breath being audible after the formation of the consonant. It is not clear that Greek took over ⊘ with this value, for in one Theran inscription Θ ⊟ are found combined as equivalent to T—H, while the regular representation of φ and χ is Π ⊟ and K ⊟, or Ϙ (koppa) ⊟ respectively. In the great Gortyn inscription from Crete and occasionally in Thera, Π (in Crete in the form C) and K are used alone for φ and χ, just as conversely even in the 5th century the name of Themistocles has been found upon an *ostrakon* spelt Θεμισθοκλῆς. Such confusions show that even to Greek ears the distinction between the sounds was very small. To have recorded it in writing at all shows considerable progress in the observation of sounds. Such progress is more easily indicated by changes in the symbols among a people whose acquaintance with the art is not of long standing nor very familiar. English, though possessing sounds comparable to the Greek θ, φ, χ, has never made any attempt to represent them in writing. On the other hand, no doubt Athens in 403 B.C. officially adopted the Ionic alphabet and gave up the old Attic alphabet. The political situation in Athens, however, at this time was as exceptional as the French Revolution, and offered an opportunity not likely to recur for the adoption of a system in widely extended use which private individuals had been employing for a long time.

The history of the symbols φ and χ is altogether unknown. The very numerous theories on the subject have generally been founded on a principle which itself is in need of proof, viz. that these symbols must have arisen by differentiation from others already existing in the alphabet. The explanation is possible, but it is not easy to see why, for example, the symbol Ϙ or Φ = Koppa, the Latin Q, should have been utilized for a sound so different as *p-h*; nor, again, why the symbol for θ (⊕) by losing its cross stroke should become φ, seeing that the sounds of θ and φ outside Aeolic (a dialect which is not here in question) are never confused. On the other hand, if we remember the large number of symbols belonging to the prehistoric script, it will seem at least as easy to believe that the persons who, by adding new letters to the Phoenician alphabet, attempted to bring the symbols more into accordance with the sounds of the Greek language, may have borrowed from this older script. It is now generally admitted that the improvements of the alphabet were made by traders in the interests of commerce, and that these improvements began from the great Greek emporia of Asia Minor, above all from Miletus. Symbols exactly like φ, χ, and ψ (Φ, X, Ψ) are found in the Carian alphabet, and transliterated by Professor Sayce[1] as *v* (and *ü*), *h* and *kh* respectively. If the Carian alphabet goes back to the prehistoric script, why should not Miletus have borrowed them from it? We have already seen that, in the earliest alphabets of Thera and Corinth, the ordinary symbol for ξ in the Ionic alphabet was used for ζ. This usage brought in its train another—the use of Ψ, not for ψ as in Ionic, but for ξ in the name ΑΛΕΨΑ | CORA = Ἀλεξαγόρα, and similarly in Melos, . PAΨ | IKVΔ | ECM = Πραξικύδεος.[2] This experiment, for it was no more, belongs apparently to the latter part of the 6th century, and was soon given up. As the Ionians kept the form Ξ, which the people of Thera used for ζ, in the same position in their alphabet as Samech occupied in the Phoenician alphabet, there can be no doubt as to its origin. The symbol + which the Chalcidian Greeks used in the 6th century B.C. for ξ may be derived, according to the most widely accepted theory, from a primitive form of Samech ⊞, which is recorded only in the *abecedaria* of the Chalcidian colonies in Italy. In this case the borrowing of the Greek alphabet must long precede any Phoenician record we possess. But it is not probable that the Ionic and Phoenician Ξ developed independently from the closed form. Kretschmer, however, in several publications[3] takes a different view. He thinks that the guttural element in ξ was a spirant, and therefore different from χ, which is an aspirate. He points out that in Naxos, in a 6th-century inscription,[4] ξ in Ναξίου, ἔξοχος and Φράξου is represented by □Σ, the first element in which he regards as a form of ⊟ = *h*. As χ is found in the same inscription (in the form X), the guttural element must have been different, else ξ would have been spelt XΣ. Attica and most of the Cyclades kept X for the guttural element in ξ (written XS or +S) and for χ as well. On the west of the Aegean a new symbol Ψ was invented for the aspirate value, and this spread over the mainland and was carried by emigrants to Rhodes, Sicily and Italy. The sign X was kept in the western group for the guttural spirant in ξ, which was written XΣ; but, as this spirant occurred nowhere else, the combination was often abbreviated, and X was used for XΣ precisely as in the Italic alphabets we shall find that F = *f* develops out of a combination FH.

The development of symbols for the long vowels η and ω was also the work of the Ionians. The *h*-sound ceased at a very early period to exist in Ionic, and by 800 B.C. was ignored in writing. The symbol ⊟ or H was then employed for the long open *ē*-sound, a use suggested by the name of the letter, which, by the loss of the aspirate, had passed from Heta to Eta. About the same period, and probably as a sequel to this change, the Greeks of Miletus developed Ω for the long open *ō*-sound, a form which in all probability is differentiated out of O. Centuries passed, however, before this symbol was generally adopted, Athens using only O for ο, ω and ου, the spurious diphthong, until the adoption of the whole Ionic alphabet in 403 B.C.[5]

Latin alphabet.

The discoveries of the last quarter of the 19th century carried back our knowledge of the Latin alphabet by at least two centuries, although the monuments of an early age which have been discovered are only three. (*a*) In 1880 was discovered between the Quirinal and Viminal hills a little earthenware pot of a curious shape, being, as it were, three vessels radiating from a centre, each with a separate mouth at the top.[6] Round the sides of the triangle formed by the three vessels and under the mouths runs an inscription of considerable length. The use for which the pot was intended and the purport of the inscription have been much disputed, there being at least as many interpretations as there are words in the inscription. The date is probably the early part of the 4th century B.C. Though found in Rome, the vessel is small enough to be easily portable, and might therefore have been brought from elsewhere in Italy. It is equally possible that the potter who inscribed the words upon it was not a native of Rome. One or two points in the inscription make it doubtful whether the Latin upon it is really the Latin of Rome.

The Dvenos inscription.

It is generally known as the Dvenos inscription, from the name of the maker who wrote on the vessel from right to left the inscription, part of which is DVENOS MED FECED (= *fecit*). (*b*) The second of these early records is the inscription on a gold fibula found at Praeneste and published in 1887. The inscription runs from right to left, and is in letters which show more clearly than ever that the Roman alphabet is borrowed from the alphabets of the Chalcidian Greek colonies in Italy. Its date cannot be later than the 5th and is possibly as early as the 6th century B.C. The words are MANIOS MED FHEFHAKED NVMASIOI, "Manius made me for Numasius." The symbol for M has still five strokes, *s* has the angular form S, S. The inscription is earlier than the Latin change of *s* between vowels into *r*, for *Numasioi* is the dative of the older form which corresponds to the later *Numerius*. The verb form

The Praeneste fibula.

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[1] See especially *Proceedings of the Society of Biblical Archaeology* for 1895, p. 40; cf. also Kalinka, *Neue Jahrbücher für Philologie*, iii. (1899), p. 683. Similar forms are also found in the Safa inscriptions (South Semitic) with similar values, and Praetorius argues (*Z.D.M.G.* lvi., 1902, pp. 677 ff., and again, lviii., 1904, pp. 725 f.) that these were somehow borrowed by Greek in the 8th century B.C., while in lxii. pp. 283 ff. he argues that the reason why the Greeks borrowed Θ for the aspirated *t* was its form, the cross in ⊗ being regarded as T and the surrounding circle as a variety of □ an occasional form of ⊟ the aspirate. Here also (p. 287) as in his *Ursprung des kanaanäischen Alphabets*, pp. 13 f., he argues that the two forms of the digamma F and ⊏, and also the South Semitic ⊕ = *w*, could all have developed from the Cyprian I = *we*. But proof is impossible without evidence of the intermediate steps.

[2] *Inscriptiones Graecae*, xii., fasc. iii. Nos. 811, 1149.

[3] See especially *Athenische Mitteilungen*, xxi. p. 426.

[4] Figured in Roberts's *Introduction to Greek Epigraphy*, p. 65.

[5] Details of the history of the individual letters will be found in separate articles.

[6] It is figured most accessibly in Egbert's *Introduction to the Study of Latin Inscriptions*, p. 16.

is remarkable. In the Dvenos inscription the perfect of *facio* is *feced*; here it is a reduplicated form with the same vowel as the present. The spelling also is interesting. The symbol **K** is still in ordinary use, and not merely used for abbreviations as in the classical age. But most remarkable is the representation of Latin **F** by **FH**. The reason for this is clear. The value of **F** in the Greek alphabet is *w* and not *f* as in Latin. Greek had no sound corresponding to Latin **F**, consequently an attempt is made by combining **F** and **H** to indicate the difference of sound. Etruscan uses **FH** in the same way. As Latin, however, made the symbol **V** indicate not only the vowel sound *u*, but also the consonant sound *v* (*i.e.* English *w*), the sign for the digamma **F** was left unemployed, and as **FH** was a cumbrous method of representing a sound which did not exist in Greek, the second element came to be left out in writing. Thus **F** came to be the representative of the unvoiced labiodental spirant instead of that for the bilabial voiced spirant. Whether the form *fefaked* was ever good Latin in Rome may be doubted, for the Romans, in spite of the few miles that separate Praeneste from Rome, were inclined to sneer at the pronunciation and idiom of the Praenestines (cf. Plautus, *Trin.* 609, *Truc.* 691; Quintilian i. 5, 56). (*c*) The last, and in some respects the most important, of these records was found in 1899 under an ancient pavement in the *Comitium* at the north-west corner of the Roman Forum. It is engraved upon the four sides and one bevelled edge of a pillar, the top of which has been broken off. As the writing is *βουστροφηδόν*, beginning at the bottom of the pillar and running upwards and down again, no single line of the inscription is complete. Probably more than half the pillar is lost, so that it is not possible to make out the sense with certainty. The inscription is probably not older than that on the fibula from Praeneste, but has the additional interest of being undoubtedly couched in the Latin of Rome. The surviving portion of the inscription contains examples of all the letters of the early alphabet, though the forms of **F** and **B** are fragmentary and doubtful. As in the Praenestine inscription, the alphabet is still the western (Chalcidian) alphabet. **K** is still in use as an ordinary consonant, and not limited to a symbol for abbreviations as in the classical period. The rounded form of γ is found with the value of **G** in **RECEI**, which is probably the dative of *rex*. **H** has still the closed form **⊟**, **M** has the five-stroke form, **S** is the three-stroke **ϟ**, tending to become rounded. **R** appears in the Greek form without a tail, and **V** and **Y** are both found for the same sound. The manner of writing up and down instead of backwards and forwards across the stone is obviously appropriate to a surface which is of considerable length, but comparatively narrow, a connected sense being thus much easier to observe than in writing across a narrow surface where, as in the gravestones of Melos, three lines are required for a single word. The form of the monument corresponds to that which we are told was given to the revolving wooden pillars on which the laws of Solon were painted. That the writing of Solon's laws, which was *βουστροφηδόν*, was also vertical is rendered probable by the phrase *ὁ κάτωθεν νόμος* in Demosthenes' speech *Against Aristocrates*, § 28, for which Harpocration is unable to supply a satisfactory explanation.

Forum inscription.

The differentiation of the Roman alphabet from the Greek is brought about (*a*) by utilizing the digamma for the unvoiced labiodental spirant **F**; (*b*) by dropping out the aspirates *θ*, *φ*, *χ* (**Ψ** in the Chalcidian alphabet, whence the Roman is derived) from the alphabet proper and employing them only as numerals, *θ* (**⊙**) being gradually modified till it was identified with **C** as though the initial of *centum*, 100. Similarly **Φ** became in time identified with **M** as though the initial of *mille*, 1000, and the side strokes of *χ* in the above form were flattened out till it became **⊥**, and ultimately **L**, 50. (*c*) After 350 B.C., at latest, there was in Latin no sound corresponding to **Z**, which was therefore dropped. In the Chalcidian alphabet the symbol for *x* was placed after the symbols common to all Greek alphabets, a position which **X** retains in the Latin (and also in the Faliscan) alphabet. **K** in time passed out of use except as an abbreviation, its place being taken by **C**, which, as we have seen, is in the earliest inscription still *g*. Three points here require explanation: (1) Why **K** fell into disuse; (2) why **C** took the place of **K**; (3) why the new symbol **G** was put in the place of the lost **Z**. It is clear that **C** must have become an equivalent of **K** before the latter fell out of use. There is some evidence which seems to point to a pronunciation of the voiced mutes which, like the South German pronunciation of *g*, *d*, *b*, but slightly differentiated them from the unvoiced mutes, so that confusion might easily arise. The Etruscans, who were separated from the Romans only by the Tiber, gradually lost the voiced mutes. But another cause was perhaps more potent. **C** and **IC**, as *k* was frequently written, would easily be confused in writing, and Professor Hempl (*Transactions of the American Philological Association* for 1899, pp. 24 ff.) shows that the Chalcidian form of ζ—**I** developed into shapes which might have partaken of the confusion. Owing to this confusion, the new symbol **G**, differentiated from **C**, took the place of the useless **I**. In abbreviations, however, **C** remained as before in the value of **G**, as in the names Gaius and Gnaeus. **Y** and **Z** were added in the last century of the republic for use in transliterating Greek words containing *υ* and *ζ*.[1]

Differentiation of Roman from Greek alphabet.

The dialect which was most closely akin to Latin was Faliscan. The men of Falerii, however, regularly took the side of the Etruscans in wars with Rome, and it is clear that the civilization of the old Falerii, destroyed for its rebellion in 241 B.C., was Etruscan and not Roman in character. Peculiar to this alphabet is the form for *f*—**↑**. Much more important than the scanty remains of Faliscan is the Oscan alphabet. The history of this alphabet is different from that of Rome. It is certain from the symbols which they develop or drop that the people of Campania and Samnium borrowed their alphabet from the Etruscans, who held dominion in Campania from the 8th to the 5th century B.C. Previous to the Punic wars Campania had reached a higher stage of civilization than Rome. Unfortunately, the remains of that civilization are very scanty, and our knowledge of the official alphabet outside Capua, and at a later period Pompeii, is practically confined to two important inscriptions, the tabula Agnonensis, now in the British Museum, and the Cippus Abellanus, which is now kept in the Episcopal Seminary at Nola. Of Etruscan origin also is the Umbrian alphabet, represented first and foremost in the bronze tablets from Gubbio (the ancient Iguvium). The Etruscan alphabet, like the Latin, was of Chalcidian origin. That it was borrowed at an early date is shown by the fact that most of its numerous inscriptions run from right to left, though some are written *βουστροφηδόν*. That it took over the whole Chalcidian alphabet is rendered probable by the survival in Umbrian and Oscan, its daughter alphabets, of forms which are not found in Etruscan itself. This mysterious language, despite the existence of more than 6000 inscriptions, and the publication in 1892 of a book written in the language and handed down to us by the accident of its use to pack an Egyptian mummy, remains as obscure as ever, but apparently it underwent very great phonetic changes at an early period, so that the voiced mutes **B**, **D**, **G** disappeared. Of the existence of the vowel **O** there is no evidence. If it ever existed in Etruscan, it had been lost before the Oscans and Umbrians borrowed their alphabets. On the other hand, both of their alphabets preserve **B** and Umbrian **G** in the form **>**. Etruscan also retained this symbol in the form **Ↄ**, and utilized it exactly as Latin did to replace **Ӿ**. Oscan, in order to represent **D**, introduced later a form **Я**, thus creating confusion between the symbols for *d* and for *r*. This form was adopted for *d* because **D** had already been borrowed from Etruscan as the symbol for *r*, although **ꟼ** is also found on Etruscan inscriptions. For the Greek digamma Etruscan used both **Ↄ** and **ꟻ**, but the former only was borrowed by the other languages. Etruscan, like Latin, used **⊟ꟻ** (from right to left) to represent the sound of Latin **F**, but, unlike Latin, adopted **⊟** not **ꟻ** as the single symbol. This form it then wrote as two lozenges **8**, whence developed a later sign, **8**, which is used also in Umbrian and Oscan. As the old digamma was kept, this new sign was placed after those borrowed from the Chalcidian alphabet. Similarly it used **ǂ** and **I** for the Chalcidian ζ; Umbrian borrowed the first, Oscan the second form. The form for *h* was still closed **⊟**, which Etruscan passed on to Oscan, while Umbrian modified it to **Φ**. The form for *m* has five strokes; from a later form **ꟿ** the Oscan form was borrowed. Of the two sibilants, **M** and **Ƨ** or **S**, Oscan adopted only **Ƨ**, Umbrian both **M** and the rounded form **S**. **ϙ** is found on Etruscan inscriptions, but not in the alphabet series preserved; neither Umbrian nor Oscan has this form. **T** appears in Etruscan as **Y**, **⋌**, and **X**; of these Umbrian borrows the first two, while Oscan has a form **T** like Latin. Etruscan took over the three Greek aspirates, *θ*, *φ*, *χ*, in their Chalcidian forms; *θ* survives in Umbrian as **⊙**, the others naturally disappear. Both Umbrian and Oscan devised two new symbols. Umbrian took over from Etruscan perhaps the sign q, but gave it the new value of a spirant which developed out of an earlier *d*-sound, but which is written in the Latin alphabet with *rs*. The second Umbrian symbol was d, which was the representative of an *s*-sound developed by palatalizing an earlier *k*. In Oscan, which had an *o*-sound, but no symbol for it, a new sign was invented by placing a dot between the legs of the symbol for *u*—𐌞. This, however, is found only in the best-written documents, and on some materials the dot cannot be distinguished. The symbol ⊢ was invented for the open *ĭ*-sound and close *ē*-sound.[1] At a much later epoch it was introduced into the Latin alphabet by the emperor Claudius to represent *y*, and the sound which was written as *i* or *u* in *maximus*, *maxumus*, &c.

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[1] Gardthausen, "Ursprung und Entwickelung der griechisch-lateinischen Schrift" (*Germanisch-romanische Monatsschrift*, i. (1909), pp. 337 ff.) argues for a "proto-Tyrrhenian" alphabet from which Etruscan, Umbrian and Oscan descended as one group, and Faliscan and Latin as the other. Evidence in favour of such a position for the Latin alphabet is not forthcoming.

Besides the Italic alphabets already mentioned, which are all derived from the alphabet of the Chalcidian Greek colonists in Italy, there were at least four other alphabets in use in different parts of Italy: (1) the Messapian of the south-east part of the peninsula, in which the inscriptions of the Illyrian dialect in use there were written, an alphabet which, according to Pauli (*Alt-italische Forschungen*, iii. chap. ii.) was borrowed from the Locrian alphabet; (2) the Sabellic alphabet, derived from that of Corinth and Corcyra, and found in a few inscriptions of eastern-central Italy; (3) the alphabet of the Veneti of north-east Italy derived from the Elean; (4) the alphabet of Sondrio (between Lakes Como and Garda), which Pauli, on the insufficient ground that it possesses no symbols corresponding to φ and χ, derives from a source at the same stage of development as the oldest alphabets of Thera, Melos and Crete.

From the fact that upon the Galassi vase (unearthed at Cervetri, but probably a product of Caere), which is now in the Gregorian Museum of the Vatican, a syllabary is found along with one of the most archaic Greek alphabets, and that a similar combination was found upon the wall of a tomb at Colle, near Siena, it has been argued that syllabic preceded alphabetic writing in Italy. But a syllabary where each syllable is made by the combinations of a symbol for a consonant with that for a vowel can furnish no proof of the existence of a syllabary in the strict sense, where each symbol represents a syllable; it is rather evidence against the existence of such writing. The syllabary upon the Galassi vase indicates in all probability that the vase, which resembles an ink-bottle, belonged to a child, for whose edification the syllables *pa*, *pi*, *pe*, *pu* and the rest were intended. The evidence adduced from the Latin grammarians, and from abbreviations on Latin inscriptions like *lubs* for *lubens*, is not sufficient to establish the theory.

Teutonic runes.

It has been argued that the runes of the Teutonic peoples have been derived from a form of the Etruscan alphabet, inscriptions in which are spread over a great part of northern Italy, but of which the most characteristic are found in the neighbourhood of Lugano, and in Tirol near Innsbruck, Botzen and Trent. The Danish scholar L. F. A. Wimmer, in his great work *Die Runenschrift* (Berlin, 1887), contends that the resemblance, though striking, is superficial. Wimmer's own view is that the runes were developed from the Latin alphabet in use at the end of the 2nd century A.D. Wimmer supports his thesis with great learning and ingenuity, and when allowance is made for the fact that a script to be written upon wood, as the runes were, of necessity avoids horizontal lines which run along the fibres of the wood, and would therefore be indistinct, most of the runic signs thus receive a plausible explanation. The strongest argument for the derivation from the Latin alphabet is undoubtedly the value of *f* attaching to ᚠ; for, as we have seen, the Greek value of this symbol is *w*, and its value as *f* arises only by abbreviation from FH. On the other hand, several of Wimmer's equations are undoubtedly forced. Even if we grant that the Latin symbols were inverted or set at an angle (a proceeding which is paralleled by the treatment of the Phoenician signs in Greek hands), so that ᚢ represents Latin V, M Latin E, ᚨ Latin V, and ᚦ Latin D; while the symbol for the voiced spirant ծ is ᚦ doubled, ⋈, ᛞ, it is difficult to believe that the symbol for the spirant *g*, viz. X, represents a Latin K (which was of rare occurrence), or again ᚾ, ⨯ a Latin N, or that the symbol for *ng*, ◇, represents < = *c* doubled. Moreover, the date of the borrowing seems too late. The runes are found in all Teutonic countries, and the Romans were in close contact with the Germans on the Rhine before the beginning of the Christian era. We hear of correspondence between the Romans and German chieftains in the early days of the empire. It is strange, therefore, if the Roman alphabet, which formed the model for the runes, was that of two whole centuries later, and even then the formal alphabet of inscriptions. By that time the Teutons were likely to have more convenient materials than wood whereon to write, so that the adaptation of the forms would not have been necessary. That the Germans were familiar with some sort of marks on wood at a much earlier period is shown by Tacitus's *Germania*, chap. x. There we are told that for purposes of divination certain signs were scratched on slips of wood from a fruit-bearing tree (including, no doubt, the beech; cp. *book*, German *Buch*, and *Buchstabe*, a letter of the alphabet); the slips were thrown down promiscuously on a white cloth, whence the expert picked them up at random and by them interpreted fate. In these slips we have the origin of the Norse *kefli*, the Scots *kaivel*, which were and are still used as lots. The fishermen of north-east Scotland, when they return after a successful haul, divide the spoil into as many shares as there are men in the boat, with one share more for the boat. Each man then procures a piece of wood or stone, on which he puts a private mark. These lots are put in a heap, and an outsider is called in who throws one lot or kaivel upon each heap of fish. Each fisherman then finds his kaivel, and the heap on which it lies is his. This system of "casting kaivels," as it is called, is certainly of great antiquity. But its existence will not help to prove an early knowledge of reading or writing, for in order that everything may be fair, it is clear that the umpire should not be able to identify the lot as belonging to a particular individual. It has, however, been contended that a system of primitive runes existed whence some at least of the later runes were borrowed, and the ownership marks of the Lapps, who have no knowledge of reading and writing, have been regarded as borrowed from these early Teutonic runes.[2] Be this as it may, the resemblances between the runic and the Mediterranean alphabets are too great to admit of denial that it is from a Greek alphabet, whether directly or indirectly, that the runes are derived. That Wimmer postdates the introduction of the runic alphabet seems clear from the archaic forms and method of writing. It is very unlikely that a people borrowing an alphabet which was uniformly written from left to right should have used it in order to write from right to left, or *βουστροφηδόν*. Hence Hempl contends[3] that Wimmer's view must be discarded, and that the runes were derived about 600 B.C. from a western Greek alphabet which closely resembled the Formello alphabet (one of the ancient Chalcidian *abecedaria*) and the Sabellic and North Etruscan alphabets. He thus fixes the date at the same period as Isaac Taylor had done in his *Greeks and Goths* and *The Alphabet*. Taylor, however, derived the runes from the alphabet of a Greek colony on the Black Sea. Hempl's initiative was followed by Professor Gundermann of Giessen, who announced in November 1897[4] that he had discovered the source of the runic alphabet, the introduction of which he declares preceded the first of the phonetic changes known as the "Teutonic sound-shifting," since < = *g* is used for *k*, X = χ for *g*, a Theta-like symbol for *d*, while *zd* is used for *st*. If this view (which is identical with Taylor's) be true, we have a parallel in the Armenian alphabet, which is similarly used for a new value of the sounds. Hempl, on the other hand, contends that the sound-shifting had already taken place, and, arguing that several of the symbols have changed places (*e.g.* ᚠ *f* and ᚨ *a*, ᚢ *u* and ᛒ *b*, because at this time *b* was a bilabial spirant and not a stop), ultimately obtains an order—a b d e f z *kgw* h i j ƕ p r s t u l m n ծ o. As neither Gundermann nor Hempl has published the full evidence for his view, no definite conclusion at the moment is possible.

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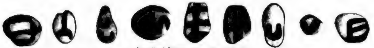
[1] For further details of these alphabets, see Conway, *The Italic Dialects*, ii. pp. 458 ff. The recent discovery by Keil and Premerstein (*Denkschriften der Wiener Akademie*, liii., 1908) of Lydian inscriptions containing the symbol 8 suggests that the old derivation of the Etruscans from Lydia may be true and that they brought this symbol with them (see article on F). But the inscriptions are not yet deciphered, so that conclusive proof is still wanting.

[2] R. M. Meyer, *Paul Braune und Sievers' Beiträge*, xxi. (1896), pp. 162 ff.

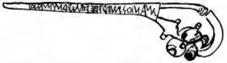
[3] In a paper published in the volume of *Philologische Studien*, presented as a "Festgabe" to Professor Sievers in 1896, and in a second paper in the *Journal of Germanic Philology*, ii. (1899), pp. 370 ff.

[4] See *Literaturblatt für germanische und romanische Philologie* for 1897, col. 429 f.



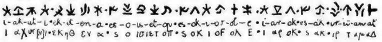
Inscribed Pebbles from Mas d'Azil.

Prehistoric Linear Script from Crete.

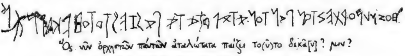


Gold Fibula from Praeneste, with Early Latin Inscription. Right to left.

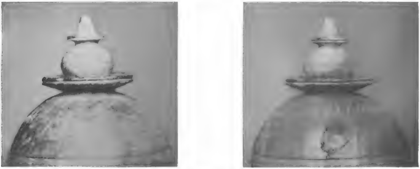
Vadstena Pendant, with Runic Alphabet; about A.D. 600.


i-ak-ut-i•ek-it-en-a•es-o-u-et-qu•es-ok-i-or-ol-e•i-ar-ok•es-ak•ur-iu-an-at

Cyprian Inscription (4th century B.C.) from Curium (*British Museum Excavations*, p. 64). Below are (1) the transliteration of the symbols; (2) the Greek words, both like the Cyprian reading from right to left.


Ὃς νῦν ὀρχηστῶν πάντων ἀταλώτατα παίζει το(ῦ)το δεκᾶ[ν]? μιν?

Oldest Attic Inscription. From a Dipylon Vase probably of 8th century B.C. Right to left.

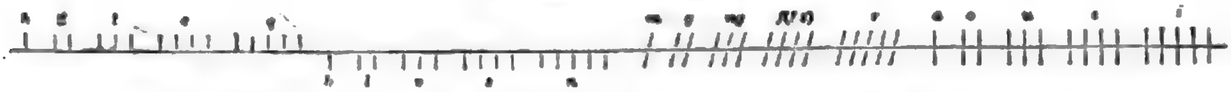


Inscription on Buddha Vase, perhaps 4th century B.C.

In one of the earliest runic records which we possess, the pendant found at Vadstena in Sweden in 1774, and dating from about A.D. 600 (see Plate), the signs are divided up into three series of eight (the twenty fourth, ⋈, being omitted for want of room). Upon the basis of this division a system of cryptography (in the sense that the symbols are unintelligible without knowledge of the runic alphabet) was developed, wherein the series and the position within the series of the letter indicated, were each represented by straight strokes, the strokes for the series being shorter than those for the runes, or the series being represented by strokes to the left, the runes by strokes to the right, of a medial line.[1] From this system probably developed the ogam writing employed among the Celtic peoples of Britain and Ireland. The ogam inscriptions in Wales are frequently accompanied by Latin legends, and they date probably as far back as the 5th and 6th centuries A.D. Hence the connexion between Celt and Teuton as regards writing must go back to a period preceding the Viking inroads of the 8th century. Taylor, however, conjectures (*The Alphabet*, ii. p. 227) that the ogams originated in Pembroke, "where there was a very ancient Teutonic settlement, possibly of Jutes, who, as is indicated by the evidence of runic inscriptions found in Kent, seem to have been the only Teutonic people of southern Britain who were acquainted with the Gothic Futhorc." However this may be, the ogam alphabet shows some knowledge of phonetics and some attempt to classify the sounds accordingly. The symbols are as follows[2]:—

Ogam writing.

Symbols of Ogam Alphabet.



The form of the ogam alphabet made it easy to carve hastily; hence in the old sagas, when a hero is killed we find the common formula, "His grave was dug and his stone was raised, and his name was written in ogam." According to Sophus Müller (*Nordische Altertumskunde*, ii. p. 264), it was from Britain that the use of runes upon gravestones was derived, a use which, to judge from the number of bilingual inscriptions in Britain, the Celts derived from the Romans.

The special forms of the alphabet—the Cyrillic and the Glagolitic—which have been adopted by certain of the Slavonic peoples are both sprung directly from the Greek alphabet of the ninth century A.D., with the considerable additions rendered necessary by the much greater variety of sounds in Slavonic as compared with Greek. Apart from other evidence, the use of B with the value of *v*, of H as well as I with the value of ĭ, of Φ with the value of *f*, and X with that of the Scotch *ch*, would be proof that the alphabet was not borrowed till long after the Greek classical period, for not till later did β, φ, χ become spirants and η become identified with ι. The confusion of β with *v* necessitated the invention of a new symbol Б in the Cyrillic, Ⰱ in the Glagolitic for *b*, while new symbols were also required for the sounds or combinations of sounds *ž* (*zh*), *dz*, *št* (*sht*), *c* (*ts*), *č* (*ch* in *church*), *š* (*sh*), *ŭ*, *ĭ*, *y* (*u* without protrusion of the lips), *ě* (a close long *e* sound), for the combination of *o*, *a* and *e* with consonantal *I* (English *y*) and for the nasalized vowels *ę*, *ǫ* (nasalized *o* in pronunciation) and the combinations *ję* and *ją* (English *yę*, *yą*). In all these matters Glagolitic differs very little from Cyrillic; it has only one symbol for *ja* (*ya*) and *ě* because both in this dialect were pronounced the same. It has also only one symbol for *e* and *je* (*ye*) for the phonetic reason that *je* always appears in the old ecclesiastical Slavonic, for which the alphabets were fashioned, at the beginning of words and after vowels: cp. the English use of the symbol *u* in *unspoken* and *uniform*. Glagolitic has a symbol for the palatalized *g* (Ʒ), but it is used only in the transcription of Greek words, γ having become *y* early between vowels in the popular dialects.

Such an elaborate alphabet could hardly have been invented except by a scholar, and tradition, probably rightly, has attached the credit for its invention to Cyril (originally Constantine), who along with his brother Methodius proceeded in A.D. 863 to Moravia from Constantinople, for the purpose of converting the Slavonic inhabitants to Christianity. The only question which concerns us here is which of the two alphabets was the earlier in use, and after much discussion authorities on Slavonic seem generally agreed that it was the Glagolitic (the name is derived from the Old Bulgarian, *i.e.* old ecclesiastical Slavonic *glagolŭ*, "word"). According to Professor Leskien (*Grammatik der altbulgarischen* (*altkirchenslavischen*) *Sprache*, Heidelberg, 1909, p. xxi.), Cyril had probably made a prolonged and careful study of Slavonic before proceeding on his missionary journey, and probably in the first instance with a view to preaching the Gospel to the Slavs of Macedonia and Bulgaria, who were much nearer his own home, Thessalonica, than were those of Moravia. The Glagolitic was founded upon the ordinary Greek minuscule writing of the period, as was shown by Dr Isaac Taylor,[3] though the writing of the letters separately without abbreviations and an obvious attempt at artistic effect has gradually differentiated it from Greek writing. This alphabet, which is much more difficult to read than the bolder Cyrillic founded on the Greek uncial, survived for ordinary purposes in Croatia and in the islands of the Quarnero till the 17th century. The Servians and Russians apparently always used the Cyrillic, and its advantages gradually ousted the Glagolitic elsewhere, though the service book in the old ecclesiastical language which is used by the Roman Catholic Croats is in Glagolitic.[4]

Phrygian.

While the Carian and Lycian were probably independent of the Greek in origin, so, too, at the opposite end of the Mediterranean was the Iberian. On the other hand, the Phrygian was very closely akin to the Greek in alphabet as well as in linguistic character. The Greek alphabet, with which it was most closely connected, was the Western, for the evidence is strongly in favour of the form Ψ having the value of χ, not ψ, in Phrygian, as it certainly has in the Etruscan inscription found on Lemnos in 1886, which is in an alphabet practically identical.

Armenian.

To a much later era belongs the Armenian alphabet, which, according to tradition, was revealed to Bishop Mesrob in a dream. The land might have been Grecized had it not, about A.D. 387, been divided between Persia and Byzantium, the greater part falling to the former, who discouraged Greek and favoured Syriac, which the Christian Armenians did not understand. As those within Persian territory were forbidden to learn Greek, an Armenian Christian literature became a necessity. Taylor contends that the alphabet is Iranian in origin, but the circumstances justify Gardthausen and Hübschmann in claiming it for Greek. That some symbols are like Persian only shows that Mesrob was not able to rid himself of the influences under which he lived.

Of the later development of Phoenician amongst Phoenician people little need be said here. It can be traced in the *graffiti* of the mercenaries of Psammetichus at Abu Simbel in Upper Egypt, where Greeks, Carians and Phoenicians all cut their names upon the legs of the colossal statues. Still later it is found on the stele of Byblos, and on the sarcophagus of Eshmunazar (about 300 B.C.). The most numerous inscriptions come from the excavations in Carthage, the ancient colony of Sidon. One general feature characterizes them all, though they differ somewhat in detail. The symbols become longer and thinner; in fact, cease to be the script of monuments and become the script of a busy trading people. While the Phoenician alphabet was thus fertile in developing daughter alphabets in the West, the progress of writing was no less great in the East, first among the Semitic peoples, and through them among other peoples still more remote. The carrying of the alphabet to the Greeks by the Phoenicians at an early period affords no clue to the period when Semitic ingenuity constructed an alphabet out of a heterogeneous multitude of signs. If it be possible to assign to some of the monuments discovered in Arabia by Glaser a date not later than 1500 B.C., the origin of the alphabet and its dissemination are carried back to a much earlier period than had hitherto been supposed. Next in date amongst Semitic records of the Phoenician type to the bowl of Baal-Lebanon and the Moabite stone comes the Hebrew inscription found in the tunnel at the Pool of Siloam in 1881, which possibly dates back to the reign of Hezekiah (700 B.C.). The only other early records are seals with Hebrew inscriptions and potters' marks upon clay vessels found in Lachish and other towns.[5]

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[1] A species of cryptography exactly like this, based upon the "abjad" order of the Arabic letters, is still in use among the Eastern Persians (E. G. Browne, *A Year amongst the Persians*, p. 391 f.).

[2] Cf. Rhŷs, *Outlines of Manx Phonology*, p. 73 (Publications of the Manx Society, vol. xxxiii.); Rhŷs and Brynmor Jones, *The Welsh People*, pp. 3, 502. An interpretation of the oldest ogam inscriptions is given by Whitley Stokes in *Bezzenberger's Beiträge*, xi. (1886), p. 143 ff. Besides the collections of ogams by Brash (1879) and Ferguson (1887), a new collection by Mr R. A. S. Macalister is in course of publication (*Studies in Irish Epigraphy*, 1897, 1902, 1907). Professor Rhŷs, who at one time considered runes and ogam to be connected, now thinks that ogam was the invention of a grammarian in South Wales who was familiar with Latin letters.

[3] *Archiv für slavische Philologie*, v. 191 ff., where the Glagolitic and the cursive Greek, the Cyrillic and the Greek uncial are set side by side in facsimile.

[4] For further details and references to literature see the introduction to Leskien's *Grammatik* (not to be confused with his *Handbuch*), from which this is abbreviated.

[5] These are figured most accessibly in Lidzbarski's article on the alphabet in the *Jewish Encyclopaedia*, vol. i. (1901); see also his table of symbols added to the 27th edition of Gesenius' *Hebräischer Grammatik* (1902).

Like the Phoenician, these Hebrew signs are distinctly cursive in character, but, as the legend on the coins of the Maccabees shows, became stereotyped for monumental use, while the Jews after the exile gradually adopted the Aramaic writing, whence the square Hebrew script is descended. The Samaritans alone stuck fast to the old Hebrew as part of their contention that they, and not the Jews, were the true Hebrews.

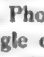
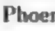
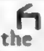
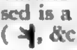
Aramaic.

The oldest records in Aramaic were found at Sindjirli, in the north of Syria, in 1890, and date to about 800 B.C. At this epoch the Aramaic alphabet, or at any rate the alphabet of these records, is but little different from that shown upon the Moabite stone. Either two sounds are confused under one symbol, or these records represent a dialect which, like Hebrew and Assyrian, shows *sh*, *z*, and *ṣ*, where the ordinary Aramaic representation is *ṭ*, *d*, and *ṭ*, the Arabic *th*, *dh*, and *ẓh*. The Aramaic became in time by far the most important of the northern Semitic alphabets. Even while long and important documents in Assyria were still written on clay tablets, in cuneiform, a docket or précis of the contents was made upon the side in Aramaic, which thus became the alphabet of cursive writing—a fact which explains its later development. Two changes, the inception of which is early, but the completion of which belongs to the Persian period, gave the impulse which Aramaic obeyed in all its later developments. These were (*a*) the opening of the heads of letters, so that *beth* , *daleth* , and *resh* become respectively , , and , while becomes first and ultimately . In the later development the heads tend to be reduced in size, and finally to disappear. (*b*) As was natural in cursive writing, angles tend to become rounded, and the tails of the letters, which in Phoenician are very long, are curved round in the middle of words so as to join on to the succeeding letter. These characteristics were naturally emphasized in the Aramaic writing on papyrus which, beginning about 500 B.C., during the Persian sovereignty in Egypt, lasted on there till about 200 B.C. The gradual development of this script into the square Hebrew, and the more ornamental writing of Palmyra, may be traced in the works of Berger and Lidzbarski.[1]

Arabic.

In the land of the Nabataeans, a people of Arabian origin, the Aramaic alphabet was employed in a form which ultimately developed into the modern Arabic alphabet. Probably the earliest example of the Aramaic script in Arabia is the stele of Tema, in north-western Arabia, whereon is commemorated the establishment of a worship of an Aramaic divinity. This monument, now in the Louvre, is not later than the 5th century B.C. In it the writing preserves its ancient form, the heads of the closed letters being only very slightly opened. The Nabataean inscriptions belong to a different epoch and a different style. They were first discovered by Charles Doughty in 1876–1877, who was followed between 1880 and 1884 by Hüber and Euting, to whom a complete collection of these records is due. The records are fortunately dated, and belong to the period from 9 B.C. to A.D. 75. A further development can be traced in the *graffiti* with which pilgrims adorned the rocks of Mount Sinai down to the 2nd or 3rd century A.D. By the help of these inscriptions it is possible to trace the development of the modern Arabic where so many of the forms of the letters have become similar that diacritic points are essential to distinguish them, the original causes of confusion being the continuous development of cursive writing and the adoption of ligatures. Arabic writing, as known to us from documents of the early Mahommedan period, exhibits two principal types which are known respectively as the Cufic and the *naskhi*. The former soon fell into disuse for ordinary purposes and was retained only for inscriptions, coins, &c.; the latter, which is more cursive in character, is the parent of the Arabic writing of the present day. Another form of the Aramaic alphabet, namely, the so-called Estrangela writing which was in use amongst the Christians of northern Syria, was carried by Nestorian missionaries into Central Asia and became the ancestor of a multitude of alphabets spreading through the Turkomans as far east as Manchuria.

South Semitic.

There still remains a branch of the Semitic languages which, except for one or two of the languages belonging to it, was practically unknown till recent years. This is the South Semitic. Till the 19th century the earliest form known of this alphabet was the Ethiopian or Geez, in which Christian documents have been preserved from the early centuries of our era, and which is still used by the Abyssinians for liturgical purposes. The travels of two English naval officers, Wellsted and Cruttenden, through Yemen in southern Arabia in 1835, first called attention to the earlier monuments of Arabia. Fulgence Fresnel first established the importance of the inscriptions discovered by these Englishmen, and in 1843, when French consul at Jeddah, obtained through a French traveller, François Arnaud, information about other monuments of the same kind. In 1869 Joseph Halévy brought back nearly seven hundred inscriptions from Yemen, and this number has been increased from other quarters by several thousands, through the energy of several adventurous scholars, but chiefly by Eduard Glaser's repeated journeys. The south Arabian inscriptions to which the terms Himyaritic and Sabaean are applied fall into two groups, the Sabaean proper and the Minaean. These are distinguished by differences in grammar and phraseology rather than in alphabet. The relative age of the Minaean and Sabaean monuments is a matter of dispute amongst Semitic scholars. Inscriptions in a kindred dialect were brought from El-Ola, in the north of the Hedjaz, by Professor Euting. To these D. H. Müller[2] gave the title of Lihyanite, from the name of the tribe (Libjān) to which they belong. Their date is supposed to be earlier than that of the Sabaean and Minaean. Minaean inscriptions were found at the same place, the Minaeans having had a trading station there. In 1893 J. Theodore Bent copied carefully at Yeha in Abyssinia a few inscriptions, some of which had been already copied in 1814 by the English traveller Salt. These inscriptions are of the greatest importance, because they demonstrate, according to D. H. Müller,[3] that the Sabaeans had colonized Abyssinia as early as 1000 B.C. Other inscriptions copied by Bent at Aksum belong to the 4th century A.D. and later. Two of the earliest are written in Sabaean characters, but in the language which is known as Geez or Ethiopic. From about A.D. 500 Ethiopic was written in an alphabet which according to Müller was no gradual growth but an ingenious device of a Greek scholar of this period at the court of Abyssinia. The Sabaean, like other Semitic, inscriptions are generally written from right to left, but a few are *βουστροφηδόν*; the Ethiopic is written from left to right, and makes a marked advance upon the ordinary Semitic manner of writing by indicating the vowels. This is done by varying the form of the consonant according to the vowel which follows it. The Ethiopic system is thus rather a syllabary than an alphabet. It is noticeable that the changes thus established were made upon the basis of the old Sabaean script, which in its oldest form is evidently closely related to the old Phoenician, though it would be premature to say that the Sabaean alphabet is derived from the Phoenician. It is as likely, considering the date of both, that they are equally descendants from an older source. The characteristics of the Sabaean are great squareness and boldness in outline. It has twenty-nine symbols, whereby it is enabled to differentiate certain sounds which are not distinguished from one another in the writing of the northern Semites. As we have seen, it is a tendency in northern Semitic to open the heads of letters, and therefore it is possible that the Sabaean form for Jod may be older[4] than the Phoenician . Similarly if *Pē* means *mouth*, Hommel is right in contending that the Sabaean is more like the object than the Phoenician , if we suppose the form, like or the Phoenician  and for the Phoenician , turned through an angle of 90°. So also if Kaf corresponds to the Babylonian *Kappu*, "hollow-hand," the Sabaean form  which Hommel[5] interprets as the outline of the hand with the fingers turned in and the thumb raised is a better pictograph than the various meaningless forms of *k* (, &c.).

The rock inscriptions in the wild district of Safah near Damascus which have been collected by Halévy are also written in an Arabic dialect, but, owing chiefly to their careless execution, they are to a large extent unintelligible. The character appears to be akin to the Sabaean. It has been suggested that they were the work of Arabs who had wandered thus far from the south.

Persia.

There still remain for discussion the alphabets of the Indo-European peoples of Persia and India from which the other alphabets of the Farther East are descended. When Darius in 516 B.C. caused the great Behistun inscription to be engraved, it was the cuneiform writing, already long in use for the languages of Mesopotamia, that was adopted for this purpose. We have seen that at Babylon itself the Aramaic language and character were well known. It is probable therefore, a priori, that from the Aramaic alphabet the later writing of Persia should be developed. The conclusion is confirmed by the coins, the only records with Iranian script which go back so far; but the special form of Aramaic from which the Iranian alphabet is derived must at present be left undecided. The later developments of the Iranian alphabet are the Pahlavi and the Zend, in which the MSS. of the Avesta are written. Of these manuscripts none is older than the 13th century A.D. The Pahlavi is properly the alphabet of the Sassanid kings who ruled in Persia from A.D. 226 till the Arab conquest in the 7th century A.D. Under the Sassanids the old Persian worship, which had fallen with the Achaemenid dynasty in Alexander's time, and had been neglected by the subsequent Arsacid line, was revived and the remains of its liturgical literature collected. The name is, however, also applied to the alphabet on the coins of the Parthian or Arsacid dynasty, which in its beginnings was clearly under Greek influence; while later, when a knowledge of Greek had disappeared, the attempts to imitate the old legends are as grotesque as those in western Europe to copy the inscriptions on Roman coins. The relationship between the Pahlavi and the Aramaic is clearest in the records written in the "Chaldaeo-Pahlavi" characters; the most important of these documents is the liturgical inscription of Hadji-abad, where the Arsacid and Sassanian alphabets are found side by side. Taylor (*The Alphabet*, ii. p. 248 f.) regards the former as probably derived from the "ancient alphabet of Eastern Iran, a sister alphabet of the Aramaean of the satrapies," while the Sassanian belongs to a later stage of Aramaic.

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[1] See Berger's *Histoire de l'écriture dans l'antiquité*, p. 252 ff.; Lidzbarski, *Nordsemitische Epigraphik*, p. 186 ff., from whom this summary is taken. Lidzbarski's second volume and G. A. Cooke's *Textbook of North-Semitic Inscriptions* (Oxford, 1903) contain the most convenient collections of Northern Semitic inscriptions for the student's purposes.

[2] Müller, *Epigraphische Denkmäler aus Arabien* (Vienna, 1889).

[3] *Epigraphische Denkmäler aus Abessinien* (Vienna, 1894). Praetorius (*Z.D.M.G.* lviii. p. 724) holds that the oldest Sabaean inscriptions may date from about 700 B.C., that the Lihyan inscriptions are at earliest of the Hellenistic period and the Safa inscriptions still later.

[4] Praetorius (*Z.D.M.G.* lviii. p. 461 f.) attempts to trace the development of the Sabaean form from the Phoenician.

[5] Hommel, *Süd-arabische Chrestomathie* (Munich, 1893), p. 5.

India. The alphabets of India all spring from two sources: (*a*) the Kharoṣṭhī, (*b*) the Brāhmī alphabet. The history of the former is fairly clear. It was always a local alphabet, and never attained the importance of its rival. According to Bühler,[1] its range lay between 69° and 73° 30′ E. and 33° to 35° N., a conclusion which is not invalidated by the fact that some important modifications are found beyond this area, nor by Dr Stein's discovery of a great mass of documents in this alphabet at Khotan in Turkestan, for, according to tradition, the ancient inhabitants of Khotan were emigrants banished in the time of King Açoka from the area to which Bühler assigns this alphabet (see Stein's *Preliminary Report*, 1901, p. 51). Rapson[2] has pointed out that both Kharoṣṭhī and Brāhmī letters are found upon Persian silver *sigloi*, which were coined in the Punjab and belong to the period of the Achaemenid kings of Persia. As Bühler shows in detail, the Kharoṣṭhī alphabet is derived from the alphabet of the Aramaic inscriptions which date from the earlier part of the Achaemenid period. The Aramaic alphabet passed into India with the staff of subordinate officials by whom Darius organized his conquests there. The people of India already possessed their Brāhmī alphabet,

TABLE I.

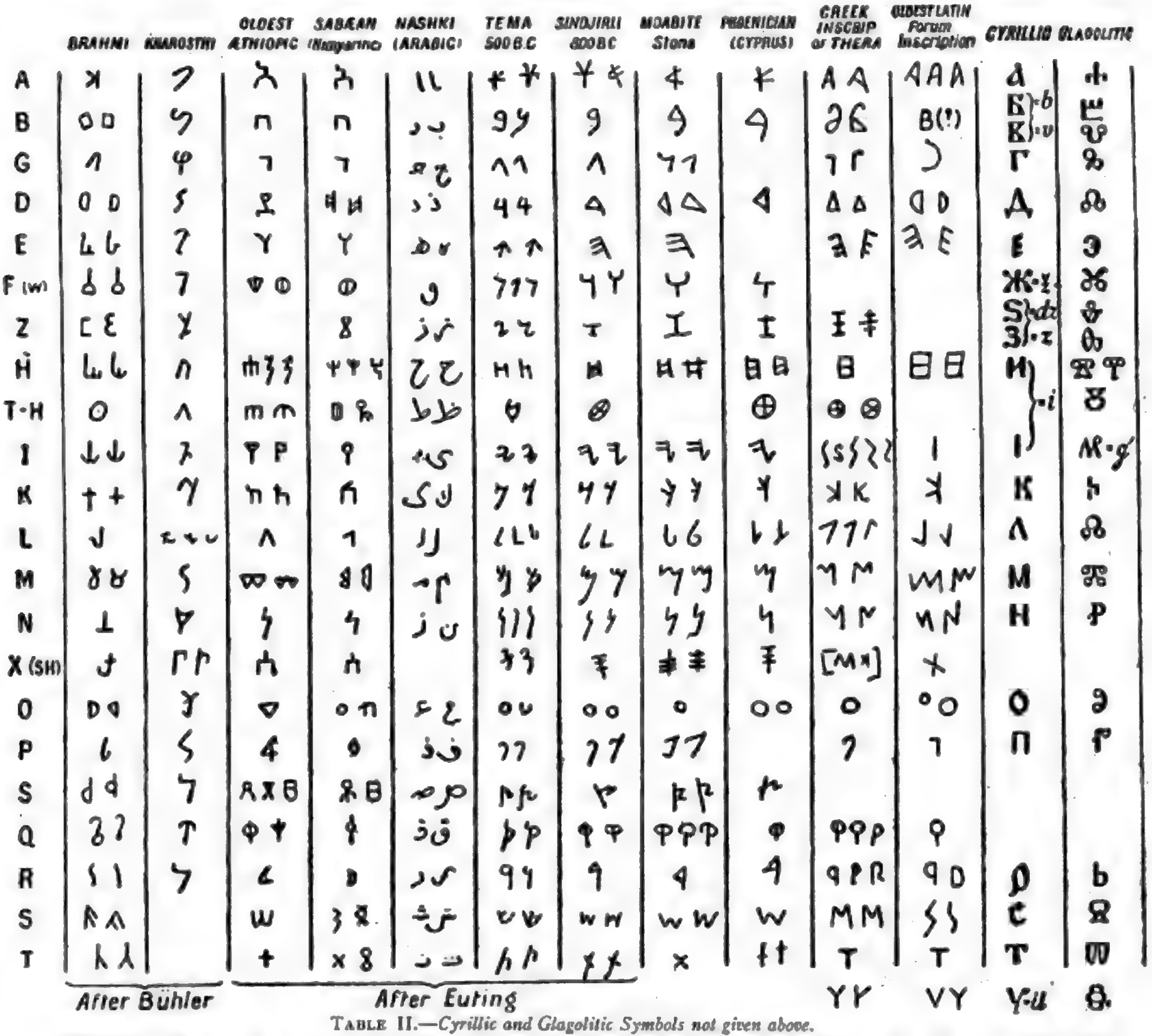
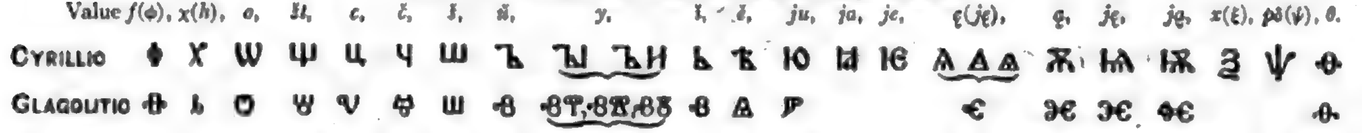

BRAHMI
KHAROSTHI
OLDEST ÆTHIOPIC
SABÆAN (Himyaritic)
NASHKI (ARABIC)
TEMA 500 B.C
SINDJIRLI 800 BC
MOABITE Stone
PHOENICIAN (CYPRUS)
GREEK INSCRIP. of THERA
OLDEST LATIN Forum Inscription
CYRILLIC
GLAGOLITIC
A
B
G
D
E
F (w)
Z
Ḣ
T-H
I
K
L
M
N
X (SH)
O
P
S
Q
R
S
T
b
v
dz
z
i
After Bühler
After Euting

TABLE II.—*Cyrillic and Glagolitic Symbols not given above.*


Value f(φ), χ(h), o, št, c, č, š, šč, y, ě, ˊ ě, ju, ja, je, ę(ję), ǫ, ję, jǫ, x(ξ), ps(ψ), θ.
CYRILLIC
GLAGOLITIC

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[1] Bühler, *Indian Studies*, iii. (2nd ed., 1898), p. 93. The account of these alphabets is drawn from this work and from the same author's *Indische Paläographie* in the *Grundriss der indo-arischen Philologie*, to which is attached an atlas of plates (Strassburg, 1896), and in which a full bibliography is given.

[2] For a coin and a gild token with inscriptions see Rapson's *Indian Coins* (in *Grundriss d. ind.-ar. Phil.*), Plate I.

but had this other alphabet forced upon them in their dealings with their rulers. The Kharoṣṭhi is then the gradual development under local conditions of the Aramaic alphabet of the Persian period. As Stein's explorations show, both alphabets may be found on opposite sides of the same piece of wood.

The history of the Brāhmi alphabet is more difficult. In its later forms it is so unlike other alphabets that many scholars have regarded it as an invention within India itself. The discovery of earlier inscriptions than were hitherto known has, however, caused this view to be discarded, and the problem is to decide from which form of the Semitic alphabet it is derived. Taylor (*The Alphabet*, ii. p. 314 ff.), following Weber, argues that it comes from the Sabaeans who were carrying on trade with India as early as 1000 B.C. Even if the alphabet had not reached India till the 6th century B.C., there would be time, he contends, for the peculiarities of the Indian form of it to develop before the period when records begin. The alphabet, according to Taylor, shows no resemblance to any northern Semitic script, while its stiff, straight lines and its forms seem like the Sabaean. Bühler, on the other hand, shows from literary evidence that writing was in common use in India in the 5th, possibly in the 6th, century B.C. The oldest alphabet must have been the *Brāhmī lipi*, which is found all over India. But he rejects Taylor's derivation of this alphabet from the Sabaean script, and contends that it is borrowed from the North Semitic. To the pedantry of the Hindu he attributes its main characteristics, viz. (*a*) letters made as upright as possible, and with few exceptions equal in height; (*b*) the majority of the letters constructed of vertical lines, with appendages attached mostly at the foot, occasionally at the foot and at the top, or (rarely) in the middle, but never at the top alone; (*c*) at the tops of the characters the ends of vertical lines, less frequently straight horizontal lines, still more rarely curves or the points of angles opening downwards, and quite exceptionally, in the symbol *ma*, two lines rising upwards. A remarkable feature of the alphabet is that the letters are hung from and do not stand upon a line, a characteristic which, as Bühler notes (*Indian Studies*, iii. p. 57 *n.*), belongs even to the most ancient MSS., and to the Asoka inscriptions of the 3rd century B.C. When these specially Indian features have been allowed for, Bühler contends that the symbols borrowed from the Semitic alphabet can be carried back to the forms of the Phoenician and Moabite alphabets. The proof deals with each symbol separately; as might be expected of its author, it is both scholarly and ingenious, but, it must be admitted, not very convincing. Further evidence as to the early history of this alphabet must be discovered before we can definitely decide what its origin may be. That such evidence will be forthcoming there is little doubt. Even since Bühler wrote, the vase, the top of which is reproduced (see Plate), has been discovered on the borders of Nepal in a stupa where some of the relics of Buddha were kept. The inscription is of the same type as the Asoka inscriptions, but, in Bühler's opinion (*Journal of the Royal Asiatic Society*, xxx., 1898, p. 389), is older than Asoka's time. It reads as follows: *iyam salilanidhane Budhasa bhagavate sakiyanam sukitibhatinam sabhaginikanam saputadalanam.* "This casket of relics of the blessed Buddha is the pious foundation (so Pischel, no doubt rightly, *Zeitsch. d. deutsch. morg. Gesell.* lvi. 158) of the Sākyas, their brothers and their sisters, together with children and wives."

How this alphabet was modified locally, and how it spread to other Eastern lands, must be sought in the specialist works to which reference has already been made. Its extension to new and hitherto unknown languages was in 1910 in process of being rapidly demonstrated by English and German expeditions in Chinese Turkestan.

AUTHORITIES.—Owing to the rapid increase of materials, all early works are out of date. The best general accounts, though already somewhat antiquated, are: (1) *The Alphabet* (2 vols., with references to earlier works), by Canon Isaac Taylor (1883), reprinted from the stereotyped plates with small necessary corrections (1899); and (2) *Histoire de l'écriture dans l'antiquité*, by M. Philippe Berger (Paris, 1891, 2nd ed. 1892). An excellent popular account is *The Story of the Alphabet*, by E. Clodd (no date, about 1900). Faulmann's *Illustrierte Geschichte der Schrift* (1880) is a popular work with good illustrations. For the beginnings of the alphabet, Dr A. J. Evans's *Scripta Minoa* (vol. i., 1909) is indispensable, whether his theories hold their ground or not. The Semitic alphabet is excellently treated by Lidzbarski in the *Jewish Encyclopaedia* (1901); his *Nordsemitische Epigraphik* (1898) has excellent facsimiles and tables of the alphabets, and there are many contributions to the history of the alphabet in the same writer's *Ephemeris für semitische Epigraphik* (Giessen, since 1900). See also "Writing" (by A. A. Bevan) in the *Encyclopaedia Biblica*, and "Alphabet" (by Isaac Taylor) in Hastings' *Dictionary of the Bible*. A very good article, now somewhat antiquated, is Schlottmann's "Schrift und Schriftzeichen" in Riehm's *Handwörterbuch des biblischen Altertums* (1884, reprinted 1894). For Greek epigraphy the fullest and also most recent work is W. Larfeld's *Handbuch der griechischen Epigraphik* (vol. ii., 1902; vol. i., 1907) (see especially *Herkunft und Alter des griechischen Alphabets*, i. 330 ff.). For the history of the Greek alphabet the fundamental work was A. Kirchhoff's *Studien zur Geschichte des griechischen Alphabets* (4th ed., 1887): his theories were adopted and worked out on a much larger scale in E. S. Roberts's *Introduction to Greek Epigraphy*, pt. i. "The Archaic Inscriptions and the Greek Alphabet" (1887), pt. ii. (with E. A. Gardner) "The Inscriptions of Attica" (1905). See also Salomon Reinach's *Traité d' épigraphie grecque* (1885). In Iwan von Müller's *Handbuch der klassischen Altertumswissenschaft* important articles on both Greek and Latin epigraphy and alphabets have appeared (Greek in edition 1 by G. Heinrichs, 1886; in edition 2 by W. Larfeld, 1892; Latin by Emil Hübner). See also "Alphabet," by W. Deecke, in Baumeister's *Denkmäler des klassischen Altertums* (1884), and by Szanto (Greek) and Joh. Schmidt (Italic) in Pauly's *Realencyclopädie* edited by Wissowa (1894). Mommsen's *Die unteritalischen Dialekte* (1850) is not without value even now. Other literature and references to fuller bibliographies in separate departments have been given in the notes. Elsewhere in this edition of the *Encyclopaedia Britannica* the articles on the various languages and under the headings INSCRIPTIONS, PALAEOGRAPHY, WRITING, &c., should be consulted, while separate articles are given on each letter of the English alphabet. The writer is indebted to Dr A. J. Evans for a photograph of the Cretan linear script, and to Professors A. A. Bevan and Rapson of Cambridge, and to Mr F. W. Thomas, librarian of the India Office, for help in their respective departments of Semitic and Indian languages. (P. Gi.)

'AL-PHASI, ISAAC (1013–1103), Jewish rabbi and codifier, known as *Riph*, was born near Fez in 1013 and died at Lucena in 1103. 'Al-Phasi means the "man of Fez" (medieval Jews were often named after their birthplaces). He was forced to leave Fez when an old man of 75, being accused on some unknown political charge. He then settled in Spain where he was held in much esteem. His magnanimous character was illustrated by two incidents. When 'Al-phasi's opponent Isaac 'Albalia died, 'Al-phasi received 'Albalia's son with the greatest kindness and adopted him as a son. When, again, 'Al-phasi was himself on the point of death, he recommended as his successor in the Lucena rabbinate, not his own son, but his pupil Joseph ibn Migash. The latter became the teacher of Maimonides, and thus 'Al-phasi's teaching as well as his work must have directly influenced Maimonides. 'Al-phasi's fame rests on his Talmudical Digest called *Halakhoth* or *Decisions*. The Talmud was condensed by him with a special view to practical law. He omitted all the homiletical passages, and also excluded those parts of the Talmud which deal with religious duties practicable only in Palestine. 'Al-phasi thus occupies an important place in the development of the Spanish method of studying the Talmud. In contradistinction to the French rabbis, the Spanish sought to simplify the Talmud and free it from casuistical detail. 'Al-phasi succeeded in producing a Digest, which became the object of close study, and led in its turn to the great Codes of Maimonides and of Joseph Qaro.

ALPHEGE [ÆLFHEAH], SAINT (954–1023), archbishop of Canterbury, came of a noble family, but in early life gave up everything for religion. Having assumed the monastic habit in the monastery of Deerhurst, he pased thence to Bath, where he became an anchorite and ultimately abbot, distinguishing himself by his piety and the austerity of his life. In 984 he was appointed through Dunstan's influence to the bishopric of Winchester, and in 1006 he succeeded Ælfric as archbishop of Canterbury. At the sack of Canterbury by the Danes in 1011 Ælfheah was captured and kept in prison for seven months. Refusing to pay a ransom he was barbarously murdered at Greenwich on the 19th of April 1012. He was buried in St Paul's, whence his body was removed by Canute to Canterbury with all the ceremony of a great act of state in 1023.

Lives of St. Alphege in prose (which survives) and in verse were written by command of Lanfranc by the Canterbury monk Osbern (d. *c.* 1090), who says that his account of the solemn translation to Canterbury in 1023 was received from the dean, Godric, one of Alphege's own scholars.

ALPHEUS ('Αλφειός; mod. *Ruphia*), the chief river of Peloponnesus. Strictly Ruphia is the modern name for the ancient *Ladon*, a tributary which rises in N.E. Elis, but the name has been given to the whole river. The Alpheus proper rises near Asea; but its passage thither by subterranean channels from the Tegean plain and its union with the Eurotas are probably mythical (see W. Loring, in *Journ. Hell. Studies*, xv. p. 67). It consists for the most part of a shallow and rapid stream, occupying but a small part of its broad, stony bed. It empties itself into the Ionian sea. Pliny states that in ancient times it was navigable for six Roman miles from its mouth. Alpheus was recognized in cult and myth as the chief or typical river-god in the Peloponnesus, as was Achelous in northern Greece. His waters were said to pass beneath the sea and rise again in the fountain Arethusa at Syracuse; such is the earlier version from which later mythologists and poets evolved the familiar myth of the loves of Alpheus and Arethusa.

ALPHONSE I., Count of Toulouse (1103–1148), son of Count Raymond IV. by his third wife, Elvira of Castile, was born in 1103, in the castle of Mont-Pèlerin, Tripoli. He was surnamed Jourdain on account of his being baptized in the river Jordan. His father died when he was two years old and he remained under the guardianship of his cousin, Guillaume Jourdain, count of Cerdagne (d. 1109), until he was five. He was then taken to Europe and his brother Bertrand gave him the countship of Rouergue; in his tenth year, upon Bertrand's death (1112), he succeeded to the countship of Toulouse and marquisate of Provence, but Toulouse was taken from him by William IX., count of Poitiers, in 1114. He recovered a part in 1119, but continued to fight for his possessions until about 1123. When at last successful, he was excommunicated by Pope Calixtus II. for having expelled the monks of Saint-Gilles, who had aided his enemies. He next fought for the sovereignty of Provence against Raymond Berenger I., and not till September 1125 did the war end in an amicable agreement. Under it Jourdain became absolute master of the regions lying between the Pyrenees and the Alps, Auvergne and the sea. His ascendancy was an unmixed good to the country, for during a period of fourteen years art and industry flourished. About 1134 he seized the countship of Narbonne, only restoring it to the Viscountess Ermengarde (d. 1197) in 1143. Louis VII., for some reason which has not appeared, besieged Toulouse in 1141, but without result. Next year Jourdain again incurred the displeasure of the church by siding with the rebels of Montpellier against their lord. A second time he was excommunicated; but in 1146 he took the cross at the meeting of Vézelay called by Louis VII., and in August 1147 embarked for the East. He lingered on the way in Italy and probably in Constantinople; but in 1148 he had arrived at Acre. Among his companions he had made enemies and he was destined to take no share in the crusade he had joined. He was poisoned at Caesarea, either the wife of Louis or the mother of the king of Jerusalem suggesting the draught.

See the documentary *Histoire générale de Languedoc* by De Vie and Vaissette, vol. iii. (Toulouse, 1872).

ALPHONSE, Count of Toulouse and of Poitiers (1220–1271), the son of Louis VIII., king of France, and brother of St Louis, was born on the 11th of November 1220. He joined the county of Toulouse to his appanage of Poitou and Auvergne, on the death, in September 1249, of Raymond VII., whose daughter Jeanne he had married in 1237. He took the cross with his brother, St Louis, in 1248 and in 1270. In 1252, on the death of his mother, Blanche of Castile, he was joint regent with Charles of Anjou until the return of Louis IX., and took a great part in the negotiations which led to the treaties of Abbeville and of Paris (1258–1259). His main work was on his own estates. There he repaired the evils of the Albigensian war and made a first attempt at administrative centralization, thus preparing the way for union with the crown. The charter known as "Alphonsine," granted to the town of Riom, became the code of public law for Auvergne. Honest and moderate, protecting the middle classes against exactions of the nobles, he exercised a happy influence upon the south, in spite of his naturally despotic character and his continual and pressing need of money. He died without heirs on his return from the 8th crusade, in Italy, probably at Savona, on the 21st of August 1271.

See B. Ledain, *Histoire d'Alphonse, frère de S. Louis et du comté de Poitou sous son administration* (1241–1271) (Poitou, 1869); E. Boutaric, *Saint Louis et Alphonse de Poitiers* (Paris, 1870); A. Molinier, *Étude sur l'administration de S. Louis et d'Alphonse de Poitiers* (Toulouse, 1880); and also his edition of the *Correspondance administrative d'Alphonse de Poitiers* in the *Collection de documents inédits pour servir à l'histoire de France* (Paris, 1894 and 1895).

ALPHONSO, the common English spelling of Affonso, Alonso and Alfonso, which are respectively the Galician, the Leonese and the Castilian forms of Ildefonso (Ildefonsus), the name of a saint and archbishop of Toledo in the 7th century. The name has been borne by a number of Portuguese and Spanish kings, who are distinguished collectively below.

Kings of Portugal.

Portuguese Kings.—Alphonso I. (Affonso Henriques), son of Henry of Burgundy, count of Portugal, and Teresa of Castile, was born at Guimaraēs in 1094. He succeeded his father in 1112, and was placed under the tutelage of his mother. When he came of age, he was obliged to wrest from her by force that power which her vices and incapacity had rendered disastrous to the state. Being proclaimed sole ruler of Portugal in 1128, he defeated his mother's troops near Guimaraēs, making her at the same time his prisoner. He also vanquished Alphonso Raymond of Castile, his mother's ally, and thus freed Portugal from dependence on the crown of Leon. Next turning his arms against the Moors, he obtained, on the 26th July 1139, the famous victory of Ourique, and immediately after was proclaimed king by his soldiers. He assembled the Cortes of the kingdom at Lamego, where he received the crown from the archbishop of Braganza; the assembly also declaring that Portugal was no longer a dependency of Leon. Alphonso continued to distinguish himself by his exploits against the Moors, from whom he wrested Santarem in 1146 and Lisbon in 1147. Some years later he became involved in a war that had broken out among the kings of Spain; and in 1167, being disabled during an engagement near Badajoz by a fall from his horse, he was made prisoner by the soldiers of the king of Leon, and was obliged to surrender as his ransom almost all the conquests he had made in Galicia. In 1184, in spite of his great age, he had still sufficient energy to relieve his son Sancho, who was besieged in Santarem by the Moors. He died shortly after, in 1185. Alphonso was a man of gigantic stature, being 7 ft. high according to some authors. He is revered as a saint by the Portuguese, both on account of his personal character and as the founder of their kingdom.

Alphonso II., "the Fat," was born in 1185, and succeeded his father, Sancho I., in 1211. He was engaged in war with the Moors and gained a victory over them at Alcácer do Sal in 1217. He also endeavoured to weaken the power of the clergy and to apply a portion of their enormous revenues to purposes of national utility. Having been excommunicated for this by the pope (Honorius III.), he promised to make amends to the church; but he died in 1223 before doing anything to fulfil his engagement. He framed a code which introduced several beneficial changes into the laws of his kingdom.

Alphonso III., son of Alphonso II., was born in 1210, and succeeded his brother, Sancho II., in 1248. Besides making war upon the Moors, he was, like his father, frequently embroiled with the church. In his reign Algarve became part of Portugal. He died in 1279.

Alphonso IV. was born in 1290, and in 1325 succeeded his father, Dionis, whose death he had hastened by his intrigues and rebellions. Hostilities with the Castilians and with the Moors occupied many years of his reign, during which he gained some successes; but by consenting to the barbarous murder of Iñez de Castro, who was secretly espoused to his son Peter, he has fixed an indelible stain on his character. Enraged at this barbarous act, Peter put himself at the head of an army and devastated the whole of the country between the Douro and the Minho before he was reconciled to his father. Alphonso died almost immediately after, on the 12th of May 1357.

Alphonso V., "Africano," was born in 1432, and succeeded his father Edward in 1438. During his minority he was placed under the regency, first of his mother and latterly of his uncle, Dom Pedro. In 1448 he assumed the reins of government and at the same time married Isabella, Dom Pedro's daughter. In the following year, being led by what he afterwards discovered to be false representations, he declared Dom Pedro a rebel and defeated his army in a battle at Alfarrobeira, in which his uncle was slain. In 1458, and with more numerous forces in 1471, he invaded the territories of the Moors in Africa and by his successes there acquired his surname of "the African." On his return to Portugal in 1475 his ambition led him into Castile, where two princesses were disputing his succession to the throne. Having been affianced to the Princess Juana, Alphonso caused himself to be proclaimed king of Castile and Leon; but in the following year he was defeated at Toro by Ferdinand, the husband of Isabella of Castile. He went to France to obtain the assistance of Louis XI., but finding himself deceived by the French monarch, he abdicated in favour of his son John. When he returned to Portugal, however, he was compelled by his son to resume the sceptre, which he continued to wield for two years longer. After that he fell into a deep melancholy and retired into a monastery at Cintra, where he died in 1481.

Alphonso VI., the second king of the house of Braganza, was born in 1643 and succeeded his father in 1656. In 1667 he was compelled by his wife and brother to abdicate the throne and was banished to the island of Terceira. These acts, which the vices of Alphonso had rendered necessary, were sanctioned by the Cortes in 1668. He died at Cintra in 1675.

Kings of medieval and modern Spain.

Spanish Kings.—From Alphonso I. (739–757) to Alphonso V. (999–1028) the personal history of the Spanish kings of this name is unknown and their very dates are disputed. **Alphonso I.** is said to have married Ormesinda, daughter of Pelayo, who was raised on the shield in Asturias as king of the Goths after the Arab conquest. He is also said to have been the son of Peter, duke of Cantabria. It is not improbable that he was in fact an hereditary chief of the Basques, but no contemporary records exist. His title of "the Catholic" itself may very well have been the invention of later chronicles. **Alphonso II.** (789–842), his reputed grandson, bears the name of "the Chaste." The Arab writers who speak of the Spanish kings of the north-west as the Beni-Alfons, appear to recognize them as a royal stock derived from Alphonso I. The events of his reign are in reality unknown. Poets of a later generation invented the story of the secret marriage of his sister Ximena with Sancho, count of Saldaña, and the feats of their son Bernardo del Carpio. Bernardo is the hero of a *cantar de gesta* (*chanson de geste*) written to please the anarchical spirit of the nobles.

The first faint glimmerings of medieval Spanish history begin with **Alphonso III.** (866–914) surnamed "the Great." Of him also nothing is really known except the bare facts of his reign and of his comparative success in consolidating the kingdom known as "of Galicia" or "of Oviedo" during the weakness of the Omayyad princes of Cordova. **Alphonso IV.** (924–931) has a faint personality. He resigned the crown to his brother Ramiro and went into a religious house. A certain instability of character is revealed by the fact that he took up arms against Ramiro, having repented of his renunciation of the world. He was defeated, blinded and sent back to die in the cloister of Sahagun. It fell to **Alphonso V.** (999–1028) to begin the work of reorganizing the Christian kingdom of the north-west after a most disastrous period of civil war and Arab inroads. Enough is known of him to justify the belief that he had some of the qualities of a soldier and a statesman. His name, and that of his wife Geloria (Elvira), are associated with the grant of the first franchises of Leon. He was killed by an arrow while besieging the town of Viseu in northern Portugal, then held by the Mahommedans. (For all these kings see the article Spain: *History*.)

With **Alphonso VI.** (1065–1109) we come to a sovereign of strong personal character. Much romance has gathered round his name. In the *cantar de gesta* of the Cid he plays the part attributed by medieval poets to the greatest kings, to Charlemagne himself. He is alternately the oppressor and the victim of heroic and self-willed nobles—the idealized types of the patrons for whom the jongleurs and troubadours sang. (For the events of his reign see the article Spain: *History*.) He is the hero of a *cantar de gesta* which, like all but a very few of the early Spanish songs, like the *cantar* of Bernardo del Carpio and the *Infantes* of Lara, exists now only in the fragments incorporated in the chronicle of Alphonso the Wise or in ballad form. His flight from the monastery of Sahagun, where his brother Sancho endeavoured to imprison him, his chivalrous friendship for his host Almanun of Toledo, *caballero aunque mon*, a gentleman although a Moor, the passionate loyalty of his vassal Peranzules and his brotherly love for his sister Urraca of Zamora, may owe something to the poet who took him for hero. They are the answer to the poet of the nobles who represented the king as having submitted to take a degrading oath at the hands of Ruy Diaz of Bivar (the Cid), in the church of Santa Gadea at Burgos, and as having then persecuted the brave man who defied him. When every allowance is made, Alphonso VI. stands out as a strong man fighting for his own hand, which in his case was the hand of the king whose interest was law and order and who was the leader of the nation in the reconquest. On the Arabs he impressed himself as an enemy very fierce and astute, but as a keeper of his word. A story of Mahommedan origin, which is probably no more historical than the oath of Santa Gadea, tells of how he allowed himself to be tricked by Ibn Ammar, the favourite of Al Motamid, the king of Seville. They played chess for an extremely beautiful table and set of men, belonging to Ibn Ammar. Table and men were to go to the king if he won. If Ibn Ammar gained he was to name the stake. The latter did win and demanded that the Christian king should spare Seville. Alphonso kept his word. Whatever truth may lie behind the romantic tales of Christian and Mahommedan, we know that Alphonso represented in a remarkable way the two great influences then shaping the character and civilization of Spain. At the instigation, it is said, of his second wife, Constance of Burgundy, he brought the Cistercians into Spain, established them in Sahagun, chose a French Cistercian, Bernard, as the first archbishop of Toledo after the reconquest in 1085, married his daughters, legitimate and illegitimate, to French princes, and in every way forwarded the spread of French influence—then the greatest civilizing force in Europe. He also drew Spain nearer to the papacy, and it was his decision which established the Roman ritual in place of the old missal of Saint Isidore—the so-called Mozarabic. On the other hand he was very open to Arabic influence. He protected the Mahommedans among his subjects and struck coins with inscriptions in Arabic letters. After the death of Constance he perhaps married and he certainly lived with Zaida, said to have been a daughter of "Benabet" (Al Motamid), Mahommedan king of Seville. Zaida, who became a Christian under the name of Maria or Isabel, bore him the only son among his many children, Sancho, whom Alphonso designed to be his successor, but who was slain at the battle of Uclés in 1108. Women play a great part in Alphonso's life.

[**Alphonso I.**, king of Aragon, "the Battler," who married Urraca, daughter of Alphonso VI. (1104–1134), is sometimes counted the VIIth in the line of the kings of Leon and Castile. A passionate fighting-man (he fought twenty-nine battles against Christian or Moor), he was married to Urraca, widow of Raymond of Burgundy, a very dissolute and passionate woman. The marriage had been arranged by Alphonso VI. in 1106 to unite the two chief Christian states against the Almoravides, and to supply them with a capable military leader. But Urraca was tenacious of her right as proprietary queen and had not learnt chastity in the polygamous household of her father. Husband and wife quarrelled with the brutality of the age and came to open war. Alphonso had the support of one section of the nobles who found their account in the confusion. Being a much better soldier than any of his opponents he gained victories at Sepúlveda and Fuente de la Culebra, but his only trustworthy supporters were his Aragonese, who were not numerous enough to keep down Castile and Leon. The marriage of Alphonso and Urraca was declared null by the pope, as they were third cousins. The king quarrelled with the church, and particularly the Cistercians, almost as violently as with his wife. As he beat her, so he drove Archbishop Bernard into exile and expelled the monks of Sahagun. He was finally compelled to give way in Castile and Leon to his stepson Alphonso, son of Urraca and her first husband. The intervention of Pope Calixtus II. brought about an arrangement between the old man and the young. Alphonso the Battler won his great successes in the middle Ebro, where he expelled the Moors from Saragossa; in the great raid of 1125, when he carried away a large part of the subject-Christians from Granada, and in the south-west of France, where he had rights as king of Navarre. Three years before his death he made a will leaving his kingdom to the Templars, the Hospitallers, and the Knights of the Sepulchre, which his subjects refused to carry out. He was a fierce, violent man, a soldier and nothing else, whose piety was wholly militant. Though he died in 1134 after an unsuccessful battle with the Moors at Braga, he has a great place in the reconquest.]

Alphonso VII., "the Emperor" (1126–1157), is a dignified and somewhat enigmatical figure. A vague tradition had always assigned the title of emperor to the sovereign who held Leon as the most direct representative of the Visigoth kings, who were themselves the representatives of the Roman empire. But though given in charters, and claimed by Alphonso VI. and the Battler, the title had been little more than a flourish of rhetoric. Alphonso VII. was crowned emperor in 1135 after the death of the Battler. The weakness of Aragon enabled him to make his superiority effective. He appears to have striven for the formation of a national unity, which Spain had never possessed since the fall of the Visigoth kingdom. The elements he had to deal with could not be welded together. Alphonso was at once a patron of the church, and a protector if not a favourer of the Mahommedans, who formed a large part of his subjects. His reign ended in an unsuccessful campaign against the rising power of the Almohades. Though he was not actually defeated, his death in the pass of Muradel in the Sierra Morena, while on his way back to Toledo, occurred in circumstances which showed that no man could be what he claimed to be—"king of the men of the two religions." His personal character does not stand out with the emphasis of those of Alphonso VI. or the Battler. Yet he was a great king, the type and to some extent the victim of the confusions of his age—Christian in creed and ambition, but more than half oriental in his household.

Alphonso VIII. (1158–1214), king of Castile only, and grandson of Alphonso VII., is a great name in Spanish history, for he led the coalition of Christian princes and foreign crusaders who broke the power of the Almohades at the battle of the Navas de Tolosa in 1212. The events of his reign are dealt with under Spain. His personal history is that of many medieval kings. He succeeded to the throne on the death of his father, Sancho, at the age of a year and a half. Though proclaimed king, he was regarded as a mere name by the unruly nobles to whom a minority was convenient. The devotion of a squire of his household, who carried him on the pommel of his saddle to the stronghold of San Esteban de Gormaz, saved him from falling into the hands of the contending factions of Castro and Lara, or of his uncle Ferdinand of Leon, who claimed the regency. The loyalty of the town of Avila protected his youth. He was barely fifteen when he came forth to do a man's work by restoring his kingdom to order. It was only by a surprise that he recovered his capital Toledo from the hands of the Laras. His marriage with Leonora of Aquitaine, daughter of Henry II. of England, brought him under the influence of the greatest governing intellect of his time. Alphonso VIII. was the founder of the first Spanish university, the *studium generale* of Palencia, which, however, did not survive him.

Alphonso IX. (1188–1230) of Leon, first cousin of Alphonso VIII. of Castile, and numbered next to him as being a junior member of the family (see the article Spain for the division of the kingdom and the relationship), is said by Ibn Khaldun to have been called the "Baboso" or Slobberer, because he was subject to fits of rage during which he foamed at the mouth. Though he took a part in the work of the reconquest, this king is chiefly remembered by the difficulties into which his successive marriages led him with the pope. He was first married to his cousin Teresa of Portugal, who bore him two daughters, and a son who died young. The marriage was declared null by the pope, to whom Alphonso paid no attention till he was presumably tired of his wife. It cannot have been his conscience which constrained him to leave Teresa, for his next step was to marry Berengaria of Castile, who was his second cousin. For this act of contumacy the king and kingdom were placed under interdict. The pope was, however, compelled to modify his measures by the threat that if the people could not obtain the services of religion they would not support the clergy, and that heresy would spread. The king was left under interdict personally, but to that he showed himself indifferent, and he had the support of his clergy. Berengaria left him after the birth of five children, and the king then returned to Teresa, to whose daughters he left his kingdom by will.

Alphonso X., *El Sabio*, or the learned (1252–1284), is perhaps the most interesting, though he was far from being the most capable, of the Spanish kings of the middle ages. (His merits as a writer are dealt with in the article Spain: *Literature*). His scientific fame is based mainly on his encouragement of astronomy. It may be pointed out, however, that the story which represents him as boasting of his ability to make a better world than this is of late authority. If he said so, he was speaking of the Ptolemaic cosmogony as known to him through the Arabs, and his vaunt was a humorous proof of his scientific instinct. As a ruler he showed legislative capacity, and a very commendable wish to provide his kingdoms with a code of laws and a consistent judicial system. The *Fuero Real* was undoubtedly his work, and he began the code called the *Siete Partidas*, which, however, was only promulgated by his great-grandson. Unhappily for himself and for Spain, he wanted the singleness of purpose required by a ruler who would devote himself to organization, and also the combination of firmness with temper needed for dealing with his nobles. His descent from the Hohenstaufen through his mother, a daughter of the emperor Philip, gave him claims to represent the Swabian line. The choice of the German electors, after the death of Conrad IV. in 1254, misled him into wild schemes which never took effect but caused immense expense. To obtain money he debased the coinage, and then endeavoured to prevent a rise in prices by an arbitrary tariff. The little trade of his dominions was ruined, and the burghers and peasants were deeply offended. His nobles, whom he tried to cow by sporadic acts of violence, rebelled against him. His second son, Sancho, enforced his claim to be heir, in preference to the children of Ferdinand de la Cerda, the elder brother who died in Alphonso's life. Son and nobles alike supported the Moors, when he tried to unite the nation in a crusade; and when he allied himself with the rulers of Morocco they denounced him as an enemy of the faith. A reaction in his favour was beginning in his later days, but he died defeated and deserted at Seville, leaving a will by which he endeavoured to exclude Sancho and a heritage of civil war.

Alphonso XI. (1312–1350) is variously known among Spanish kings as the Avenger or the Implacable, and as "he of the Rio Salado." The first two names he earned by the ferocity with which he repressed the disorder of the nobles after a long minority; the third by his victory over the last formidable African invasion of Spain in 1340. The chronicler who records his death prays that "God may be merciful to him, for he was a very great king." The mercy was needed. Alphonso XI. never went to the insane lengths of his son Peter the Cruel, but he could be abundantly sultanesque in his methods. He killed for reasons of state without form of trial, while his open neglect of his wife, Maria of Portugal, and his ostentatious passion for Leonora de Guzman, who bore him a large family of sons, set Peter an example which he did not fail to better. It may be that his early death, during the great plague of 1350, at the siege of Gibraltar, only averted a desperate struggle with his legitimate son, though it was a misfortune in that it removed a ruler of eminent capacity, who understood his subjects well enough not to go too far.

[Four other kings of Aragon, besides the Battler, bore the name of Alphonso. All these princes held territory in the south-east of France, and had a close connexion with Italy. Alphonso II. of Aragon (1162–1196) was the son of Raymond Berenger, count of Barcelona, and of Petronilla, niece of Alphonso the Battler, and daughter of Ramiro surnamed the Monk. He succeeded to the county of Barcelona in 1162 on the death of his father, at the age of eleven, and in 1164 his mother renounced her rights in Aragon in his favour. Though christened Ramon (Raymond), the favourite name of his line, he reigned as Alphonso out of a wish to please his Aragonese subjects, to whom the memory of the Battler was dear. As king of Aragon he took a share in the work of the reconquest, by helping his cousin Alphonso VIII. of Castile to conquer Cuenca, and to suppress one Pero Ruiz de Azagra, who was endeavouring to carve out a kingdom for himself in the debatable land between Christian and Mahommedan. But his double position as ruler both north and south of the eastern Pyrenees distracted his policy. In character and interests he was rather Provençal than Spanish, a favourer of the troubadours, no enemy of the Albigensian heretics, and himself a poet in the southern French dialect. Alphonso III. of Aragon (1285–1291), the insignificant son of the notable Peter III., succeeded to the Spanish and Provençal possessions of his father, but his short reign did not give him time even to marry. His inability to resist the demands of his nobles left a heritage of trouble in Aragon. By recognising their right to rebel in the articles called the Union he helped to make anarchy permanent. Alphonso IV. of Aragon (1327–1336) was a weak man whose reign was insignificant. Alphonso V. of Aragon (1416–1458), surnamed the Magnanimous, who represented the old line of the counts of Barcelona only through women, and was on his father's side descended from the Castilian house of Trastamara, is one of the most conspicuous figures of the early Renaissance. No man of his time had a larger share of the quality called by the Italians of the day "virtue." By hereditary right king of Sicily, by the will of Joanna II. and his own sword king of Naples, he fought and triumphed amid the exuberant development of individuality which accompanied the revival of learning and the birth of the modern world. When a prisoner in the hands of Filipo Maria Visconti, duke of Milan, in 1435, Alphonso persuaded his ferocious and crafty captor to let him go by making it plain that it was the interest of Milan not to prevent the victory of the Aragonese party in Naples. Like a true prince of the Renaissance he favoured men of letters whom he trusted to preserve his reputation to posterity. His devotion to the classics was exceptional even in that time. He halted his army in pious respect before the birthplace of a Latin writer, carried Livy or Caesar on his campaigns with him, and his panegyrist Panormita did not think it an incredible lie to say that the king was cured of an illness by having a few pages of Quintus Curtius read to him. The classics had not refined his taste, for he was amused by setting the wandering scholars, who swarmed to his court, to abuse one another in the indescribably filthy Latin scolding matches which were then the fashion. Alphonso founded nothing, and after his conquest of Naples in 1442 ruled by his mercenary soldiers, and no less mercenary men of letters. His Spanish possessions were ruled for him by his brother John. He left his conquest of Naples to his bastard son Ferdinand; his inherited lands, Sicily and Sardinia, going to his brother John who survived him.]

Alphonso XII. (1857–1885), king of modern Spain, son of Isabella II. and Maria Fernando Francisco de Assisi, eldest son of the duke of Cadiz, was born on the 28th of November 1857. When Queen Isabella and her husband were forced to leave Spain by the revolution of 1868 he accompanied them to Paris, and from thence he was sent to the Theresianum at Vienna to continue his studies. On the 25th of June 1870 he was recalled to Paris, where his mother abdicated in his favour, in the presence of a number of Spanish nobles who had followed the fortunes of the exiled queen. He assumed the title of Alphonso XII.; for although no king of *united* Spain had previously borne the name, the Spanish monarchy was regarded as continuous with the more ancient monarchy, represented by the eleven kings of Leon and Castile already referred to. Shortly afterwards he proceeded to Sandhurst to continue his military studies, and while there he issued, on the 1st of December 1874, in reply to a birthday greeting from his followers, a manifesto proclaiming himself the sole representative of the Spanish monarchy. At the end of the year, when Marshal Serrano left Madrid to take command of the northern army, General Martinez Campos, who had long been working more or less openly for the king, carried off some battalions of the central army to Sagunto, rallied to his own flag the troops sent against him, and entered Valencia in the king's name. Thereupon the president of the council resigned, and the power was transferred to the king's plenipotentiary and adviser, Canovas del Castillo. In the course of a few days the king arrived at Madrid, passing through Barcelona and Valencia, and was received everywhere with acclamation (1875). In 1876 a vigorous campaign against the Carlists, in which the young king took part, resulted in the defeat of Don Carlos and his abandonment of the struggle. Early in 1878 Alphonso married his cousin, Princess Maria de las Mercedes, daughter of the duc de Montpensier, but she died within six months of her marriage. Towards the end of the same year a young workman of Tarragona, Oliva Marcousi, fired at the king in Madrid. On the 29th of November 1879 he married a princess of Austria, Maria Christina, daughter of the Archduke Charles Ferdinand. During the honeymoon a pastrycook named Otero fired at the young sovereigns as they were driving in Madrid. The children of this marriage were Maria de las Mercedes, titular queen from the death of her father until the birth of her brother, born on the 11th of September 1880, married on the 14th of February 1901 to Prince Carlos of Bourbon, died on the 17th of October 1904; Maria Teresa, born on the 12th of November 1882, married to Prince Ferdinand of Bavaria on the 12th of January 1906; and Alphonso (see below). In 1881 the king refused to sanction the law by which the ministers were to remain in office for a fixed term of eighteen months, and upon the consequent resignation of Canovas del Castillo, he summoned Sagasta, the Liberal leader, to form a cabinet. Alphonso died of phthisis on the 24th of November 1885. Coming to the throne at such an early age, he had served no apprenticeship in the art of ruling, but he possessed great natural tact and a sound judgment ripened by the trials of exile. Benevolent and sympathetic in disposition, he won the affection of his people by fearlessly visiting the districts ravaged by cholera or devastated by earthquake in 1885. His capacity for dealing with men was considerable, and he never allowed himself to become the instrument of any particular party. In his short reign peace was established both at home and abroad, the finances were well regulated, and the various administrative services were placed on a basis that afterwards enabled Spain to pass through the disastrous war with the United States without even the threat of a revolution.

Alphonso XIII. (1886–   ), king of Spain, son of Alphonso XII., was born, after his father's death, on the 17th of May 1886. His mother, Queen Maria Christina, was appointed regent during his minority (see Spain: *History*). In 1902, on attaining his 16th year, the king assumed control of the government. On the 31st of May 1906 he married Princess Victoria Eugénie Julia Ena Maria Christina of Battenberg, niece of Edward VII. of England. As the king and queen were returning from the wedding they narrowly escaped assassination in a bomb explosion, which killed and injured many bystanders and members of the royal procession. An heir to the throne was born on the 10th of May 1907, and received the name of Alphonso.

Authorities.—The lives of all the early kings of Spain will be found in the general histories (see the article Spain: *Authorities*), of which the most trustworthy is the *Anales de la Corona de Aragon*, by Geronimo Zurita (Saragossa, 1610). See also the Chronicles of the Kings of Castile in the *Biblioteca de Autores Españoles de Rivadeneyra* (Madrid, 1846–1880, vols. 66, 68, 70). (D. H.)

ALPHONSUS A SANCTA MARIA, or Alphonso de Cartagena (1396–1456), Spanish historian, was born at Carthagena, and succeeded his father, Paulus, as bishop of Burgos. In 1431 he was deputed by John II., king of Castile, to attend the council of Basel, in which he made himself conspicuous by his learning. He was the author of several works, the principal of which is entitled *Rerum Hispanorum Romanorum imperatorum, summorum pontificum, nec non regum Francorum anacephaleosis.*

This is a history of Spain from the earliest times down to 1456, and was printed at Granada in 1545, and also in the *Rerum Hispanicarum Scriptores aliquot*, by R. Bel (Frankfort, 1579). Alphonsus died on the 12th of July 1456.

ALPINI, PROSPERO (Prosper Alpinus), 1553-1617, Italian physician and botanist, was born at Marostica, in the republic of Venice, on the 23rd of November 1553. In his youth he served for a time in the Milanese army, but in 1574 he went to study medicine at Padua. After taking his doctor's degree in 1578, he settled as a physician in Campo San Pietro, a small town in the Paduan territory. But his tastes were botanical, and to extend his knowledge of exotic plants he travelled to Egypt in 1580 as physician to George Emo or Hemi, the Venetian consul in Cairo. In Egypt he spent three years, and from a practice in the management of date-trees, which he observed in that country, he seems to have deduced the doctrine of the sexual difference of plants, which was adopted as the foundation of the Linnaean system. He says that "the female date-trees or palms do not bear fruit unless the branches of the male and female plants are mixed together; or, as is generally done, unless the dust found in the male sheath or male flowers is sprinkled over the female flowers." On his return, he resided for some time at Genoa as physician to Andrea Doria, and in 1593 he was appointed professor of botany at Padua, where he died on the 6th of February 1617. He was succeeded in the botanical chair by his son Alpino Alpini (d. 1637). His best-known work is *De Plantis Aegypti liber* (Venice, 1592). His *De Medicina Egyptiorum* (Venice, 1591) is said to contain the first account of the coffee plant published in Europe. The genus *Alpinia*, belonging to the order Zingiberaceae, was named after him by Linnaeus.

ALPS, the collective name for one of the great mountain systems of Europe.

1. *Position and Name.*—The continent of Europe is no more than a great peninsula extending westwards from the much vaster continent of Asia, while it is itself broken up by two inland seas into several smaller peninsulas—the Mediterranean forming the Iberian, the Italian and the Greek peninsulas, while the Baltic forms that of Scandinavia and the much smaller one of Denmark. Save the last-named, all these peninsulas of Europe are essentially mountain ranges. But in height and importance the ranges that rise therein are much surpassed by a great mountain-chain, stretching from south-eastern France to the borders of Hungary, as well as between the plains of northern Italy and of southern Germany. This chain is collectively known as the Alps, and is the most important physical feature of the European continent. The Alps, however, do not present so continuous a barrier as the Himalayas, the Andes or even the Pyrenees. They are formed of numerous ranges, divided by comparatively deep valleys, which, with many local exceptions, tend towards parallelism with the general direction of the whole mass. This, between the Dauphiné and the borders of Hungary, forms a broad band convex towards the north, while most of the valleys lie between the directions west to east and south-west to north-east. But in many parts deep transverse valleys intersect the prevailing direction of the ridges, and facilitate the passage of man, plants and animals, as well as of currents of air which mitigate the contrast that would otherwise be found between the climates of the opposite slopes.

The derivation of the name Alps is still very uncertain, some writers connecting it with a Celtic root *alb*, said to mean height, while others suggest the Latin adjective *albus* (white), referring to the colour of the snowy peaks. But in all parts of the great chain itself, the term *Alp* (or *Alm* in the Eastern Alps) is exclusively applied to the high mountain pastures (see Alp), and not to the peaks and ridges of the chain.

2. *Limits.*—These will depend on the meaning we attach to the word Alps as referring to the great mountain-chain of central Europe. If we merely desire to distinguish it from certain minor ranges (*e.g.* the Cévennes, the Jura, the hills of central Germany, the Carpathians, the Apennines), which are really independent ranges rather than offshoots of the main chain, the best limits are on the west (strictly speaking south), the Col d'Altare or di Cadibona (1624 ft.), leading from Turin to Savona and Genoa, and on the east the line of the railway over the Semmering Pass (3215 ft.) from Vienna to Marburg in the Mur valley, and on by Laibach to Trieste. But if we confine the meaning of the term Alps to those parts of the chain that are what is commonly called "Alpine," where the height is sufficient to support a considerable mass of perpetual snow, our boundaries to the west and to the east must be placed at spots other than those mentioned above. To the west the limit will then be the Col de Tenda (6145 ft.), leading from Cuneo (*Coni*) to Ventimiglia, while on the east our line will be the route over the Radstädter Tauern (5702 ft.) and the Katschberg (5384 ft.) from Salzburg to Villach in Carinthia, and thence by Klagenfurt to Marburg and so past Laibach in Carniola on to Trieste; from Villach the direct route to Trieste would be over the Predil Pass (3813 ft.) or the Pontebba or Saifnitz Pass (2615 ft.), more to the west, but in either case this would exclude the Terglou (9400 ft.), the highest summit of the entire South-Eastern Alps, as well as its lower neighbours.

On the northern side the Alps (in whichever sense we take this term) are definitely bounded by the course of the Rhine from Basel to the Lake of Constance, the plain of Bavaria, and the low region of foot-hills that extend from Salzburg to the neighbourhood of Vienna. One result of this limit, marked out by Nature herself, is that the waters which flow down the northern slope of the Alps find their way either into the North Sea through the Rhine, or into the Black Sea by means of the Danube, not a drop reaching the Baltic Sea. On the southern side the mountains extending from near Turin to near Trieste subside into the great plain of Piedmont, Lombardy and Venetia. But what properly forms the western bit of the Alps runs, from near Turin to the Col de Tenda, in a southerly direction, then bending eastwards to the Col d'Altare that divides it from the Apennines.

It should be borne in mind that the limits adopted above refer purely to the topographical aspect of the Alps as they exist at the present day. Naturalists will of course prefer other limits according as they are geologists, botanists or zoologists.

3. *Climate.*—It is well known that as we rise from the sea-level into the upper regions of the atmosphere the temperature decreases. The effect of mountain-chains on prevailing winds is to carry warm air belonging to the lower region into an upper zone, where it expands in volume at the cost of a proportionate loss of heat, often accompanied by the precipitation of moisture in the form of snow or rain. The position of the Alps about the centre of the European continent has profoundly modified the climate of all the surrounding regions. The accumulation of vast masses of snow, which have gradually been converted into permanent glaciers, maintains a gradation of very different climates within the narrow space that intervenes between the foot of the mountains and their upper ridges; it cools the breezes that are wafted to the plains on either side, but its most important function is to regulate the water-supply of that large region which is traversed by the streams of the Alps. Nearly all the moisture that is precipitated during six or seven months is stored up in the form of snow, and is gradually diffused in the course of the succeeding summer; even in the hottest and driest seasons the reserves accumulated during a long preceding period of years in the form of glaciers are available to maintain the regular flow of the greater streams. Nor is this all; the lakes that fill several of the main valleys on the southern side of the Alps are somewhat above the level of the plains of Lombardy and Venetia, and afford an inexhaustible supply of water, which, from a remote period, has been used for that system of irrigation to which they owe their proverbial fertility. Six regions or zones, which are best distinguished by their characteristic vegetation, are found in the Alps. It is an error to suppose that these are indicated by absolute height above the sea-level. Local conditions of exposure to the sun, protection from cold winds, or the reverse, are of primary importance in determining the climate and the corresponding vegetation.

Olive region.

The great plain of Upper Italy has a winter climate colder than that of the British Islands. The olive and the characteristic shrubs of the northern coasts of the Mediterranean do not thrive in the open air, but the former valuable tree ripens its fruit in sheltered places at the foot of the mountains, and penetrates along the deeper valleys and the shores of the Italian lakes. The evergreen oak is wild on the rocks about the Lake of Garda, and lemons are cultivated on a large scale, with partial protection in winter. The olive has been known to survive severe cold when of short duration, but it cannot be cultivated with success where frosts are prolonged, or where the mean winter temperature falls below 42° F.; and to produce fruit it requires a heat of at least 75° F. during the day, continued through four or five months of the summer and autumn.

Vine region.

The vine is far more tolerant of cold than the olive, but to produce tolerable wine it demands, at the season of ripening, a degree of heat not much less than that needed by the more delicate tree. These conditions are satisfied in the deeper valleys of the Alps, even in the interior of the chain, and up to a considerable height on slopes exposed to the sun. The protection afforded by winter snow enables the plant to resist severe and prolonged frosts, such as would be fatal in more exposed situations. Many wild plants characteristic of the warmer parts of middle Europe are seen to flourish along with the vine. A mean summer temperature of at least 68° F. is considered necessary to produce tolerable wine, but in ordinary seasons this is much exceeded in many of the great valleys of the Alps.

Mountain region, or region of deciduous trees.

Many writers take the growth of grain as the characteristic of the mountain region; but so many varieties of all the common species are in cultivation, and these have such different climatal requirements, that they do not afford a satisfactory criterion. A more natural limit is afforded by the presence of the chief deciduous trees—oak, beech, ash and sycamore. These do not reach exactly to the same elevation, nor are they often found growing together; but their upper limit corresponds accurately enough to the change from a temperate to a colder climate that is further proved by a change in the wild herbaceous vegetation. This limit usually lies about 4000 ft. above the sea on the north side of the Alps, but on the southern slopes it often rises to 5000 ft., sometimes even to 5500 ft. It must not be supposed that this region is always marked by the presence of the characteristic trees. The interference of man has in many districts almost extirpated them, and, excepting the beech forests of the Austrian Alps, a considerable wood of deciduous trees is scarcely anywhere to be found. In many districts where such woods once existed, their place has been occupied by the Scottish pine and spruce, which suffer less from the ravages of goats, the worst enemies of tree vegetation. The mean annual temperature of this region differs little from that of the British Islands; but the climatal conditions are widely different. Here snow usually lies for several months, till it gives place to a spring and summer considerably warmer than the average of British seasons.

Subalpine region, or region of coniferous trees.

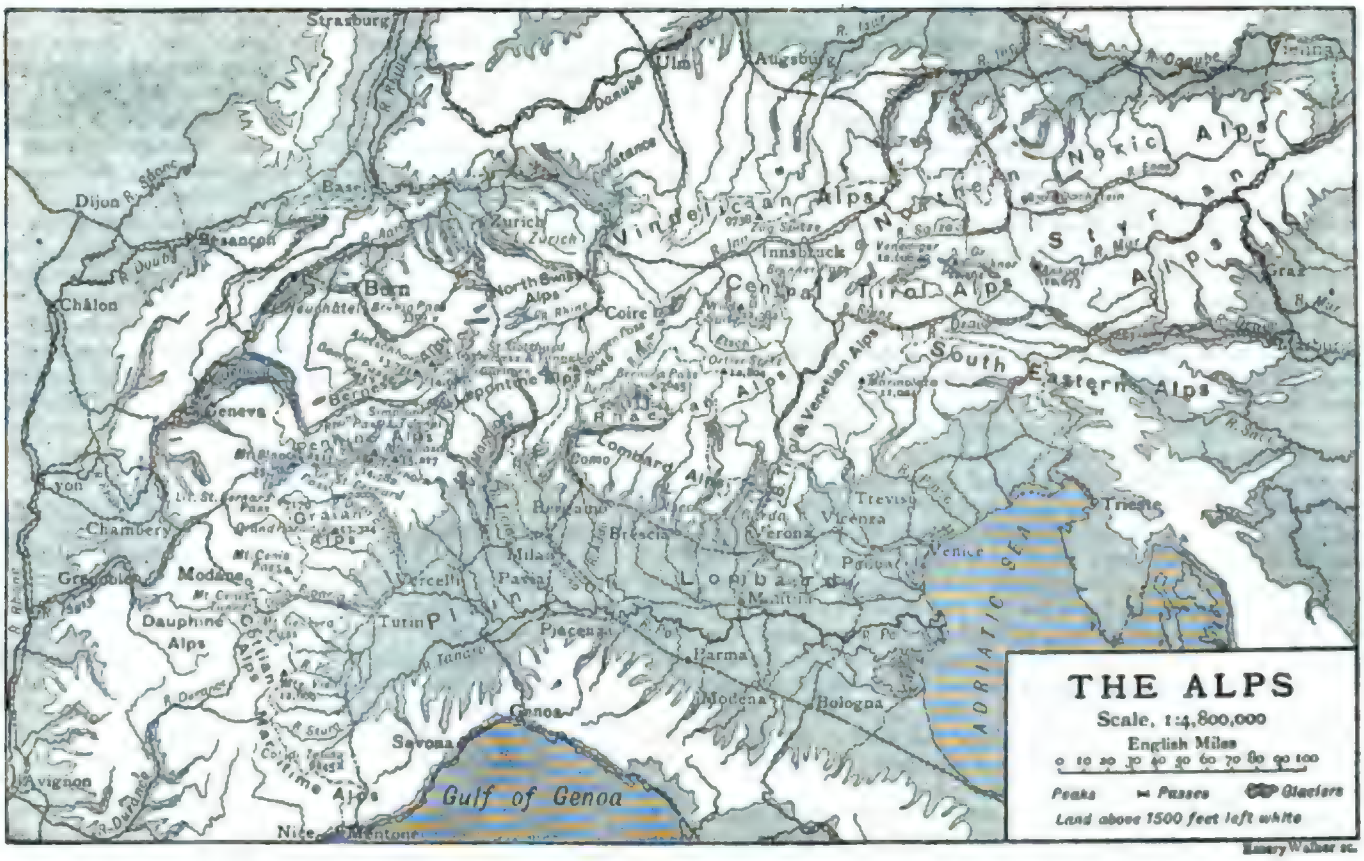
The Subalpine is the region which mainly determines the manner of life of the population of the Alps. On a rough estimate we may reckon that, of the space lying between the summits of the Alps and the low country on either side, one-quarter is available for cultivation, of which about one-half may be vineyards and corn-fields, while the remainder produces forage and grass. About another quarter is utterly barren, consisting of snow-fields, glaciers, bare rock, lakes and the beds of streams. There remains about one-half, which is divided between forest and pasture, and it is the produce of this half which mainly supports the relatively large population. For a quarter of the year the flocks and herds are fed on the upper pastures; but the true limit of the wealth of a district is the number of animals that can be supported during the long winter, and while one part of the population is engaged in tending the beasts and in making cheese and butter, the remainder is busy cutting hay and storing up winter food for the cattle. The larger villages are mostly in the mountain region, but in many parts of the Alps the villages stand in the subalpine region at heights varying from 4000 ft. to 5500 ft. above the sea, more rarely extending to about 6000 ft. The most characteristic feature of this region is the prevalence of coniferous trees, which, where they have not been artificially kept down, form vast forests that cover a large part of the surface. These play a most important part in the natural economy of the country. They protect the valleys from destructive avalanches, and, retaining the superficial soil by their roots, they mitigate the destructive effects of heavy rains. In valleys where they have been rashly cut away, and the waters pour down the slopes unchecked, every tiny rivulet becomes a raging torrent, that carries off the grassy slopes and devastates the floor of the valley, covering the soil with gravel and débris. In the pine forests of the Alps the prevailing species are the common spruce and the silver fir; on siliceous soil the larch flourishes, and surpasses every other European species in height. The Scottish pine is chiefly found at a lower level and rarely forms forests. The Siberian fir is found scattered at intervals throughout the Alps but is not common. The mughus, creeping pine, or *Krummholz* of the Germans, is common in the Eastern Alps, and sometimes forms on the higher mountains a distinct zone above the level of its congeners. In the Northern Alps the pine forests rarely surpass the limit of 6000 ft. above the sea, but on the south side they commonly attain 7000 ft., while the larch, Siberian fir and mughus often extend above that elevation.

Alpine region.

Throughout the Teutonic region of the Alps the word *Alp* is used specifically for the upper pastures where cattle are fed in summer, but this region is held to include the whole space between the uppermost limit of trees and the first appearance of permanent masses of snow. It is here that the characteristic vegetation of the Alps is developed in its full beauty and variety. Shrubs are not wanting. Three species of rhododendron vie with each other in the brilliancy of their masses of red or pink flowers; the common juniper rises higher still, along with three species of bilberry; and several dwarf willows attain nearly to the utmost limit of vegetation. The upper limit of this region coincides with the so-called limit of perpetual snow.

Glacial region.

On the higher parts of lofty mountains more snow falls in each year than is melted on the spot. A portion of this is carried away by the wind before it is consolidated; a larger portion accumulates in hollows and depressions of the surface, and is gradually converted into glacier-ice, which descends by a slow secular motion into the deeper valleys, where it goes to swell perennial streams. As on a mountain the snow does not lie in beds of uniform thickness, and some parts are more exposed to the sun and warm winds than others, we commonly find beds of snow alternating with exposed slopes covered with brilliant vegetation; and to the observer near at hand there is no appearance in the least corresponding to the term *limit of perpetual snow*, though the case is otherwise when a high mountain-chain is viewed from a distance. Similar conditions are repeated at many different points, so that the level at which large snow-beds show themselves along its flanks is approximately horizontal. But this holds good only so far as the conditions are similar. On the opposite sides of the same chain the exposure to the sun or to warm winds may cause a wide difference in the level of permanent snow; but in some cases the increased fall of snow on the side exposed to moist winds may more than compensate the increased influence of the sun's rays. Still, even with these reservations, the so-called line of perpetual snow is not fixed. The occurrence of favourable meteorological conditions during several successive seasons may and does increase the extent of the snow-fields, and lower the limit of seemingly permanent snow; while an opposite state of things may cause the limit to rise higher on the flanks of the mountains. Hence all attempts to fix accurately the level of perpetual snow in the Alps are fallacious, and can at the best approach only to local accuracy for a particular district. In some parts of the Alps the limit may be set at about 8000 ft. above the sea, while in others it cannot be placed much below 9500 ft.


THE ALPS
Scale, 1:4,800,000
English Miles
0 10 20 30 40 50 60 70 80 90 100
Peaks
Passes
Glaciers
Land above 1500 feet left white
Strasburg
Ulm
Augsburg
Vienna
R. Danube
Noric Alps
Vindelician Alps
Northern
Styrian Alps
Basel
Zurich
Dijon
Besançon
Châlon
Bern
North Swiss Alps
Coire
Innsbruck
Central Tirol Alps
Graz
R. Mur
South Eastern Alps
Geneva
Bernese
Lepontine Alps
Rhaetian Alps
Pennine Alps
Lyon
Chambery
Graian Alps
Lombard Alps
Treviso
Trieste
Verona
Vicenza
Brescia
Bergamo
Como
Milan
Venice
Padua
Grenoble
Modane
Dauphiné Alps
Cottian Alps
Turin
Vercelli
Pavia
Piacenza
Lombardy
Parma
Modena
Bologna
ADRIATIC SEA
Genoa
Savona
Gulf of Genoa
Maritime Alps
Avignon
Nice
Mentone
R. Rhone
R. Po
R. Tanaro
R. Durance
R. Drau
R. Inn
R. Isar
R. Enns
R. Rhine
R. Aar
R. Doubs
Constance

Emery Walker sc.

As very little snow can rest on rocks that lie at an angle exceeding 60°, and this is soon removed by the wind, some steep masses of rock remain bare even near the summits of the highest peaks, but as almost every spot offering the least hold for vegetation is covered with snow, few flowering plants are seen above 11,000 ft. There is reason to think, however, that it is the want of soil rather than climatal conditions that checks the upward extension of the alpine flora. Increased direct effect of solar radiation compensates for the cold of the nights, and in the few spots where plants have been found in flower up to a height of 12,000 ft., nothing has indicated that the processes of vegetation were arrested by the severe cold which they must sometimes endure. The climate of the glacial region has often been compared to that of the polar regions, but they are widely different. Here, intense solar radiation by day, which raises the surface when dry to a temperature approaching 80° F., alternates with severe frost by night. There, a sun which never sets sends feeble rays that maintain a low equable temperature, rarely rising more than a few degrees above the freezing-point. Hence the upper region of the Alps sustains a far more varied and brilliant vegetation.

4. *Main Chain.*—In the case of every mountain system geographers are disposed to regard, as a general rule, the watershed (or boundary dividing the waters flowing towards opposite slopes of the range) as marking the main chain, and this usage is justified in that the highest peaks often rise on or very near the watershed. Yet, as a matter of fact, several important mountain groups are situated on one or other side of the watershed of the Alps, and form almost independent ranges, being only connected with the main chain by a kind of peninsula: such are the Dauphiné Alps, the Eastern and Western Graians, the entire Bernese Oberland, the Tödi, Albula and Silvretta groups, the Ortler and Adamello ranges, and the Dolomites of south Tirol, not to speak of the lower Alps of the Vorarlberg, Bavaria and Salzburg. Of course each of these semi-detached ranges has a watershed of its own, like the lateral ridges that branch off from the main watershed. Thus there are lofty ranges parallel to that which forms the main watershed. The Alps, therefore, are not composed of a single range (as shown on the old maps) but of a great "divide," flanked on either side by other important ranges, which, however, do not comprise such lofty peaks as the main watershed. In the following remarks we propose to follow the main watershed from one end of the Alps to the other.

Starting from the Col d'Altare or di Cadibona (west of Savona), the main chain extends first south-west, then north-west to the Col de Tenda, though nowhere rising much beyond the zone of coniferous trees. Beyond the Col de Tenda the direction is first roughly west, then north-west to the Rocher des Trois Évêques (9390 ft.), just south of the Mont Enchastraye (9695 ft.), several peaks of about 10,000 ft. rising on the watershed, though the highest of all, the Punta dell' Argentera (10,794 ft.) stands a little way to its north. From the Rocher des Trois Évêques the watershed runs due north for a long distance, though of the two loftiest peaks of this region one, the Aiguille de Chambeyron (11,155 ft.), is just to the west, and the other, the Monte Viso (12,609 ft.), is just to the east of the watershed. From the head of the Val Pellice the main chain runs north-west, and diminishes much in average height till it reaches the Mont Thabor (10,440 ft.), which forms the apex of a salient angle which the main chain here presents towards the west. Hence the main watershed extends eastwards, culminating in the Aiguille de Scolette (11,500 ft.), but makes a great curve to the north-west and back to the south-east before rising in the Rochemelon (11,605 ft.), which may be considered as a re-entering angle in the great rampart by which Italy is guarded from its neighbours. Thence the direction taken is north as far as the eastern summit (11,693 ft.) of the Levanna, the watershed rising in a series of snowy peaks, though the loftiest point of the region, the Pointe de Charbonel (12,336 ft.), stands a little to the west. Once more the chain bends to the north-west, rising in several lofty peaks (the highest is the Aiguille de la Grande Sassière, 12,323 ft.), before attaining the considerable depression of the Little St Bernard Pass. Thence for a short way the direction is north to the Col de la Seigne, and then north-east along the crest of the Mont Blanc chain, which culminates in the peak of Mont Blanc (15,782 ft.), the loftiest in the Alps. A number of high peaks crown our watershed before it attains the Mont Dolent (12,543 ft.). Thence after a short dip to the south-east, our chain takes near the Great St Bernard Pass the generally eastern direction that it maintains till it reaches Monte Rosa, whence it bends northwards, making one small dip to the east as far as the Simplon Pass. It is in the portion of the watershed between the Great St Bernard and the Simplon that the main chain maintains a greater average height than in any other part. But, though it rises in a number of lofty peaks, such as the Mont Vélan (12,353 ft.), the Matterhorn (14,782 ft.), the Lyskamm (14,889 ft.), the Nord End of Monte Rosa (15,132 ft.), and the Weissmies (13,226 ft.), yet many of the highest points of the region, such as the Grand Combin (14,164 ft.), the Dent Blanche (14,318 ft.), the Weisshorn (14,804 ft.), the true summit or Dufourspitze (15,217 ft.) of Monte Rosa itself, and the Dom (14,942 ft.), all rise on its northern slope and not on the main watershed. On the other hand the chain between the Great St Bernard and the Simplon sinks at barely half a dozen points below a level of 10,000 ft. The Simplon Pass corresponds to what may be called a dislocation of the main chain. Thence to the St Gotthard the divide runs north-east, all the higher summits (including the Monte Leone, 11,684 ft., and the Pizzo Rotondo, 10,489 ft.) rising on it, a curious contrast to the long stretch just described. From the St Gotthard to the Maloja the watershed between the basins of the Rhine and Po runs in an easterly direction as a whole, though making two great dips towards the south, first to near the Vogelberg (10,565 ft.) and again to near the Pizzo Gallegione (10,201 ft.), so that it presents a broken and irregular appearance. But all the loftiest peaks rise on it: Scopi (10,499 ft.), Piz Medel (10,509 ft.), the Rheinwaldhorn (11,149 ft.), the Tambohorn (10,749 ft.) and Piz Timun (10,502 ft.).

From the Maloja Pass the main watershed dips to the south-east for a short distance, and then runs eastwards and nearly over the highest summit of the Bernina group, the Piz Bernina (13,304 ft.), to the Bernina Pass. Thence to the Reschen Scheideck Pass the main chain is ill-defined, though on it rises the Corno di Campo (10,844 ft.), beyond which it runs slightly north-east past the sources of the Adda and the Fraële Pass, sinks to form the depression of the Ofen Pass, soon bends north and rises once more in the Piz Sesvenna (10,568 ft.).

The break in the continuity of the Alpine chain marked by the deep valley, the *Vintschgau*, of the upper Adige (Etsch) is one of the most remarkable features in the orography of the Alps. The little Reschen lake which forms the chief source of the Adige is only 13 ft. below the Reschen Scheideck Pass (4902 ft.), and by it is but 5 m. from the Inn valley. Eastward of this pass, the main chain runs north-east to the Brenner Pass along the snowy crest of the Oetzthal and Stubai Alps, the loftiest point on it being the Weisskugel (12,291 ft., Oetzthal), for the highest summits both of the Oetzthal and of the Stubai districts, the Wildspitze (12,382 ft.) and the Zuckerhütl (11,520 ft.) stand a little to the north.

The Brenner (4495 ft.) is almost the lowest of all the great carriage-road passes across the main chain, and has always been the chief means of communication between Germany and Italy. For some way beyond it the watershed runs eastwards over the highest crest of the Zillerthal Alps, which attains 11,559 ft. in the Hochfeiler. But, a little farther, at the Dreiherrenspitze (11,500 ft.) we have to choose between following the watershed southwards, or keeping due east along the highest crest of the Greater Tauern Alps. (*a*) The latter course is adopted by many geographers and has much in its favour. The eastward direction is maintained and the watershed (though not the chief Alpine watershed) continues through the Greater Tauern Alps, culminating in the Gross Venediger (12,008 ft.), for the Gross Glockner (12,461 ft.) rises to the south. Our chain bends north-east near the Radstädter Tauern Pass, and preserves that direction through the Lesser Tauern Alps to the Semmering Pass. (*b*) On the other hand, if from the Dreiherrenspitze we cleave to the true main watershed of the Alpine chain, we find that it dips south, passes over the Hochgall (11,287 ft.), the culminating point of the Rieserferner group, and then sinks to the Toblach Pass, but at a point a little east of the great Dolomite peak of the Drei Zinnen it bends east again, and rises in the Monte Coglians (9128 ft., the monarch of the Carnic Alps). Soon after our watershed makes a last bend to the south-east and culminates in the Terglou (9400 ft.), the highest point of the Julic Alps, though the Grintovc (8429 ft., the culminating point of the Karawankas Alps) stands more to the east. Finally our watershed turns south and ends near the great limestone plateau of the Birnbaumerwald, between Laibach and Görz.

As might be expected, the main chain boasts of more glaciers and eternal snow than the independent or external ranges. Yet it is a curious fact that the three longest glaciers in the Alps (the Great Aletsch, 16½ m., and the Unteraar and the Fiescher, each 10 m.) are all in the Bernese Oberland. In the main chain the two longest are both 9¼ m., the Mer de Glace at Chamonix and the Gorner at Zermatt. In the Eastern Alps the longest glacier is the Pasterze (rather over 6¼ m.), which is not near the true main watershed, though it clings to the slope of the Greater Tauern range, east of the Dreiherrenspitze. But the next two longest glaciers in the Eastern Alps (the Hintereis, 6¼ m., and the Gepatsch, 6 m.) are both in the Oetzthal Alps, and so close to the true main watershed.

The so-called alpine lakes are the sheets of water found at the foot of the Alps, on either slope, just where the rivers that form them issue into the plains. There are, however, alpine lakes higher up (*e.g.* the lake of Thun, and those in the Upper Engadine, in the heart of the mountains, though these are naturally smaller in extent, while the true lakes of the High Alps are represented by the glacier lakes of the Märjelensee (near the Great Aletsch glacier) and those on the northern slope of the Col de Fenêtre, between Aosta and the Val de Bagnes. The most singular, and probably the loftiest, lake in the Alps is the ever-frozen tarn that forms the summit of the Roccia Viva (11,976 ft.) in the Eastern Graians.

Among the great alpine rivers we may distinguish two classes: those which spring directly from glaciers and those which rise in lakes, these being fed by eternal snows or glaciers. In the former class are the Isère, the Rhone, the Aar, the Ticino, the Tosa, the Hinter (or main) Rhine and the Linth; while in the latter class we have the Durance, the Po, the Reuss, the Vorder and middle branches of the Rhine, the Inn, the Adda, the Oglio and the Adige. The Piave and the Drave seem to be outside either class.

5. *Principal Passes.*—Though the Alps form a barrier they have never formed an impassable barrier, since, from the earliest days onwards, they have been traversed first, perhaps, for purposes of war or commerce, and later by pilgrims, students and tourists. The spots at which they were crossed are called passes (this word is sometimes though rarely applied to gorges only), and are the points at which the great chain sinks to form depressions, up to which deep-cut valleys lead from the plains. Hence the oldest name for such passes is *Mont* (still retained in cases of the Mont Cenis and the Monte Moro), for it was many ages before this term was especially applied to the peaks of the Alps, which with a few very rare exceptions (*e.g.* the Monte Viso was known to the Romans as Vesulus) were long simply disregarded. The native inhabitants of the Alps were naturally the first to use the alpine passes. But to the outer world these passes first became known when the Romans traversed them in order to conquer the world beyond. In the one case we have no direct knowledge (though the Romans probably selected the passes pointed out to them by the natives as the easiest), while in the other we hear almost exclusively of the passes across the main chain or the principal passes of the Alps. For obvious reasons the Romans, having once found an easy direct pass across the main chain, did not trouble to seek for harder and more devious routes. Hence the passes that can be shown to have been certainly known to them are comparatively few in number: they are, in topographical order from west to east, the Col de l'Argentière, the Mont Genèvre, the two St Bernards, the Splügen, the Septimer, the Brenner, the Radstädter Tauern, the Sölkscharte, the Plöcken and the Pontebba (or Saifnitz). Of these the Mont Genèvre and the Brenner were the most frequented, while it will be noticed that in the Central Alps only

two passes (the Splügen and the Septimer) were certainly known to the Romans. In fact the central portion of the Alps was by far the least Romanised and least known till the early middle ages. Thus the Simplon is first certainly mentioned in 1235, the St Gotthard (without name) in 1236, the Lukmanier in 965, the San Bernardino in 941; of course they may have been known before, but authentic history is silent as regards them till the dates specified. Even the Mont Cenis (from the 15th to the 19th century the favourite pass for travellers going from France to Italy) is first heard of in 756 only. In the 13th century many hitherto unknown passes came into prominence, even some of the easy glacier passes. It should always be borne in mind that in the Western and Central Alps there is but one ridge to cross, to which access is gained by a deep-cut valley, though often it would be shorter to cross a second pass in order to gain the plains, *e.g.* the Mont Genèvre, that is most directly reached by the Col du Lautaret; and the Simplon, which is best gained by one of the lower passes over the western portion of the Bernese Oberland chain. On the other hand, in the Eastern Alps, it is generally necessary to cross three distinct ridges between the northern and southern plains, the central ridge being the highest and most difficult. Thus the passes which crossed a single ridge, and did not involve too great a detour through a long valley of approach, became the most important and the most popular, *e.g.* the Mont Cenis, the Great St Bernard, the St Gotthard, the Septimer and the Brenner. As time went on the travellers (with whatever object) who used the great alpine passes could not put up any longer with the bad old mule paths. A few passes (*e.g.* the Semmering, the Brenner, the Tenda and the Arlberg) can boast of carriage roads constructed before 1800, while those over the Umbrail and the Great St Bernard were not completed till the early years of the 20th century. Most of the carriage roads across the great alpine passes were thus constructed in the 19th century (particularly its first half), largely owing to the impetus given by Napoleon. As late as 1905, the highest pass over the main chain that had a carriage road was the Great St Bernard (8111 ft.), but three still higher passes over side ridges have roads—the Stelvio (9055 ft.), the Col du Galibier (8721 ft.), in the Dauphiné Alps, and the Umbrail Pass (8242 ft.). Still more recently the main alpine chain has been subjected to the further indignity of having railway lines carried over it or through it—the Brenner and the Pontebba lines being cases of the former, and the Col de Tenda, the Mont Cenis (though the tunnel is really 17 m. to the west), the Simplon and the St Gotthard, not to speak of the side passes of the Arlberg, Albula and Pyhrn of the latter. There are also schemes (more or less advanced) for piercing the Splügen and the Hohe Tauern, both on the main ridge, and the Lötschen Pass, on one of the external ranges. The numerous mountain railways, chiefly in Switzerland, up various peaks (*e.g.* the Rigi and Pilatus) and over various side passes (*e.g.* the Brünig and the Little Scheidegg) do not concern us here.

6. *Divisions.*—The Alps, within the limits indicated under (2) above, form a great range, consisting of a main chain, with ramifications, and of several parallel minor chains. They thus form a single connected whole as contrasted with the plains at their base, and nature has made no breaks therein, save at the spots where they sink to comparatively low depressions or passes. But for the sake of practical convenience it has long been usual to select certain of the best marked of these passes to serve as limits within the range, whether to distinguish several great divisions from each other, or to further break up each of these great divisions into smaller groups. As these divisions, great or small, are so to speak artificial, several systems have been proposed according to which the Alps may be divided. We give below that which seems to us to be the most satisfactory (based very largely on personal acquaintance with most parts of the range), considering, as in the case of the limits of the chain, only its topographical aspect, as it exists at the present day, while leaving it to geologists, botanists and zoologists to elaborate special divisions as required by these various sciences. Our selected divisions relate only to the High Alps between the Col de Tenda and the route over the Radstädter Tauern, while in each of the 18 subdivisions the less elevated outlying peaks are regarded as appendages of the higher group within the topographical limits of which they rise. No attempt, of course, has been made to give a complete catalogue of the peaks and passes of the Alps, while in the case of the peaks the culminating point of a lower half-detached group has been included rather than the loftier spurs of the higher and main group; in the case of the passes, the villages or valleys they connect have been indicated, and also the general character of the route over each pass.

As regards the main divisions, three are generally distinguished; the Western Alps (chiefly French and Italian, with a small bit of the Swiss Valais) being held to extend from the Col de Tenda to the Simplon Pass, the Central Alps (all but wholly Swiss and Italian) thence to the Reschen Scheideck Pass, and the Eastern Alps (wholly Austrian and Italian, save the small Bavarian bit at the north-west angle) thence to the Radstädter Tauern route, with a bend outwards towards the south-east, as explained under (2) in order to include the higher summits of the South-Eastern Alps. Strictly speaking, we should follow the Reschen Scheideck route down the Adige valley, but as this would include in the Central Alps the Ortler and some other of the highest Tirolese summits, it is best (remembering the artificial character of the division) to draw a line from Mals southwards either over the Umbrail Pass (the old historical pass) or the Stelvio (well-known only since the carriage road was built over it in the first quarter of the 19th century) to the head of the Valtellina, and then over the Aprica Pass (as the Bergamasque Alps properly belong to the Central Alps) to the Oglio valley or the Val Camonica, and down that valley to the Lake of Iseo and Brescia.

Assuming these three main divisions, we must now consider in detail the 18 sub-divisions which we distinguish; the first 5 forming the Western Alps, the next 7 the Central Alps, and the rest the Eastern Alps, the heights throughout being, of course, given in English feet and representing the latest measurements.

I. WESTERN ALPS

1. Maritime Alps (from the Col de Tenda to the Col de l'Argentière).

Chief Peaks of the Maritime Alps.

Punta dell' Argentera	10,794	Mont Tinibras	9,948
Cima dei Gelas	10,286	Mont Enchastraye	9,695
Monte Matto	10,128	Monte Bego	9,426
Mont Pelat	10,017	Mont Monnier	9,246
Mont Clapier	9,994	Rocca dell' Abisso	9,039

Chief Passes of the Maritime Alps.

Passo del Pagarin (Vésubie Valley to Valdieri), snow	9,236
Col di Fremamorta (Tinée Valley to the Baths of Valdieri), bridle path	8,688
Bassa di Druos (same to same), bridle path	8,629
Passo di Collalunga (Tinée Valley to Vinadio), bridle path	8,531
Coll dell' Agnel (Tenda to Valdieri), foot path	8,426
Col della Ciriegia (St Martin Vésubie to the Baths of Valdieri), bridle path	8,370
Col des Granges Communes (St Etienne de Tinée to Barcelonnette), bridle path	8,242
Col de Pourriac (Tinée Valley to Argentera), foot path	8,222
Col della Finestre (St Martin de Vésubie to Valdieri), bridle path	8,107
Col di Guercia (Tinée Valley to Vinadio), foot path	8,042
Col della Lombarda (same to same), bridle path	7,858
Col de la Cayolle (Var Valley to Barcelonnette), carriage road	7,717
Col di Santa Anna (Tinée Valley to Vinadio), bridle path	7,605
Col del Sabbione (Tenda to Valdieri), bridle path	7,428
Col d'Allos or de Valgelaye (Verdon Valley to Barcelonnette), carriage road	7,382
Col de l'Argentière (Barcelonnette to Cuneo), carriage road	6,545
Col de Tenda (Tenda to Cuneo), carriage road, railway beneath	6,145

2. Cottian Alps (from the Col de l'Argentière to the Mont Cenis and westwards to the Col du Galibier).

Chief Peaks of the Cottian Alps.

Monte Viso	12,609	Dents d'Ambin	11,096
Viso di Vallante	12,048	Mont d'Ambin	11,080
Aiguille de Scolette	11,500	Pointe de la Font Sancte	11,057
Aiguille de Chambeyron	11,155	Punta Ferrant	11,037
Grand Rubren	11,142	Visolotto	11,001
Brec de Chambeyron	11,116	Rochebrune	10,906
Rognosa d'Etache	11,106	Punta Sommeiller	10,896

Bric Froid	10,860
Grand Glayza	10,781
Rognosa di Sestrières	10,758
Panestrel	10,673
Roche du Grand Galibier	10,637
Péou Roc	10,601
Pic du Pelvat	10,558
Pointe Haute de Mary	10,539
Pic du Thabor	10,516
Mont Thabor	10,440
Pointe des Cerces	10,434
Tête des Toillies	10,430
Monte Granero	10,401
Mont Chaberton	10,286
Tête de Moyse	10,204
Monte Meidassa	10,187
Pelvo d'Elva	10,053
Mont Politri	10,009
Mont Albergian	9,974
Bric Bouchet	9,853
Punta Cournour	9,410

Chief Passes in the Cottian Alps.

Col Sommeiller (Bardonnèche to Bramans), snow	9,718
Col de la Traversette (Crissolo to Abriès), mainly bridle path beneath pass tunnel made in 1478–1480	9,679
Col d'Ambin (Exilles to Bramans), snow	9,364
Col de St Véran (Val Varaita to the Queyras Valley), foot path	9,331
Col d'Etache (Bardonnèche to Bramans), bridle path	9,144
Col dell' Agnello (Val Varaita to the Queyras Valley), bridle path	9,003
Col Girardin (Ubaye Valley to the Queyras Valley), bridle path	8,855
Col de Sautron (Val Maira to Barcelonnette), bridle path	8,823
Col de Longet (Ubaye Valley to Val Varaita), bridle path	8,767
Col de Mary or de Maurin (Ubaye Valley to Val Maira), bridle path	8,708
Col d'Abriès or de Prali (Perosa to Abriès), bridle path	8,695
Col de la Roue (Bardonnèche to Modane), bridle path	8,419
Col de Fréjus (same to same), carriage road, beneath which is the so-called Mont Cenis railway tunnel	8,294
Col de Clapier (Bramans to Susa), bridle path	8,173
Col d'Izouard (Briançon to the Queyras Valley), carriage road	7,835
Col de la Croix (Torre Pellice to Abriès), bridle path	7,576
Petit Mont Cenis (Bramans to the Mont Cenis Plateau), bridle path	7,166
Col de Vars (Ubaye Valley to the Queyras Valley), carriage road	6,939
Mont Cenis (Lanslebourg to Susa), carriage road	6,893
Col de Sestrières (Pignerol to Césanne), carriage road	6,631
Mont Genèvre (Briançon to Césanne), carriage road	6,083
Col des Echelles de Planpinet (Briançon to Bardonnèche), partly carriage road	5,774

3. Dauphiné Alps (from the Col du Galibier, westwards and southwards).

Chief Peaks of the Dauphiné Alps.

Pointe des Écrins	13,462
Meije	13,081
Ailefroide	12,989
Mont Pelvoux	12,973
Pic Sans Nom	12,845
Pic Gaspard	12,730
Pic Coolidge	12,323
Grande Ruine	12,317
Râteau	12,317
Montagne des Agneaux	12,008
Les Bans	11,979
Sommet des Rouies	11,923
Aiguille du Plat	11,818
Pic d'Olan	11,735
Pic Bonvoisin	11,680
Aiguilles d'Arves (highest point)	11,529
Grandes Rousses	11,395
Roche de la Muzelle	11,349
Sirac	11,280
Pic Félix Neff	10,571
Vieux Chaillol	10,378
Tête de Vautisse	10,375
Grand Pinier	10,237
Pic de Parières	10,007
Mourre Froid	9,830
Belledonne (highest)	9,781
Rocher Blanc (Sept Laux)	9,617
Taillefer	9,387
Pic du Frêne	9,219
Tête de l'Obiou	9,164
Grand Ferrand	9,059
Pic de Bure (Aurouse)	8,898
Grand Veymont	7,697
Mont Aiguille	6,880
Chamechaude	6,847
Dent de Crolles	6,779
Grand Som	6,670
Mont Granier	6,358
Dent du Chat	4,593

Chief Passes of the Dauphiné Alps.

Col de la Lauze (St Christophe to La Grave), snow	11,625
Col des Avalanches (La Bérarde to Vallouise), snow	11,520
Col de la Casse Déserte (La Bérarde to La Grave), snow	11,516
Col Émile Pic (La Grave to Vallouise), snow	11,490
Col des Écrins (La Bérarde to Vallouise), snow	11,205
Col du Glacier Blanc (La Grave to Vallouise), snow	10,854
Col du Sélé (La Bérarde to Vallouise), snow	10,834
Brèche de la Meije (La Bérarde to la Grave), snow	10,827
Col de la Temple (La Bérarde to Vallouise), snow	10,772
Col des Aiguilles d'Arves (Valloire to St Jean d'Arves), snow	10,335
Col du Says (La Bérarde to the Val Gaudemar), snow	10,289
Col du Clot des Cavales (La Bérarde to La Grave), snow	10,263
Col du Loup du Valgaudemar (Vallouise to the Val Gaudemar), snow	10,210
Col Lombard (La Grave to St Jean d'Arves), snow	10,171
Brèche des Grandes Rousses (Allemont to Clavans), snow	10,171
Col du Sellar (Vallouise to the Val Gaudemar), snow	10,063
Col de la Muande (St Christophe to the Val Gaudemar), snow	10,037
Col des Quirlies (St Jean d'Arves to Clavans), snow	9,679
Col du Goléon (La Grave to Valloire), foot path	9,449
Pas de la Cavale (Vallouise to Champoléon), carriage road	8,990
Col d'Orcières (Dormillouse to Orcières), bridle path	8,859
Col de l'Infernet (La Grave to St Jean d'Arves), foot path	8,826
Col du Galibier (Lautaret Hospice to St Michel de Maurienne), carriage road	8,721
Brèche de Valsenestre (Bourg d'Oisans to Valsenestre), foot path	8,642 8,642
Col de Vallonpierre (Val Gaudemar to Champoléon), foot path	8,596 8,596
Col de Val Estrète (same to same), foot path	8,596
Col de Vaurze (Val Gaudemar to Val Jouffrey), foot path	8,531
Col de Martignare (La Grave to St Jean d'Arves), foot path	8,531
Col des Tourettes (Orcières to Châteauroux), bridle path	8,465
Col de la Muzelle (St Christophe to Valsenestre), foot path	8,202
Col de l'Eychauda (Vallouise to Monestier), bridle path	7,970
Col d'Arsine (La Grave to Monestier), bridle path	7,874
Col des Prés Nouveaux (Le Freney to St Jean d'Arves), bridle path	7,523
Col des Sept Laux (Allevard to Bourg d'Oisans), bridle path	7,166
Col du Lautaret (Briançon to Bourg d'Oisans), carriage road	6,808
Col de la Croix de Fer (Bourg d'Oisans to St Jean d'Arves), carriage road	6,765
Col du Glandon (Bourg d'Oisans to La Chambre), carriage road	6,401
Col de l'Alpe de Vénosc (Vénosc to Le Freney), bridle path	5,446
Col d'Ornon (Bourg d'Oisans to La Mure), carriage road	4,462
Col Bayard (La Mure to Gap), carriage road	4,088
Col de la Croix Haute (Grenoble to Veynes and Gap), railway line over	3,829

4. Graian Alps (from the Mont Cenis to the Little St Bernard Pass). These are usually divided into three groups, the Central (the watershed between the two passes named), the Western or French, and the Eastern or Italian; in the following lists the initials "C," "W," and "E" show to which group each peak and pass belongs.

Chief Peaks of the Graian Alps.

Grand Paradis (E)	13,324
Grivola (E)	13,022
Grande Casse (W)	12,668
Mont Pourri (W)	12,428
Mont Herbetet (E)	12,396
Pointe de Charbonel (C)	12,336
Aiguille de la Grande Sassière (C)	12,323
Dent Parrachée (W)	12,179
Tour du Grand St Pierre (E)	12,113
Uja di Ciamarella (C)	12,061
Cima di Charforon (E)	12,025
Grande Motte (W)	12,018
Albaron (C)	12,015
Roccia Viva (E)	11,976
Levanna (C)	11,943
Bessanese (C)	11,917
Punta di Gaij (E)	11,887
Dôme de l'Arpont (W)	11,874
Pointe de Ronce (C)	11,871
Bec de l'Invergnan (C)	11,838
Tsanteleina (C)	11,831
Dôme de Chasseforêt (W)	11,802
Croce Rossa (C)	11,703
Aiguille de Péclet (W)	11,700
Mont Emilius (E)	11,677
Punta d'Arnas (C)	11,615
Aiguille de Polset (W)	11,608
Rochemelon (C)	11,605
Mont Chalanson(C)	11,582
Tersiva (E)	11,526
Grande Traversière (C)	11,467
Tête du Rutor (C)	11,438
Grande Aiguille Rousse (C)	11,424
Granta Parey (C)	11,395
Roc du Mulinet (C)	11,382
Aiguille Pers (C)	11,323
Pointe de la Sana (W)	11,319
Cima dell' Auille (C)	11,306
Pointe de l'Échelle (W)	11,260
Punta Fourà (E)	11,188
Pointe des Sengies (E)	11,182
Pointe de la Glière (W)	11,109
Pointe de la Galise (C)	10,975
Pointe de la Traversière (C)	10,962
Pointe de Méan Martin (W)	10,949
Punta Lavina (E)	10,854
Ormelune (C)	10,771
Roche Chevrière (W)	10,768
Signal du Mont Iseran (C)	10,634
Pointe de la Rechasse (W)	10,575
Grand Assaly (C)	10,414
Roisebanque (E)	10,381
Becca di Nona (E)	10,309
Torre d'Ovarda (C)	10,089
Pointe du Pousset (E)	9,994
Dôme de Val d'Isère (C)	9,951
Uja di Mondrone (C)	9,725
Bellagarda (C)	9,643
Monte Marzo (E)	9,023
Petit Mont Blanc de Pralognan (W)	8,809
Mont Jouvet (W)	8,409
Monte Civrari (C)	7,553

Chief Passes of the Graian Alps.

Col de la Grande Rousse (Rhêmes Valley to the Val Grisanche), snow (C)	11,483
Col de Gébroulaz (Arc Valley to Moûtiers Tarentaise), snow (W)	11,385
Col de Monei (Cogne to Locana), snow (E)	11,247
Col du Grand Paradis (Ceresole to the Val Savaranche), snow (E)	10,988
Col du Charforon (same to same), snow (E)	10,929
Col de Teleccio (Cogne to Locana), snow (E)	10,913
Col de Lauzon (Cogne to the Val Savaranche), bridle path (E)	10,831
Col du Bouquetin (Bonneval to Val d'Isère), snow (C)	10,827
Col de St Grat (Val Grisanche to La Thuille), snow (C)	10,827
Col de l'Herbetet (Cogne to the Val Savaranche), snow (E)	10,686
Col du Collerin (Bessans to Balme), snow (C)	10,506
Col du Grand Etret (Ceresole to the Val Savaranche), snow (E)	10,361

Col de Bassac (Rhèmes Valley to the Val Grisanche), snow (C)	10,345
Col du Carro (Bonneval to Ceresole), snow (C)	10,302
Col d'Arbole (Comboë to Brissógne), snow (E)	10,292
Col de la Goletta (Val d'Isère to the Rhèmes Valley), snow (C)	10,237
Col de Rhèmes (same to same), snow (C)	10,174
Col de la Grande Casse (Pralognan to the Prémou Glen), snow (W)	10,171
Col de Sea (Bonneval to Forno Alpi Graie), snow (C)	10,115
Col de l'Autaret (Bessans to Usseglio), foot path (C)	10,073
Col de Girard (Bonneval to Forno Alpi Graie), snow (C)	9,987
Col Rosset (Val Savaranche to the Rhèmes Valley), bridle path (C)	9,922
Col d'Arnas (Bessans to Balme), snow (C)	9,889
Col de la Galise (Ceresole to Val d'Isère), snow (C)	9,836
Col de Sort (Val Savaranche to the Rhèmes Valley), partly bridle path (C)	9,735
Quecées de Tignes (Val d'Isère to Termignon), snow (W)	9,646
Col della Nouva (Cogne to Pont Canavese), partly bridle path (E)	9,623
Col de Garin (Aosta to Cogne), foot path (E)	9,411
Collarin d'Arnas (Balme to Usseglio), snow (C)	9,351
Finestra del Torrent (Rhèmes Valley to the Val Grisanche), foot path (C)	9,341
Fenêtre de Champorcher (Cogne to Champorcher), bridle path (E)	9,311
Col de Vaudet (Isère Valley to the Val Grisanche), foot path (C)	9,305
Col de Bardoney (Cogne to Pont Canavese), snow (E)	9,295
Col de Chavière (Modane to Pralognan), foot path (W)	9,206
Col de la Leisse (Tignes to Termignon), snow (W)	9,121
Col du Mont Iseran (Bonneval to Val d'Isère), bridle path (C)	9,085
Ghicet di Sea (Balme to Forno Alpi Graie), foot path (C)	8,973
Col de la Sachette (Tignes to Bourg St Maurice), foot path (W)	8,954
Col du Palet (Tignes to Moûtiers Tarentaise or Bourg St Maurice), bridle path (W)	8,721
Col du Mont (Ste Foy to the Val Grisanche), bridle path (C)	8,681
Col de la Croix de Nivolet (Ceresole to the Val Savaranche), bridle path (E)	8,665
Col della Crocetta (Ceresole to Forno Alpi Graie), bridle path (C)	8,649
Col de la Platière (St Jean de Maurienne to Moûtiers Tarentaise), partly bridle path (W)	8,531
Col de la Vanoise (Pralognan to Termignon), bridle path (W)	8,291
Col des Encombres (St Michel de Maurienne to Moûtiers Tarentaise), bridle path (W)	7,668
Little St Bernard (Aosta to Moûtiers Tarentaise), carriage road (C)	7,179
Col de la Madeleine (La Chambre to Moûtiers Tarentaise), bridle path (W)	6,509

5. Pennine Alps (from the Little St Bernard to the Simplon Pass). This range contains all the highest peaks in the Alps, save the Finsteraarhorn (14,026) in the Bernese Oberland.

Chief Peaks of the Pennine Alps.

Mont Blanc	15,782	Mont Blanc de Seilon	12,700
Monte Rosa (Dufourspitze)	15,217	Aiguille du Midi	12,609
		Tour Noir	12,586
Nord End (Monte Rosa)	15,132	Aiguille des Glaciers	12,579
Dom (Mischabelhörner)	14,942	Mont Dolent	12,543
Lyskamm	14,889	Aiguille du Chardonnet	12,540
Weisshorn	14,804	Cima di Jazzi	12,527
Matterhorn	14,782	Balfrin	12,474
Täschhorn	14,758	Pigne d'Arolla	12,471
Mont Maudit	14,669	Mont Vélan	12,353
Dent Blanche	14,318	Aiguille du Dru	12,320
Dôme du Goûter	14,210	Tête Blanche	12,304
Grand Combin	14,164	L'Évêque	12,264
Castor	13,879	Mont Pleureur	12,159
Zinal Rothhorn	13,856	Dôme de Miage	12,100
Alphubel	13,803	Lo Besso	12,058
Grandes Jorasses	13,797	Aiguille de la Za	12,051
Rimpfischhorn	13,790	Mont Collon	11,956
Strahlhorn	13,751	Diablons	11,828
Dent d'Hérens	13,715	Aiguille de Tour	11,615
Zermatt Breithorn	13,685	Mont Gelé	11,539
Aiguille Verte	13,541	Bec de Luseney	11,503
Ober Gabelhorn	13,364	Aiguille de Grépon	11,489
Aiguille de Bionnassay	13,341	Château des Dames	11,447
Allalinhorn	13,236	Aiguille des Charmoz	11,293
Weissmies	13,226	Aiguille du Tacul	11,280
Aiguille du Géant	13,170	Grand Tournalin	11,086
Laquinhorn	13,140	Pointe de Rosa Blanche	10,985
Rossbodenhorn	13,128	Mont Avril	10,962
Grand Cornier	13,022	Grande Rochère	10,913
Aiguille de Trélatête	12,832	Corno Bianco	10,893
Aiguille d'Argentière	12,819	Grauhaupt	10,876
Ruinette	12,727	Pointe d'Orny	10,742
Aiguille de Triolet	12,717	Dent du Midi	10,696
Mont Favre	10,693	Tagliaferro	9,725
Sasseneire	10,693	Riffelhorn	9,617
Grand Golliaz	10,630	Pointe Percée du Reposoir	9,029
Tour Sallières	10,588	Crammont	8,980
Pizzo Bianco	10,552	Pointe des Fours	8,921
Latelhorn	10,525	Pointe du Colloney	8,832
Schwarzhorn (Augstbord)	10,512	Catogne	8,527
Gornergrat	10,289	Monte Bò	8,386
Pointe de Léchaud	10,260	Mont Joly	8,291
Buet	10,201	Brévent	8,284
Mont Ruan	10,099	Pointe de Salles	8,183
Mont Néri	10,073	Aiguille de Varens	8,163
Bella Tola	9,935	Mont Chétif	7,687
Pointe de Tanneverge	9,784	Môle	6,132
Belvédère (Aigs. Rouges)	9,731	Salève (highest point)	4,528

Chief Passes of the Pennine Alps.

Sesiajoch (Zermatt to Alagna), snow	14,515
Col de la Brenva (Courmayeur to Chamonix), snow	14,217
Domjoch (Randa to Saas), snow	14,062
Lysjoch (Zermatt to Gressoney), snow	14,033
Mischabeljoch (Zermatt to Saas), snow	12,651
Alphubel Pass (same to same), snow	12,474
Adler Pass (same to same), snow	12,461
Moming Pass (Zermatt to Zinal), snow	12,287
Schwarzthor (Zermatt to Ayas), snow	12,274
Col de Triolet (Chamonix to Courmayeur), snow	12,110
Ried Pass (St Niklaus to Saas), snow	11,800
New Weissthor (Zermatt to Macugnaga), snow	11,746
Allalin Pass (Zermatt to Saas), snow	11,713
Col de Valpelline (Zermatt to Aosta), snow	11,687
Biesjoch (Randa to Turtmann), snow	11,644
Triftjoch (Zermatt to Zinal), snow	11,615
Col d'Argentière (Chamonix to Orsières), snow	11,536
Col du Sonadon (Bourg St Pierre to the Val de Bagnes), snow	11,447
Col de Talèfre (Chamonix to Courmayeur), snow	11,430
Col d'Hérens (Zermatt to Evolena), snow	11,418
Col Durand (Zermatt to Zinal), snow	11,398
Col des Maisons Blanches (Bourg St Pierre to the Val de Bagnes), snow	11,241
Col de Bertol (Arolla to the Col d'Hérens), snow	11,200
Col de Miage (Contamines to Courmayeur), snow	11,077
Col du Géant (Chamonix to Courmayeur), snow	11,060
Col du Mont Rouge (Val de Bagnes to the Val d'Hérémence), snow	10,962
Col du Chardonnet (Chamonix to Orsières), snow	10,909
Col de St Théodule (Zermatt to Châtillon), snow	10,899
Col du Tour (Chamonix to Orsières), snow	10,762
Fenêtre de Saleinaz (Saleinaz Glacier to Trient Glacier), snow	10,709
Col de Tracuit (Zinal to Turtmann), snow	10,670
Zwischbergen Pass (Saas to Gondo), snow	10,657
Col d'Oren (Val de Bagnes to the Valpelline), snow	10,637
Col de Seilon (Val de Bagnes to the Val d'Hérémence), snow	10,499
Col du Crêt (Val de Bagnes to the Val d'Hérémence), snow	10,329
Col de Valcournera (Val Tournanche to the Valpelline), snow	10,325
Col de Collon (Arolla to Aosta), snow	10,270
Col de Valsorey (Bourg St Pierre to Aosta), snow	10,214
Col de Chermontane (Val de Bagnes to Arolla), snow	10,119
Cimes Blanches (Val Tournanche to Ayas), bridle path	9,777
Col de Torrent (Evolena to the Val de Torrent), bridle path	9,593
Augstbord Pass (St Niklaus to Turtmann), bridle path	9,492
Col de Crête Sèche (Val de Bagnes to the Valpelline), snow	9,475
Col de Breuil (Bourg St Maurice to La Thuille), snow	9,446
Col d'Olen (Alagna to Gressoney), bridle path	9,420
Monte Moro (Saas to Macugnaga), partly bridle path	9,390
Pas de Chèvres (Arolla to the Val d'Hérémence), foot path	9,354
Antrona Pass (Saas to Antrona), partly bridle path	9,331
Col de Sorebois (Zinal to the Val de Torrent), bridle path	9,269
Col de Vessona (Valpelline to the St Barthélemy Glen), foot path	9,167
Col de Fenêtre (Val de Bagnes to Aosta), bridle path	9,141
Z'Meiden Pass (Zinal to Turtmann), bridle path	9,095
Turlo Pass (Alagna to Macugnaga), foot path	8,977
Col de Fenêtre (Great St Bernard to the Swiss Val Ferret), bridle path	8,855
Bettafurka (Ayas to Gressoney), bridle path	8,780
Col du Mont Tondu (Contamines to Courmayeur), snow	8,498
Col Serena (Great St Bernard to Courmayeur), foot path	8,327
Col Ferret (Courmayeur to Orsières), carriage road in progress	8,311
Col de la Seigne (Chapieux to Courmayeur) bridle path	8,242
Col de Susanfe (Champéry to Salvan), foot path	8,202
Col du Bonhomme (Contamines to Chapieux), bridle path	8,147
Col de Valdobbia (Gressoney to the Val Sesia), bridle path	8,134
Great St Bernard (Martigny to Aosta), carriage road	8,111
Col de Sagerou (Sixt to Champéry), foot path	7,917
Col de Moud (Alagna to Rima and Varallo), bridle path	7,622
Col d'Anterne (Sixt to Servoz), bridle path	7,425

Col d'Egua (Rima to the Val Anzasca), bridle path	7,336
Col de Balme (Chamonix to the Trient Valley), bridle path	7,221
Simplon Pass (Brieg to Domo d'Ossola), carriage road over, railway tunnel beneath	6,592
Col de Chécouri (Courmayeur to the Lac de Combal), bridle path	6,431
Baranca Pass (Varallo to the Val Anzasca), bridle path	5,971
Col de Voza (Chamonix to Contamines), bridle path	5,496
Col de la Forclaz (Chamonix to St Gervais), bridle path	5,105
Col de la Forclaz (Trient Valley to Martigny), carriage road	4,987

II. CENTRAL ALPS

6. Bernese Oberland (from the Lake of Geneva to the Furka, the Reuss Valley and the Lake of Lucerne). This general name seems best to describe the range in question, though, of course, portions of it are in Cantons other than that of Berne, viz. Vaud, Fribourg, the Valais, Lucerne, Uri and Unterwalden.

Chief Peaks of the Bernese Oberland.

Finsteraarhorn	14,026	Wellhorn	10,486
Aletschhorn	13,721	Mettenberg	10,194
Jungfrau	13,669	Löffelhorn	10,165
Mönch	13,468	Grand Muveran	10,043
Gross Schreckhorn	13,386	Gross Wendenstock	9,987
Gross Fiescherhorn	13,285	Sparrhorn	9,928
Eiger	13,042	Torrenthorn	9,853
Bietschhorn	12,970	Grande Dent de Morcles	9,777
Gross Wannehorn	12,812	Schilthorn	9,754
Gross Nesthorn	12,533	Eggishorn	9,626
Lauterbrunnen Breithorn	12,399	Uri Rothstock	9,620
Balmhorn	12,176	Schwarzhorn (Grindelwald)	9,613
Wetterhorn (Mittelhorn)	12,166	Gross Siedelhorn	9,452
		Albristhorn	9,069
Wetterhorn (Hasli Jungfrau)	12,149	Röthihorn	9,052
Wetterhorn (Rosenhorn)	12,110	Faulhorn	8,803
Blümlisalphorn	12,044	Gummfluh	8,074
Gross Doldenhorn	11,966	Sulegg	7,914
Altels	11,930	Vanil Noir	7,858
Dammastock	11,920	Niesen	7,763
Galenstock	11,802	Brienzer Rothhorn	7,714
Sustenhorn	11,523	Tour d'Ai	7,658
Gspaltenhorn	11,293	Hohgant	7,225
Fleckistock	11,214	Stockhorn	7,192
Gross Hühnerstock	10,985	Kaiseregg	7,182
Ewigschneehorn	10,929	Pilatus (Tomlishorn)	6,995
Ritzlihorn	10,768	Chamossaire	6,943
Wildhorn	10,709	Gemmenalphorn	6,772
Wildstrubel	10,673	Rochers de Naye	6,710
Diablerets	10,650	Moléson	6,582
Titlis	10,627	Dent de Jaman	6,165
Gross Spannort	10,516	Napf	4,629

Chief Passes of the Bernese Oberland.

Lauithor (Lauterbrunnen to the Eggishorn), snow	12,140
Mönchjoch (Grindelwald to the Eggishorn), snow	11,680
Jungfraujoch (Wengern Alp to the Eggishorn), snow	11,385
Strahlegg Pass (Grindelwald to the Grimsel), snow	10,995
Grünhornlücke (Great Aletsch Glacier to the Fiescher Glacier), snow	10,844
Oberaarjoch (Grimsel to the Eggishorn), snow	10,607
Gauli Pass (Grimsel to Meiringen), snow	10,519
Petersgrat (Lauterbrunnen to the Lötschenthal), snow	10,516
Lötschenlücke (Lötschenthal to the Eggishorn), snow	10,512
Lauteraarsattel (Grindelwald to the Grimsel), snow	10,355
Beichgrat (Lötschenthal to the Bel Alp), snow	10,289
Lämmernjoch (Lenk to the Gemmi), snow	10,276
Triftlimmi (Rhone Glacier to the Gadmen Valley), snow	10,200
Sustenlimmi (Stein Alp to Goeschenen), snow	10,181
Gamchilücke (Kien Valley to Lauterbrunnen), snow	9,295
Tschingel Pass (Lauterbrunnen to Kandersteg), snow	9,265
Hohthürli Pass (Kandersteg to the Kien Valley), foot path	8,882
Lötschen Pass (Kandersteg to the Lötschenthal), snow	8,842
Sefinenfurka (Lauterbrunnen to the Kien Valley), foot path	8,583
Wendenjoch (Engelberg to the Gadmen Valley), snow	8,544
Furtwangsattel (Guttannen to the Gadmen Valley), foot path	8,393
Furka Pass (Rhone Glacier to Andermatt), carriage road	7,992
Rawil Pass (Sion to Lenk), bridle path	7,924
Gemmi Pass (Kandersteg to Leukerbad), bridle path	7,641
Surenen Pass (Engelberg to Altdorf), foot path	7,563
Susten Pass (Meiringen to Wassen), partly carriage road	7,422
Sanetsch Pass (Sion to Saanen), bridle path	7,331
Joch Pass (Meiringen to Engelberg), bridle path	7,267
Grimsel Pass (Meiringen to the Rhone Glacier), carriage road	7,100
Kleine Scheidegg (Grindelwald to Lauterbrunnen), railway over	6,772
Col de Cheville (Sion to Bex), bridle path	6,723
Grosse Scheidegg (Grindelwald to Meiringen), bridle path	6,434
Col de Jaman (Montreux to Montbovon), mule path over, railway tunnel beneath	4,974
Brünig Pass (Meiringen to Lucerne), railway over	3,396

7. Lepontine Alps (from the Simplon to the Splügen and south of the Furka and Oberalp Passes). The eastern portion of this range, from the St Gotthard Pass to the Splügen, is sometimes named the Adula Alps.

Chief Peaks of the Lepontine Alps.

Monte Leone	11,684	Piz Blas	9,918
Rheinwaldhorn	11,149	Monte Giove	9,876
Güferhorn	11,132	Pizzo Centrale	9,853
Blindenhorn	11,103	Pizzas d'Annarosa	9,850
Basodino	10,749	Piz Beverin	9,843
Tambohorn	10,749	Weisshorn (Splügen)	9,817
Helsenhorn	10,742	Pizzo Lucendro	9,708
Wasenhorn	10,680	Piz Tomül	9,676
Ofenhorn	10,637	Piz Cavel	9,659
Cherbadung	10,542	Bärenhorn	9,620
Piz Medel	10,509	Six Madun (Badus)	9,619
Scopi	10,499	Piz Muraun	9,512
Pizzo Rotondo	10,489	Zervreilerhorn	9,508
Pizzo dei Piani	10,361	Monte Cistella	9,353
Piz Terri	10,338	Piz Lukmanier	9,115
Piz Aul	10,250	Monte Prosa	8,983
Pizzo di Pesciora	10,247	Pizzo Columbè	8,363
Wyttenwasserstock	10,119	Monte Camoghè	7,303
Campo Tencia	10,089	Piz Mundaun	6,775
Leckihorn	10,069	Monte Generoso	5,591
Bruschghorn	10,020	Monte San Salvatore	3,004
Alperschellihorn	9,991		

Chief Passes of the Lepontine Alps.

Zapport Pass (Hinterrhein to Malvaglia and Biasca), snow	10,105
Güferlücke (Kanal Glen to the Lenta Glen), snow	9,777
Lentalücke (Hinterrhein to Vals Platz), snow	9,692
Hohsand Pass (Binn to Tosa Falls), snow	9,603
Lecki Pass (Wyttenwasser Glen to the Mutten Glen), snow	9,554
Passo Rotondo (Airolo to Oberwald), snow	9,449
Kaltwasser Pass (Simplon Hospice to Veglia Alp), snow	9,351
Scaradra Pass (Vals Platz to Olivone), foot path	9,088
Satteltelücke (Vals Platz to Vrin), foot path	9,082
Ritter Pass (Binn to Veglia Alp), snow	8,832
Cavanna Pass (Realp to the Val Bedretto), snow	8,566
Scatta Minoja (Devero to the Val Formazza), bridle path	8,521
Bocca di Cadlimo (Airolo to the Lukmanier Pass), foot path	8,340
Valserberg (Hinterrhein to Vals Platz), bridle path	8,225
Safierberg (Splügen to Safien Platz), bridle path	8,170
Geisspfad Pass (Binn to Devero), foot path	8,120
Gries Pass (Ulrichen to Tosa Falls), bridle path	8,098
Passo di Naret (Fusio to Airolo), bridle path	8,015
Nufenen Pass (Ulrichen to Airolo), bridle path	8,006
Diesrut Pass (Vrin to the Somvix Glen), bad bridle path	7,953
Albrun Pass (Binn to Devero and Baceno), bridle path	7,907
Greina Pass (Olivone to the Somvix Glen), bridle path	7,743
San Giacomo Pass (Airolo to Tosa Falls), bridle path	7,573
Passo di Buffalora (Val Mesocco to the Val Calanca), foot path	7,431
Passo dell' Uomo (Airolo to the Lukmanier Pass), bridle path	7,258
Splügen Pass (Thusis to Chiavenna), carriage road	6,946
St Gotthard Pass (Andermatt to Airolo), carriage road over, railway tunnel beneath	6,936
San Bernardino Pass (Thusis to Bellinzona), carriage road	6,769
Lukmanier Pass (Disentis to Olivone), carriage road	6,289

8. The Range of the Tödi (from the Oberalp Pass to the Klausen Pass).

Chief Peaks of the Range of the Tödi.

Tödi	11,887	Piz Segnes	10,178
Bifertenstock	11,241	Piz Giuf	10,165
Piz Urlaun	11,060	Crispalt	10,105
Oberalpstock	10,926	Bristenstock	10,086
Gross Scheerhorn	10,814	Selbsanft	9,938
Claridenstock	10,729	Vorab	9,925
Düssistock	10,703	Tschingelhörner (Elm)	9,351
Ringelspitz	10,667	Piz Sol (Grauehörner)	9,348
Brigelserhörner (highest)	10,663	Calanda	9,213
Grosse Windgälle	10,473	Kärpfstock	9,177
Hausstock	10,342	Mageren	8,294
Gross Ruchen	10,289	Mürtschenstock	8,012

Chief Passes of the Range of the Tödi.

Clariden Pass (Amsteg to Linththal), snow	9,741
Planura Pass (same to same), snow	9,646
Kammlilücke or Scheerjoch (Maderanerthal to Unterschächen), snow	9,344
Sardona Pass (Flims to Ragaz), snow	9,318
Sand Alp Pass (Disentis to Linththal), snow	9,121
Brunni Pass (Disentis to Amsteg), snow	8,977
Segnes Pass (Elm to Flims), foot path	8,613
Kisten Pass (Linththal to Ilanz), bad bridle path	8,203
Panixer Pass (Elm to Ilanz), bad bridle path	7,897
Krüzli Pass (Amsteg to Sedrun), foot path	7,710
Foo or Ramin Pass (Elm to Weisstannen), bridle path	7,290
Oberalp Pass (Andermatt to Disentis), carriage road	6,719
Klausen Pass (Altdorf to Linththal), carriage road	6,404

9. The Alps of North-Eastern Switzerland (north of the Klausen Pass).

Chief Peaks of the North-Eastern Swiss Alps.

Glärnisch (highest)	9,580	Gross Mythen	6,240
Böser Faulen	9,200	Rigikulm	5,906
Säntis	8,216	Hoher Kasten	5,899
Altmann	7,999	Rossberg	5,194
Faulfirst	7,925	Zugerberg (Hochwacht)	3,255
Alvier	7,753	Albis Hochwacht	2,887
Kurfürsten (highest)	7,576	Uetliberg	2,864
Speer	6,411		

Chief Passes of the North-Eastern Swiss Alps.

Ruosalperkulm (Schächen Valley to the Muota Valley), foot path	7,126
Karren Alp Pass (Muota Valley to Linththal), foot path	6,877
Kinzigkulm Pass (Schächen Valley to the Muota Valley), foot path	6,811
Saasberg Pass (Einsiedeln to Glarus), foot path	6,227
Kamor Pass (Appenzell to Rüti), bridle path	5,512
Saxerlücke (Appenzell to Sax), foot path	5,417
Schwein Alp Pass (Wäggithal to the Klön Glen), bridle path	5,158
Pragel Pass (Muotathal to Glarus), carriage road in progress	5,099
Hacken Pass (Schwyz to Einsiedeln), foot path	4,649
Holzegg Pass (same to same), bridle path	4,616
Ibergeregg Pass (Schwyz to Iberg and Einsiedeln), carriage road	4,613
Kräzeren Pass (Nesslau to Urnäsch), bridle path	3,993

10. Bernina Alps (from the Maloja to the Reschen Scheideck and the Stelvio, south and east of the Val Bregaglia and of the Engadine and north of the Valtellina).

Chief Peaks of the Bernina Alps.

Piz Bernina	13,304	Piz Languard	10,716
Piz Zupo	13,131	Piz Sesvenna	10,568
Monte di Scerscen	13,116	Piz Pisoc	10,427
Piz Roseg	12,934	Piz Murtaröl	10,424
Piz Palü	12,835	Piz Quatervals	10,358
Crast' Agüzza	12,704	Pizzo della Margna	10,355
Piz Morteratsch	12,317	Cima di Redascò	10,299
Monte della Disgrazia	12,067	Piz Lischanna	10,204
Pizzo di Verona	11,359	Pizzo di Sena	10,099
Cima di Piazzi	11,283	Piz Casana	10,079
Cima di Castello	11,155	Monte Foscagno	10,010
Cima Viola	11,103	Pizzo del Teo	10,007
Pizzo Cengalo	11,070	Pizzo del Ferro	10,007
Cima di Rosso	11,060	Piz Umbrail	9,955
Pizzo Scalino	10,903	Zwei Schwestern	9,784
Pizzo Badile	10,863	Monte Braulio	9,777
Corno di Campo	10,844	Monte Spluga	9,321
Pizzo di Dosdè	10,762	Monte Massuccio	9,239
Cima di Saoseo	10,752	Mont la Schera	8,494

Chief Passes of the Bernina Alps.

Fuorcla Bellavista (Pontresina to Chiesa, in Val Malenco), snow	12,087
Fuorcla Crast' Agüzza (same to same), snow	11,805
Fuorcla Tschierva (same to same), snow	11,572
Fuorcla Sella (same to same), snow	10,840
Passo di Bondo (Bondo to the Baths of Masino), snow	10,227
Passo di Castello (Maloja to Morbegno), snow	10,171
Passo Tremoggia (Sils to Chiesa), snow	9,912
Passo di Mello (Chiareggio to Val Masino), snow	9,813
Diavolezza Pass (Bernina road to the Morteratsch Glen), snow	9,767
Passo di Dosdè (Val Grosina to Val Viola Bormina), foot path	9,351
Passo di Sacco (Bernina road to Grosio), foot path	9,026
Passo di Zocca (Vicosoprano to Val Masino), snow	9,000
Casana Pass (Scanfs to Livigno), bridle path	8,832
Muretto Pass (Maloja to Chiesa), partly snow	8,389
Umbrail Pass or Wörmserjoch (Münster Valley to the Stelvio road), carriage road	8,242
Passo di Val Viola (Bernina road to Bormio), bridle path	7,976
Giufplan Pass (Ofen road to Fraële), bridle path	7,723
Bernina Pass (Pontresina to Tirano), carriage road	7,645
Forcola di Livigno (Bernina Pass to Livigno), small carriage road	7,638
Cruschetta Pass (Schuls by Scarl to Taufers), bridle path	7,599
Passo di Verva (Bormio to Grosio), foot path	7,592
Sursass or Schlinig Pass (Remüs to Mals) foot path	7,540
Foscagno Pass (Bormio to Trepalle), bridle path	7,517
Alpisella Pass (Livigno to Fraële), bridle path	7,497
Scarl Pass (Scarl to Santa Maria Münster), carriage road	7,386
Dössradond Pass (Santa Maria Münster to Fraële), bridle path	7,349
Passo Dheira (Livigno to Trepalle) bridle path	7,248
Ofen Pass (Zernez to Mals), carriage road	7,071
Fraële Pass (Bormio to the Ofen road), partly bridle path	6,398
Scale di Fraële (Bormio to Fraële), bridle path	6,372
Maloja Pass (St Moritz to Chiavenna), carriage road	5,935

11. Albula Range (from the Splügen Pass to the Flüela Pass, north and west of the Val Bregaglia and of the Engadine).

Chief Peaks of the Albula Range.

Piz Kesch	11,228	Pizzo Stella	10,375
Piz dellas Calderas	11,132	Flüela Schwarzhorn	10,335
Piz Platta	11,109	Pizzo della Duana	10,279
Piz Julier	11,106	Pizzo Gallegione	10,201
Piz d'Err	11,093	Gletscherhorn	10,191
Piz d'Aela	10,959	Cima di Lago	10,112
Cima da Flex	10,785	Hoch Ducan	10,060
Piz Uertsch	10,739	Piz Grisch	10,000
Piz Forbisch	10,689	Averser Weissberg	9,987
Piz Ot	10,667	Surettahorn	9,971
Gross Piz Vadret	10,584	Arosa Rothhorn	9,794
Piz Timun or Emet	10,502	Piz Curver	9,761
Tinzenhorn	10,430	Pizzo Lunghino	9,121
Piz Michel	10,378	Stätzerhorn	8,450

Chief Passes of the Albula Range.

Fuorcla Calderas (Molins to Bevers), snow	10,270
Fuorcla d'Eschia (Madulein to Bergün), snow	9,869
Passo della Duana (Avers Valley to the Val Bregaglia), snow	9,187
Sertig Pass (Davos to Scanfs), foot path	9,062
Forcella di Prassignola (Avers Valley to Soglio), old paved cattle path	8,924
Tinzenthor (Bergün to Savognino), foot path	8,918
Forcella di Lago or Madris Pass (Avers Valley to Chiavenna), foot path	8,793
Forcellina (Avers Valley to the Septimer Pass), foot path	8,770
Ducan Pass (Davos to Bergün), foot path	8,763
Passo di Lei (Avers Valley to Chiavenna), foot path	8,724
Forcella di Lunghino (Maloja to the Septimer Pass), foot path	8,645
Scaletta Pass (Davos to Scanfs), bridle path	8,593
Suvretta Pass (St Moritz to Bevers), bridle path	8,590
Fuorcla d'Alp Fontauna (Bergün to Scanfs), foot path	8,580
Stallerberg (Avers Valley to Bivio-Stalla), foot path	8,478
Grialetsch Pass (Davos to Süs), foot path	8,353
Flüela Pass (Davos to Süs), carriage road	7,838
Strela Pass (Davos to Langwies), bridle path	7,799
Albula Pass (Bergün to Ponte), carriage road over, railway tunnel beneath	7,595
Septimer Pass (Bivio-Stalla to Casaccia), bridle path	7,582
Julier Pass (Thusis to Silvaplana), carriage road	7,504
Passo di Madesimo or d'Emet (Avers Valley to Madesimo), foot path	7,481

12. Silvretta and Rhätikon Ranges (from the Flüela Pass to the Reschen Scheideck and the Arlberg Pass).

Chief Peaks of the Silvretta and Rhätikon Ranges.

Piz Linard	11,201	Vesulspitze	10,145
Fluchthorn	11,165	Flüela Weisshorn	10,132
Gross Piz Buin	10,880	Piz Minschun	10,079
Verstanklahorn	10,831	Patteriol	10,037
Muttler	10,821	Piz Faschalba	10,010
Piz Fliana	10,775	Hexenkopf	9,968
Stammerspitze	10,689	Gemsbleiskopf	9,899
Silvrettahorn	10,657	Pischahorn	9,784
Augstenberg	10,611	Scesaplana	9,741
Plattenhorn	10,568	Rothbleiskopf	9,640
Dreiländerspitze	10,539	Hohes Rad	9,554
Piz Tasna	10,443	Schiltfluh	9,482
Kuchenspitze	10,401	Plattenspitze	9,449
Hoher Riffler	10,368	Madrishorn	9,285
Piz Mondin	10,325	Drusenfluh	9,282
Küchelspitze	10,315	Sulzfluh	9,252
Gross Seehorn	10,247	Zimbaspitze	8,678
Vesilspitze	10,220	Naafkopf	8,445
Gross Litzner	10,207	Falknis	8,419

Chief Passes of the Silvretta and Rhätikon Ranges.

Jamjoch (Guarda to Galtür), snow	10,112
Fuorcla del Confin (Silvretta Pass to the Vermunt Glacier), snow	10,033
Buinlücke (Guarda to Patenen), snow	10,020
Silvretta Pass (Klosters to Lavin), snow	9,886
Zahnlücke (Jam Glen to the Fimber Glen), snow	9,712
Verstanklathor (Klosters to Lavin), snow	9,682
Fuorcla d'Urezzas (Ardez to Galtür), snow	9,564
Fuorcla Tasna (Ardez to Ischgl), snow	9,374
Fuorcla Maisas (Remüs to the Samnaun Glen), snow	9,357
Vermunt or Fermunt Pass (Guarda to Patenen), snow	9,193
Futschöl Pass (Ardez to Galtür), foot path	9,098
Fuorcla Zadrell or Vernela Pass (Klosters to Lavin), snow	9,033
Cuolm d'Alp bella or Vignitz Pass (Samnaun Glen to Kappl), foot path	8,852
Schafbücheljoch (Mathon to St Anton), foot path	8,685
Fimber Pass (Remüs to Ischgl), bridle path	8,570
Scheien Pass (Klosters to the See Glen), foot path	8,557
Vereina Pass or Pass da Val Torta (Klosters to Lavin), foot path	8,540

Zebles Pass (Ischgl to the Samnaun Glen), bridle path	8,350
Garnerajoch (Klosters to Gaschurn), foot path	8,153
Fless Pass (Klosters to Süs), foot path	8,045
St Antönien or Gargellenjoch (St Antönien to St Gallenkirch), foot path	7,792
Drusenthor (Schiers to Schruns), foot path	7,710
Verrajöchl (Lünersee to the Schweizerthor), foot path	7,648
Ofen Pass (Schweizerthor to Schruns), foot path	7,523
Cavelljoch (Bludenz and the Lünersee to Seewis), foot path	7,343
Gruben Pass (St Antönien to Schruns), foot path	7,333
Schlappinerjoch (Klosters to St Gallenkirch), bridle path	7,218
Schweizerthor (Schiers to Schruns), foot path	7,057
Bielerhöhe (Patenen to Galtür), bridle path	6,631
Zeinisjoch (Patenen to Galtür), bridle path	6,076
Arlberg Pass (Landeck to Bludenz), carriage road over, railway tunnel beneath	5,912

III. EASTERN ALPS

13. The Alps of Bavaria, the Vorarlberg and Salzburg (north of the Arlberg Pass, Innsbruck, the Pinzgau, and the Enns valley).

Chief Peaks of the Alps of Bavaria, the Vorarlberg and Salzburg.

Parseierspitze	9,968	Watzmann	8,901
Dachstein	9,830	Rothewandspitze	8,878
Zugspitze	9,738	Gross Krottenkopf (Allgäu)	8,718
Hochkönig	9,639	Selbhorn	8,711
Valluga	9,223	Hohes Licht	8,701
Rockspitze	9,059	Mädelegabel	8,681
E. Hohe Griesspitze	9,052	Hochvogel	8,511
Stanskogel	9,052	Elmauer Haltsspitze (Kaisergebirge)	7,691
Birkkarspitze (Karwendel)	9,042		

Chief Passes of the Alps of Bavaria, the Vorarlberg and Salzburg.

Gentschel Pass (Oberstdorf to Schröcken), bridle path	6,480
Schrofen Pass (Oberstdorf to Warth), foot path	5,538
Gerlos Pass (Zell to Mittersill), bridle path	4,876
Pass Thurn (Kitzbühel to Mittersill), carriage road	4,183
Fern Pass (Reutte to Nassereit), carriage road	4,026
Scharnitz or Seefeld Pass (Partenkirchen to Zirl), carriage road	3,874
Hirschbühel Pass (Berchtesgaden to Saalfelden), carriage road	3,858
Hochfilzen Pass (Saalfelden to Kitzbühel), railway over	3,173
Pyhrn Pass (Linz to Liezen), carriage road over, railway tunnel beneath	3,100
Wagreinstattel (Radstadt to St Johann in Pongau), carriage road	2,743

14. Central Tirol Alps (from the Brenner Pass to the Radstädter Tauern Pass, north of the Drave Valley and south of the Pinzgau and the Enns Valley). This division takes in the Zillerthal and Tauern Ranges.

Chief Peaks of the Central Tirol Alps.

Gross Glockner	12,461	Ruthnerhorn (Rieserferner)	11,024
Gross Venediger	12,008		
Gross Wiesbachhorn	11,713	Hochalmspitze	11,008
Hochfeiler (Zillerthal)	11,559	Reichenspitze (Z)	10,844
Dreiherrenspitze	11,500	Gross Rotherknopf (Schober)	10,814
Möseie (Z)	11,438		
Olperer (Z)	11,418	Gross Mörchner (Z)	10,785
Johannisberg	11,375	Hochnarr (Goldberg)	10,689
Hochgall (Rieserferner)	11,287	Ankogel	10,673
Thurnerkamp (Z)	11,228	Hochschober	10,663
Gross Löffler (Z)	11,096	Kitzsteinhorn	10,512
Fussstein (Z)	11,090	Sonnblick	10,196
Schwarzenstein (Z)	11,057	Zsigmondyspitze	10,122
Gross Geiger	11,041	Reckner (Tuxergebirge)	9,485

Chief Passes of the Central Tirol Alps.

Mitterbachjoch (Breitlahner to Taufers), snow (Z)	10,270
Trippachsattel (Floiten Valley to Taufers), snow (Z)	10,020
Riffelthor (Kaprun to Heiligenblut), snow	10,010
Bockkarscharte (Ferleiten to Heiligenblut), snow	9,994
Sonnblickscharte (Rauris to Heiligenblut), snow	9,774
Alpeinerscharte (Breitlahner to St Jodok am Brenner), foot path (Z)	9,712
Vorder Umbalthörl (Prägraten to Kasern), snow	9,607
Ober Sulzbachthörl (Prägraten to Wald), snow	9,600
Keilbachjoch (Mayrhofen to Steinhaus), foot path (Z)	9,410
Unter Sulzbachthörl (Wald to Gschlöss), snow	9,400
Schwarzkopfscharte (Bramberg to Gschlöss), snow	9,351
Prägraterthörl (Prägraten to the Defereggen Glen), foot path	9,338
Glödisthörl (Lienz to Kals), snow	9,292
Antholzerscharte (Rein Valley to the Antholz Valley), snow (Z)	9,252
Krimmlerthörl (Krimml Glen to the Obersulzbach Glen) snow	9,233
Goldzechscharte (Heiligenblut to Rauris), snow	9,220
Kalserthörl (Kals to Lienz), snow	9,197
Ober Tramerscharte (Rauris to Döllach), snow	9,193
Kleine Elendscharte (Gastein to Gmünd), snow	8,987
Kleine Zirknitzscharte (Döllach to Fragant or Rauris), snow	8,921
Dössener or Mallnitzerscharte (Mallnitz to Gmünd), snow	8,783
Grosse Elendscharte (Mallnitz to the Upper Malta Glen), snow	8,770
Unter Pfandlscharte (Ferleiten to Heiligenblut), snow	8,744
Heiliggeistjöchl (Mayrhofen to Kasern), foot path (Z)	8,721
Bergerthörl (Kals to Heiligenblut), foot path	8,695
Kaprunerthörl (upper Kaprun Glen to the upper Stubach Glen), snow	8,645
Krimmler Tauern (Krimml to Kasern), foot path	8,642
Virgner or Defereggerthörl (Defereggen Glen to Virgen and Prägraten), foot path	8,586
Backlenke or Trojerjoch (Prägraten to the Defereggen Glen), foot path	8,573
Hochthor or Heiligenbluter Tauern (Heiligenblut to Rauris), foot path	8,442
Hörndljöchl (Mayrhofen to Steinhaus), foot path (Z)	8,383
Velber Tauern (Windisch Matrei to Mittersill), bridle path	8,334
Kalser Tauern (Kals to Uttendorf), foot path	8,242
Hohe or Korn Tauern (Mallnitz to Gastein), bridle path over, railway tunnel beneath	8,081
Niedere or Mallnitzer Tauern (Mallnitz to Gastein), bridle path	7,920
Fuscherthörl (Ferleiten to the Seidlwinkel Glen), foot path	7,891
Lappacherjoch (Lappach to the Ahrn Valley), foot path (Z)	7,763
Tuxerjoch or Schmirnjoch (Mayrhofen to St Jodok am Brenner), foot path (Z)	7,697
Klammljoch (Taufers to the Defereggen Valley), bridle path	7,517
Arlscharte (St Johann in Pongau to Gmünd), foot path	7,386
Pfitscherjoch (Mayrhofen to Sterzing), foot path (Z)	7,376
Kals Matreierthörl (Kals to Windisch Matrei), bridle path	7,238
Die Stanz (Gastein to Rauris), foot path	6,900
Stallersattel (Defereggen Glen to the Antholz Glen), bridle path (R)	6,742
Radstädter Tauern (Radstadt to Mautendorf), carriage road	5,702

15. Ortler, Oetzthal and Stubai Ranges (from the Reschen Scheideck and the Stelvio to the Brenner Pass, south of the Inn Valley, and north of the Tonale Pass).

Chief Peaks of the Ortler, Oetzthal and Stubai Ranges.

Ortler	12,802	Zuckerhütl (Stubai)	11,520
Königsspitze	12,655	Schalfkogel	11,516
Monte Cevedale	12,382	Schrankogel	11,483
Wildspitze (Oetzthal)	12,382	Hochwildspitze	11,418
Weisskugel	12,291	Sonklarspitze	11,405
Monte Zebru	12,254	Tuckettspitze	11,346
Palon della Mare	12,156	Wilder Freiger	11,241
Punta San Matteo	12,113	Veneziaspitze	11,103
Thurwieserspitze	11,946	Tschengelser Hochwand	11,083
Hintere Schwärze	11,920	Monte Confinale	11,057
Similaun	11,821	Glockthurm	11,011
Pizzo Tresero	11,818	Fernerkogel	10,827
Gross Ramolkogel	11,651	Monte Sobretta	10,814
Vertainspitze	11,618	Habicht	10,758
Hochvernagtspitze	11,585	Pflerscher Tribulaun	10,178

Chief Passes of the Ortler, Oetzthal and Stubai Ranges.

Hochjoch (Sulden to the Zebru Glen), snow	11,602
Vioz Pass (Santa Caterina to Pejo), snow	10,949
Sonklarscharte (Sölden to Sterzing), snow	10,916
Königsjoch (Sulden to Santa Caterina), snow	10,811
Cevedale Pass (Santa Caterina to the Martell Glen), snow	10,732
Gepatschjoch (Vent to the Kauns Valley), snow	10,640
Ramoljoch (Vent to Gurgl), snow	10,479
Langtaufererjoch (Vent to the Reschen Scheideck Pass), snow	10,391
Bildstöckljoch (Sölden to Ranalt), snow	10,296
Gurgler Eisjoch (Gurgl to the Pfossen Glen), snow	10,292
Eissee Pass (Sulden to the Martell Glen), snow	10,279
Langthalerjoch (Gurgl to Pfelders), snow	10,033
Passo del Zebru (Santa Caterina to the Zebru Glen), snow	9,925
Sällentjoch (Martell Glen to Rabbi), snow	9,913
Niederjoch (Vent to the Schnals Valley), snow	9,899
Sforzellina Pass (Santa Caterina to Pejo), snow	9,859
Pitzthalerjöchl (Mittelberg to Sölden), snow	9,826
Eisjöchl am Bild (Pfelders to the Pfossen Glen), snow	9,541
Venter Hochjoch (Vent to the Schnals Valley), snow	9,465
Tabarettascharte (Sulden to Trafoi), foot path	9,459
Stelvio Pass (Trafoi to Bormio), carriage road	9,055
Gavia Pass (Santa Caterina to Ponte di Legno), foot path	8,651
Timmeljoch or Timblerjoch (Sölden to the Passeierthal and Meran), bridle path	8,232
Jaufen Pass (Sterzing to Meran), bridle path	6,870
Reschen Scheideck Pass (Landeck to Meran), carriage road	4,902
Brenner Pass (Innsbruck to Verona), railway over	4,495

16. Lombard Alps (from the Lake of Como to the Adige Valley, south of the Valtellina and the Aprica and Tonale Passes. This

division includes the Adamello, Presanella, Brenta and Bergamasque ranges.

Chief Peaks of the Lombard Alps.

Presanella	11,694	Pizzo del Diavolo	9,564
Adamello	11,661	Rè di Castello	9,482
Carè Alto	11,369	Recastello	9,475
Dosson di Genova	11,254	Monte Gleno	9,459
Crozzon di Lares	11,004	Monte Tornello	8,819
Corno di Baitone	10,929	Corno Stella	8,596
Busazza	10,922	Monte Legnone	8,563
Lobbia Alta	10,486	Pizzo dei Tre Signori	8,380
Cima Tosa (Brenta)	10,420	Pizzo di Presolana	8,239
Cima di Brenta	10,352	Grigna	7,907
Crozzon di Brenta	10,247	Monte Baldo	7,218
Pizzo di Coca (Bergamasque)	10,014	Monte Spinale	7,094
Pizzo di Scais	9,974	Monte Roën	6,939
Pizzo di Redorta	9,964	Monte Gazza	6,529
Pietra Grande	9,630	Monte Resegone	6,155

Chief Passes of the Lombard Alps.

Passo di Lares (Lares Glacier to the Lobbia Glacier), snow	10,483
Passo di Cercen (Val di Genova to Fucine), snow	9,984
Passo della Lobbia Alta (Lobbia Glacier to the Mandron Glacier), snow	9,961
Passo di Presena (Val di Genova to the Tonale Pass), snow	9,879
Pisgana Pass (Val di Genova to Ponte di Legno), snow	9,626
Bocca di Tuckett (Campiglio to Molveno), snow	8,714
Passo di Val Morta or del Diavolo (Val Seriana to Sondrio), foot path	8,534
Bocca di Brenta (Pinzolo or Campiglio to Molveno), snow	8,376
Passo del Grostè (Campiglio to Cles), foot path	8,006
Passo di Venina (Val Brembana to Sondrio), foot path	7,983
Passo del Salto (Val Seriana to Sondrio), foot path	7,937
Passo del Venerocolo (Val di Scalve to the Aprica road), bridle path	7,595
Passo della Forcellina or di Campo (Cedegolo to the Val di Fumo), foot path	7,507
Passo di Dordona (Val Brembana to Sondrio), foot path	6,824
Passo di San Marco (Bergamo to Morbegno), bridle path	6,513
Croce Domini Pass (Breno to Bagolino in Val Caffaro), bridle path	6,217
Tonale Pass (Trent to Edolo), carriage road	6,181
Passo di Zovetto (Val di Scalve to Edolo), bridle path	5,968
Colle Maniva (Val Trompia to Bagolino), bridle path	5,476
Campo or Ginevriè Pass (Dimaro by Campiglio to Pinzolo), carriage road	5,407
Gampenjoch (Cles to Meran), foot path	5,051
Mendel Pass (Botzen to Cles), railway on the E. slope	4,462
Passo di Castione or Presolana Pass (Clusone to the Val di Scalve), carriage road	4,219
Aprica Pass (Edolo to Tirano), carriage road	3,875

17. The Dolomites of South Tirol (from the Brenner Pass to the Monte Croce Pass, and south of the Pusterthal).

Chief Peaks of the Dolomites of South Tirol.

Marmolata	10,972	Pala di San Martino	9,831
Antelao	10,706	Rosengartenspitze	9,781
Tofana di Mezzo	10,633	Marmarole	9,715
Sorapiss	10,594	Cima di Fradusta	9,649
Monte Civetta	10,564	Fermedathurm	9,407
Vernel	10,519	Cima d'Asta	9,344
Monte Cristallo	10,496	Cima di Canali	9,338
Cima di Vezzana	10,470	Croda Grande	9,315
Cimon della Pala	10,453	Vajoletthurm (highest)	9,256
Langkofel	10,427	Sass Maor	9,239
Pelmo	10,397	Cima di Ball	9,131
Dreischusterspitze	10,375	Cima della Madonna (Sass Maor)	9,026
Boëspitze	10,342	Rosetta	8,993
Croda Rossa (Hoher Caisl)	10,329	Croda da Lago	8,911
Piz Popena	10,312	Central Grasleitenspitze	8,875
Elferkofel	10,220	Schlern	8,406
Grohmannspitze	10,207	Sasso di Mur	8,380
Zwölferkofel	10,142	Cima delle Dodici	7,671
Sass Rigais(Geislerspitzen)	9,932	Monte Pavione	7,664
Drei Zinnen	9,853	Cima di Posta	7,333
Kesselkogel (Rosengarten)	9,846	Monte Pasubio	7,323
Fünffingerspitze	9,833		

Chief Passes of the Dolomites of South Tirol.

Passo d' Ombretta (Campitello to Caprile), foot path	8,983
Langkofeljoch (Groden Valley to Campitello), foot path	8,803
Tschagerjoch (Karersee to the Vajolet Glen), foot path	8,675
Grasleiten Pass (Vajolet Glen to the Grasleiten Glen), foot path	8,521
Passo di Pravitale (Rosetta Plateau to the Pravitale Glen), foot path	8,465
Passo delle Comelle (same to Cencenighe), foot path	8,462
Passo della Rosetta (San Martino di Castrozza to the great limestone Rosetta Plateau), foot path	8,442
Vajolet Pass (Tiers to the Vajolet Glen), foot path	8,363
Passo di Canali (Primiero to Agordo), foot path	8,193
Tiersalpljöchl (Campitello to Tiers), foot path	8,055
Passo di Ball (San Martino di Castrozza to the Pravitale Glen), foot path	8,038
Forcella di Giralba (Sexten to Auronzo), foot path	7,992
Col dei Bos (Falzarego Glen to the Travernanzes Glen), foot path	7,579
Forcella Grande (San Vito to Auronzo), foot path	7,422
Pordoi Pass (Caprile to Campitello), carriage road	7,382
Sellajoch (Gröden Glen to Campitello), bridle path	7,277
Tre Sassi Pass (Cortina to St Cassian), foot path	7,215
Mahlknechtjoch (Upper Duron Glen to the Seiser Alp), foot path	7,113
Grödenerjoch (Gröden Glen to Colfuschg), bridle path	7,011
Falzarego Pass (Caprile to Cortina), small carriage road	6,946
Fedaja Pass (Campitello to Caprile), bridle path	6,713
Passo di Valles (Paneveggio to Cencenighe), foot path	6,667
Rolle Pass (Predazzo to San Martino di Castrozza and Primiero), carriage road	6,509
Forcella Forada (Caprile to San Vito), bridle path	6,480
Passo di San Pellegrino (Moëna to Cencenighe), small carriage road	6,267
Forcella d'Alleghe (Alleghe to the Zoldo Glen), foot path	5,971
Tre Croci Pass (Cortina to Auronzo), carriage road	5,932
Karersee or Caressa Pass (Welschenofen to Vigo di Fassa), carriage road	5,715
Monte Croce Pass (Innichen and Sexten to the Piave Valley and Belluno), carriage road	5,374
Ampezzo Pass (Toblach to Cortina and Belluno), carriage road	5,066
Cereda Pass (Primiero to Agordo), bridle path	4,501
Toblach Pass (Bruneck to Lienz), railway over	3,967

18. South-Eastern Alps (east of the Monte Croce Pass). This division includes three small groups, the Julic, Carnic and Karawankas Alps—each peak and pass being distinguished by one of the initial letters " J," " C " or " K."

Chief Peaks of the South-Eastern Alps.

Terglou or Triglav (J)	9,400	Monte Cridola (C)	8,468
Monte Coglians (C)	9,128	Grintovc (K)	8,429
Kellerwand (C)	9,105	Prestrelenik (J)	8,202
Jof del Montasio (J)	9,039	Monte Cavallo (C)	7,386
Cima dei Preti (C)	8,868	Krn (J)	7,369
Monte Paralba (C)	8,829	Stou (K)	7,346
Manhart (J)	8,786	Dobratsch (C)	7,110
Jalouc (J)	8,711	Velka Kappa (K)	5,059
Monte Canin (J)	8,471		

Chief Passes of the South-Eastern Alps.

Oefnerjoch (Forno Avoltri to St Lorenzen in the Gail Valley), foot path (C)	7,550
Wolayer Pass (same to Mauthen), foot path (C)	6,506
Loibl Pass (Klagenfurt to Laibach), carriage road (K)	4,495
Plöcken Pass (Tolmezzo to Mauthen), bridle path (C)	4,462
Predil Pass (Villach by Tarvis and Flitsch to Görz), carriage road (J)	3,813
Birnbaumerwald (Laibach to Görz), carriage road (J)	2,897
Saifnitz or Pontebba Pass (Villach by Tarvis and Pontebba to Udine), railway	2,615

7. *Political History and Modern State of the Inhabitants of the Alps.*—We know practically nothing of the early dwellers in the Alps, save from the scanty accounts preserved to us by Roman and Greek historians and geographers. A few details have come down to us of the conquest of many of the Alpine tribes by Augustus, though not much more than their names. The successive emigrations and occupation of the Alpine region by divers Teutonic tribes from the 5th to the 6th centuries are, too, known to us only in outline, while to them, as to the Frankish kings and emperors, the Alps offered a route from one place to another rather than a permanent residence. It is not till the final break up of the Carolingian empire in the 10th and 11th centuries that it becomes possible to trace out the local history of different parts of the Alps.

In the case of the Western Alps (minus the bit from the chain of Mont Blanc to the Simplon, which followed the fortunes of the Valais), a prolonged struggle for the Alpine region took place between the feudal lords of Savoy, the Dauphiné and Provence. In 1349 the Dauphiné fell to France, while in 1388 the county of Nice passed from Provence to the house of Savoy, which too held Piedmont as well as other lands on the Italian side of the Alps. The struggle henceforth was limited to France and the house of Savoy, but little by little France succeeded in pushing back the house of Savoy across the Alps, thus forcing it to become a purely Italian power. One turning-point in the rivalry was the treaty of Utrecht (1713), by which France gave up to Savoy the districts (all forming part of the Dauphiné, and lying on the Italian slope of the Alps) of Exilles, Bardonnèche, Oulx, Fénestrelles, and Château Dauphin, while Savoy handed over to France the valley of Barcelonnette, situated on the western slope of the Alps and forming part of the county of Nice. The final act in the long-continued struggle took place in 1860, when France obtained by cession the rest of the county of Nice and also Savoy, thus remaining sole mistress on the western slope of the Alps.

In the Central Alps the chief event, on the northern side of the chain, is the gradual formation from 1291 to 1815 of the Swiss Confederation, at least so far as regards the mountain Cantons, and with especial reference to the independent confederations of the Grisons and the Valais, which only became full members of the Confederation in 1803 and 1815 respectively. The attraction of the south was too strong for both the Forest Cantons and the Grisons, so that both tried to secure, and actually did secure, various bits of the Milanese. The former, in the 15th century, won the Val Leventina (down which the St Gotthard train now thunders) as well as Bellinzona and the Val Blenio (though the Ossola Valley was held for a time only), while the latter added to the Val Bregaglia (which had been given to the bishop of Coire in 960 by the emperor Otto I.) the valleys of Mesocco and of Poschiavo. Further, in 1512, the Swiss Confederation as a whole won the valleys of Locarno with Lugano, which, combined with the 15th century conquests by the Forest Cantons, were formed in 1803 into the new Canton of Ticino or Tessin. On the other hand, the Grisons won in 1512 the Valtellina, with Bormio and Chiavenna, but in 1797 these regions were finally lost to it as well as to the Swiss Confederation, though the Grisons retained the valleys of Mesocco, Bregaglia and Poschiavo, while in 1762 it had bought the upper bit of the valley of Münster that lies on the southern slope of the Alps.

In the Eastern Alps the political history is almost monotonous, for it relates simply to the advance or retreat of the house of Habsburg, which still holds all but the whole of the northern portion (the exception is the small bit in the north-west that belongs to Bavaria) of that region. The Habsburgers, whose original home was in the lower valley of the Aar, where still stand the ruins of their ancestral castle, lost that district to the Swiss in 1415, as they had previously lost various other bits of what is now Switzerland. But they received a rich compensation in the Eastern Alps (not to speak of the imperial crown), for they there gathered in the harvest that numerous minor dynasties had prepared for them, albeit unconsciously. Thus they won the duchy of Austria with Styria in 1282, Carinthia and Carniola in 1335, Tirol in 1363, and the Vorarlberg in bits from 1375 to 1523, not to speak of minor "rectifications" of frontiers on the northern slope of the Alps. But on the other slope their progress was slower, and finally less successful. It is true that they early won Primiero (1373), as well as (1517) the Ampezzo Valley and several towns to the south of Trent. In 1797 they obtained Venetia proper, in 1803 the secularized bishoprics of Trent and Brixen (as well as that of Salzburg, more to the north), besides the Valtellina region, and in 1815 the Bergamasque valleys, while the Milanese had belonged to them since 1535. But, as is well known, in 1859 they lost to the house of Savoy both the Milanese and the Bergamasca, and in 1866 Venetia proper also, so that the Trentino is now their chief possession on the southern slope of the Alps. The gain of the Milanese in 1859 by the future king of Italy (1861) meant that Italy then won the valley of Livigno (between the Upper Engadine and Bormio), which is the only important bit it holds on the non-Italian slope of the Alps, besides the county of Tenda (obtained in 1575, and not lost in 1860), with the heads of certain glens in the Maritime Alps, reserved in 1860 for reasons connected with hunting. Thus the Alpine states (Italy, Switzerland and Austria), other than France and Bavaria, hold bits of territory on the slope of the Alps where one would not expect to find them. Roughly speaking, in each of these five lands the Alpine population speaks the tongue of the country, though in Italy there are a few French-speaking districts (the Waldensian valleys as well as the Aosta and Oulx valleys) as well as some German-speaking and Ladin-speaking settlements. In Switzerland there are Italian-speaking regions, as well as some spots (in the Grisons) where the old Romance dialect of Romansch or Ladin survives; while in Austria, besides German, Italian and Ladin, we have a Slavonic-speaking population in the South-Eastern Alps. The highest permanently inhabited village in the Alps is Juf, 6998 ft. (Grisons); while in the French Alps, L'Écot, 6713 ft. (Savoy), and St Véran, 6726 ft. (Dauphiné), are rivals; the Italian Alps boast of Trepalle, 6788 ft. (between Livigno and Bormio), and the Tirolese Alps of Ober Gurgl, 6322 ft., and Fend, 6211 ft. (both in the Oetzthal).

8. *Exploration of the High Alps.*—The higher region of the Alps were long left to the exclusive attention of the men of the adjoining valleys, even when Alpine travellers (as distinguished from Alpine climbers) began to visit these valleys. It is reckoned that about 20 glacier passes were certainly known before 1600, about 25 more before 1700, and yet another score before 1800; but though the attempt of P. A. Arnod (an official of the duchy of Aosta) in 1689 to "re-open" the Col du Géant may be counted as made by a non-native, we do not come upon another case of the kind till the last quarter of the 18th century. Nor did it fare much better with the high peaks, though the two earliest recorded ascents were due to non-natives, that of the Rochemelon in 1358 having been undertaken in fulfilment of a vow, and that of the Mont Aiguille in 1492 by order of Charles VIII. of France, in order to destroy its immense reputation for inaccessibility—in 1555 Conrad Gesner did not climb Pilatus proper, but only the grassy mound of the Gnepfstein, the lowest and the most westerly of the seven summits. The two first men who really systematically explored the regions of ice and snow were H. B. de Saussure (1740–1799), as regards the Pennine Alps, and the Benedictine monk of Disentis, Placidus à Spescha (1752–1833, most of whose ascents were made before 1806), in the valleys at the sources of the Rhine. In the early 19th century the Meyer family of Aarau conquered in person the Jungfrau (1811) and by deputy the Finsteraarhorn (1812), besides opening several glacier passes, their energy being entirely confined to the Bernese Oberland. Their pioneer work was continued in that district, as well as others, by a number of Swiss, pre-eminent among whom were Gottlieb Studer (1804–1890) of Bern, and Edouard Desor (1811–1882) of Neuchâtel. The first-known English climber in the Alps was Colonel Mark Beaufoy (1764–1827), who in 1787 made an ascent (the fourth) of Mont Blanc, a mountain to which his fellow-countrymen long exclusively devoted themselves, with a few noteworthy exceptions, such as Principal J. D. Forbes (1809–1868), A. T. Malkin (1803–1888), John Ball (1818–1889), and Sir Alfred Wills (b. 1828). Around Monte Rosa the Vincent family, Josef Zumstein (1783–1861), and Giovanni Gnifetti (1801–1867) did good work during the half century between 1778 and 1842, while in the Eastern Alps the Archduke John (1782–1859), Prince F. J. C. von Schwarzenberg, archbishop of Salzburg (1809–1885), Valentine Stanig (1774–1847), Adolf Schaubach (1800–1850), above all, P. J. Thurwieser (1789–1865), deserve to be recalled as pioneers in the first half of the 19th century. In the early fifties of the 19th century the taste for mountaineering rapidly developed for several very different reasons. A great stimulus was given to it by the foundation of the various Alpine clubs, each of which drew together the climbers who dwelt in the same country. The first was the English Alpine Club (founded in the winter of 1857–1858), followed in 1862 by the Austrian Alpine Club (which in 1873 was fused, under the name of the German and Austrian Alpine Club, with the German Alpine Club, founded in 1869), in 1863 by the Italian and Swiss Alpine Clubs, and in 1874 by the French Alpine Club, not to mention numerous minor societies of more local character. It was by the members of these clubs (and a few others) that the minute exploration (now all but complete)

of the High Alps was carried out, while much has been done in the way of building club huts, organizing and training guides, &c., to smooth the way for later comers, who benefit too by the detailed information published in the periodicals (the first dates from 1863 only) issued by these clubs. Limits of space forbid us to trace out in detail the history of the exploration of the High Alps, but the two sub-joined lists give the dates of the conquest of about fifty of the greater peaks (apart from the two climbed in 1358 and in 1492, see above), achieved before and after 1st January 1858. As a proof of the rapidly-growing activity of Englishmen, it may be pointed out that while before 1858 only four summits (the Mittelhorn, or central peak of the Wetterhörner, the highest point of Monte Rosa, Laquinhorn and Pelmo) were first ascended by Englishmen, in the case of the second list only five (Grand Combin, Wildspitze, Marmolata, Langkofel and Meije) were not so conquered (if the present writer, an American, be included among the English *pro hac vice*).

(1) Before 1st January 1858:—Titlis (1744), Ankogel (1762), Mont Vélan (1779), Mont Blanc (1786), Rheinwaldhorn (1789), Gross Glockner (1800), Ortler (1804), Jungfrau (1811), Finsteraarhorn (1812), Zumsteinspitze (1820), Tödi (1824), Altels (1834), Piz Linard (1835), Gross Venediger (1841), Signalkuppe (1842), Wetterhörner (1844–1845), Mont Pelvoux (1848), Diablerets and Piz Bernina (both in 1850), highest point of Monte Rosa (1855), Laquinhorn (1856) and Pelmo (1857).

(2) After 1st January 1858:—Dom (1858), Aletschhorn, Bietschhorn and Grand Combin (all in 1859), Grand Paradis and Grande Casse (both in 1860), Weisshorn, Monte Viso, Gross Schreckhorn, Lyskamm and Wildspitze (all in 1861), Dent Blanche, Monte della Disgrazia and Täschhorn (all in 1862), Marmolata, Presanella, Pointe des Ecrins and Zinal Rothhorn (all in 1864), Matterhorn, Ober Gabelhorn, Aiguille Verte and Piz Roseg (all in 1865), Langkofel (1869), Cimon della Pala (1870), Rosengarten (1872), Meije (1877), Aiguille du Dru (1878), Punta dell' Argentera (1879), Aiguille des Charmoz (1880), Aiguille de Grépon (1881) and Aiguille du Géant (1882).

9. GENERAL LIST OF BOOKS AND MAPS.—(1) *Books.*—For a longer list than we can give see John Ball's *Hints and Notes for Travellers in the Alps* (new ed., 1899) and also A. Wäber's *Landes- und Reisebeschreibungen der Schweiz* (1899, supplement in 1907). In general see J. Ball's *The Alpine Guide* (3 vols., new ed. of vol. i., 1898; last ed. of vol. ii., 1876, and of vol. iii., 1879); H. A. Berlepsch, *Die Alpen in Natur- und Lebensbildern* (last ed., 1885, Eng. trans., 1861); T. G. Bonney, *The Alpine Regions of Switzerland and the Neighbouring Countries* (1868); A. Civiale, *Les Alpes au point de vue de la géographie physique* (1882); Sir Martin Conway, *The Alps* (1904); W. A. B. Coolidge, *Swiss Travel and Swiss Guide-Books* (1889) and *The Alps* (1908); R. von Lendenfeld, *Aus den Alpen* (2 vols., 1896); C. Lenthéric, *L'Homme devant les Alpes* (1896); F. Umlauft, *Die Alpen* (1887, Eng. trans., 1889). On some special subjects see W. A. Baillie-Grohmann, *Sport in the Alps* (1896); A. Mossó, *Fisiologia dell' Uomo sulle Alpi* (1897, English trans., 1898); N. Zuntz and others, *Hohenklima und Bergwanderungen in ihrer Wirkungen auf den Menschen* (1906); G. Berndt, *Der Föhn* (1896, the south wind, so important in mountain districts); and the article on GLACIER.

As to Alpine legends, consult Maria Savi-Lopez, *Leggende delle Alpi* (1889); M. Tscheinen, *Walliser-Sagen* (1872); Th. Vernaleken, *Alpensagen* (1858); and I. V. Zingerle, *Sagen aus Tirol* (1859); and as to Alpine poetry—J. Adam, *Der Natursinn in der deutschen Dichtung* (1906); E. A. Baker and F. E. Ross, *The Voice of the Mountains* (1905, an anthology in verse and prose); A. von Haller, *Die Alpen* (1732, best ed., 1882, illustrated ed., 1902); and H. E. Jenny, *Die Alpendichtung in der deutschen Schweiz* (1905).

As to Alpine dialects, consult J. Alton, *Die ladinischen Idiome in Ladinien, Gröden, Fassa, Buchenstein, Ampezzo* (1879); J. A. Chabrand and A. de Rochas d'Aiglun, *Patois des Alpes cottiennes* (1877); Z. and E. Pallioppi, *Dizionari dels Idioms Romauntschs d'Engiadina ota e bassa, &c.* (1895); A. Socin, *Schriftsprache und Dialekte im Deutschen* (1888); F. J. Stalder, *Die Landessprachen der Schweiz* (1819), and J. Zimmerli, *Die deutsch-französische Sprachgrenze in der Schweiz* (3 vols., 1891–1899); besides the great Swiss Dialect Dictionary (*Schweiz. Idiotikon*) in course of publication since 1881.

As to the history of the Alps, the following works touch on various aspects of the subject:—G. Allais, *Le Alpi Occidentali nell' Antichità* (1891); W. Brockedon, *Illustrations of the Passes of the Alps* (2 vols., 1828–1829); J. Grand-Carteret, *La Montagne à travers les ages* (2 vols., 1902–1904); G. Oberziner, *Le Guerre di Augusto contro i populi alpini* (1900); E. Oehlmann, *Die Alpenpasse im Mittelalter* (1878–1879); R. Reinhard, *Pässe und Strassen in den Schweizer Alpen* (1903); and L. Vaccarone, *Le Vie delle Alpi Occidentali negli antichi tempi* (1884); while W. A. B. Coolidge's *Josias Simler et les origines de l'alpinisme jusqu'en 1600* (1904) summarises our knowledge of the Alps up to 1600.

Among works of a more or less descriptive nature (based on actual travels), the following list includes all the standard works dated before 1855:—*Le Alpi che cingono l'Italia* (1845); J. G. Altmann, *Versuch einer hist. u. phys. Beschreibung der helvetischen Eisbergen* (1751); A. C. Bordier, *Voyage pittoresque aux glacières de Savoye* (1773); P. J. de Bourcet, *Mémoires militaires sur les frontières de la France, du Piémont, et de la Savoie* (1801); M. T. Bourrit, *Description des glacières, glaciers, et amas de glace du duché de Savoye* (1773, Eng. trans., 1775), *Description des Alpes pennines et rhétiennes* (2 vols., 1781, 3rd vol., 1785), and *Description des cols ou passages des Alpes* (2 vols., 1803); W. Brockedon, *Journals of Excursions in the Alps* (1833); U. Campell, *Raetiae alpestris topographica descriptio* (finished in 1572, but publ. only in 1884, with a supplement in 1900); J. A. Deluc and P. G. Dentan, *Relation de différents voyages dans les Alpes du Faucigny* (1776); E. Desor, *Excursions et séjours dans les glaciers* (2 series, 1844–1845); C. M. Engelhardt, *Naturschilderungen aus den hochsten Schweizer-Alpen* (1840), and *Das Monte-Rosa und Matterhorn-Gebirg* (1852); J. D. Forbes, *Travels through the Alps of Savoy* (1843, new ed., 1900); Sir John Forbes, *A Physician's Holiday* (1849); J. Fröbel, *Reise in die weniger bekannten Thäler auf der Nordseite der penninischen Alpen* (1840); G. Gnifetti, *Nozioni topografiche del Monte Rosa ed ascensioni su di esso* (1845, 2nd ed., 1858); G. S. Gruner, *Die Eisgebirge des Schweizerlandes* (3 vols., 1760); J. Hegetschweiler, *Reisen in den Gebirgsstock zwischen Glarus und Graubünden, 1819–1822* (1825); G. Hoffmann, *Wanderungen in der Gletscherwelt* (1843); F. J. Hugi, *Naturhistorische Alpenreise* (1830); C. J. Latrobe, *The Alpenstock* (1829) and *The Pedestrian* (1832); J. R. and H. Meyer, *Reise auf den Jungfrau-Gletscher und Ersteigung seines Gipfels* (1811); De Montannel, *La Topographie militaire de la frontière des Alpes* (written in 1777, but publ. in 1875 only); *Opérations géodésiques et astronomiques pour la mesure d'un arc du parallèle moyen* (2 vols., 1825–1827); H. R. Rebmann, *Ein poetisch Gastmal und Gespräch zweyer Bergen, nemlich des Niesens und Stockhorns* (1606); C. Rohrdorf, *Reise über die Grindelwald-Viescher-Gletscher und Ersteigung des Gletschers des Jungfrau-Berges* (1828); H. B. de Saussure, *Voyages dans les Alpes* (4 vols., 1779–1796); A. Schaubach, *Deutsche Alpen* (4 vols., 1845–1847); J. J. Scheuchzer, *Helvetiae Stoicheiographia, Orographia, et Oreographia* (1716), and *Itinera per Helvetiae alpinas regiones facta annis 1702–1711* (4 vols., 1723); J. Simler, *Vallesiae Descriptio et de Alpibus Commentarius* (1574, new ed. in 1904, see Coolidge above); Albert Smith, *The Story of Mont Blanc* (1853); G. Studer, *Topographische Mitteilungen aus dem Alpengebirge* (1843); R. Töpffer, *Voyages en zigzag* (2 series, 1844 and 1853); Aegid. Tschudi, *De priscâ ac verâ alpinâ Rhaetiâ* (1538, also in German, same date); and L. von Welden, *Der Monte Rosa* (1824).

As to works published after 1855 we can only give a short, though carefully selected, list. C. Aeby and others, *Das Hochgebirge von Grindelwald* (1865); W. A. Baillie-Grohmann, *Tyrol and the Tyrolese* (1876), and *Gaddings with a Primitive People* (2 vols., 1878); H. von Barth, *Aus den nördlichen Kalkalpen* (1874); L. Barth and L. Pfaundler, *Die Stubaiergebirgsgruppe* (1865); G. F. Browne, *Off the Mill* (1895); Mrs H. W. Cole, *A Lady's Tour round Monte Rosa* (1859); E. T. Coleman, *Scenes from the Snow Fields* (1859); Sir Martin Conway, *The Alps from End to End* (1895); A. Daudet, *Tartarin sur les Alpes* (1885, Eng. trans., same date); C. T. Dent, *Above the Snow Line* (1885); Miss A. B. Edwards, *Untrodden Peaks and Unfrequented Valleys* (1873, Dolomites); Max Forderreuther, *Die Allgäuer Alpen* (1906); D. W. Freshfield, *Across Country from Thonon to Trent* (1865), and *Italian Alps* (1875); Mrs Henry Freshfield, *Alpine Byways* (1861), and *A Summer Tour in the Grisons* (1862); H. B. George, *The Oberland and its Glaciers* (1866); J. Gilbert and G. C. Churchill, *The Dolomite Mountains* (1864); A. G. Girdlestone, *The High Alps without Guides* (1870); P. Grohmann, *Wanderungen in den Dolomiten* (1877); P. Güssfeldt, *In den Hochalpen* (1886), and *Der Montblanc* (1894); T. W. Hinchliff, *Summer Months among the Alps* (1857); C. Hudson and E. S. Kennedy, *Where there's a Will there's a Way* (1856); E. Javelle, *Souvenirs d'un Alpiniste* (1886, Eng. trans., 1899); S. W. King, *The Italian Valleys of the Pennine Alps* (1858); *Le Valli di Lanzo* (publ. by the Italian Alpine Club in 1899); A. Lorria and E. A. Martel, *Le Massif de la Bernina* (1894); J. Michelet, *La Montagne* (1868, Eng. trans., 1872); A. W. Moore, *The Alps in 1864* (1867, publ. ed., 1902); A. F. Mummery, *My Climbs in the Alps* (1895); *Norman-Neruda, The Climbs of* (1899); *Peaks, Passes and Glaciers* (3 vols., 1859–1862); L. Purtscheller, *Über Fels und Firn* (1901); E. Rambert, *Ascensions et flâneries* (2 vols., 1888); G. Rey, *Il Monte Cervino* (1904); John Ruskin, vol. iv. (On Mountain Beauty) of *Modern Painters* (1856); A. von Ruthner, *Aus den Tauern* (1864) and *Aus Tirol* (1869); V. Sella and D. Vallino, *Monte Rosa e Gressoney* (1890); F. Simony, *Das Dachsteingebiet* (1889–1896); L. Sinigaglia, *Climbing Reminiscences of the Dolomites* (1896); K. von Sonklar, *Die Oetzthaler Gebirgsgruppe* (1860), and *Die Gebirgsgruppe der Hohen-Tauern* (1866); Sir L. Stephen, *The Playground of Europe* (1871); B. Studer, *Geschichte der physischen Geographie der Schweiz bis 1815* (1863);

G. Studer and others, *Berg- und Gletscherfahrten* (2 series, 1859 and 1863); G. Theobald, *Naturbilder aus den rhatischen Alpen* (1860), and *Das Bündner Oberland* (1861); F. F. Tuckett, *Hochalpenstudien* (2 vols., 1873–1874); Miss L. Tuckett, *How we Spent the Summer* (1864), *Pictures in Tyrol* (1867), and *Zigzagging amongst Dolomites* (1871); J. Tyndall, *The Glaciers of the Alps* (1860), *Mountaineering in 1861* (1862), and *Hours of Exercise in the Alps* (1871); J. J. Weilenmann, *Aus der Firnenwelt* (3 vols., 1872–1877); E. Whymper, *Scrambles amongst the Alps* (1871); Sir A. Wills, *Wanderings among the High Alps* (1856), and *The "Eagle's Nest" in the Valley of Sixt* (1860); G. Yeld, *Scrambles in the Eastern Graians* (1900); H. Zschokke, *Reise auf die Eisgebirge des Kantons Bern und Ersteigung ihrer höchsten Gipfel im Sommer von 1812* (1813); E. Zsigmondy, *Im Hochgebirge* (1889); M. Zurbriggen, *From the Alps to the Andes* (1899).

Many useful practical hints as to climbing are to be found in C. T. Dent and others, *Mountaineering* (1892, 3rd ed., 1900, "Badminton Library"); the *Manuel d'Alpinisme* (1904, publ. by the French Alpine Club); J. Meurer, *Handbuch der alpinen Sport* (1882), *Katechismus für Bergsteiger* (1892), and *Der Bergsteiger im Hochgebirge* (1893); and C. Wilson, *Mountaineering* (1893, "All England" series). As regards the dangers of Alpine climbing consult C. Fiorio and C. Ratti, *I Pericoli dell' Alpinismo* (1889), and E. Zsigmondy, *Die Gefahren der Alpen* (1885, Fr. trans., 1889). There are also special guide-books for the use of climbers in the Alps—the "Climbers' Guides" series, edited by Sir Martin Conway and W. A. B. Coolidge (10 vols., 1890–1904); W. A. B. Coolidge, H. Duhamel and F. Perrin, *Guide du Haut Dauphiné* (1887, with supplement in 1890, Eng. trans., 1892 and 1905); L. Purtscheller and H. Hess, *Der Hochtourist in den Ostalpen* (2 vols., 1894, 3 vols., 3rd ed., 1903); the 3 vols. publ. (1902–1905) by the Swiss Alpine Club under the name of *Clubführer* to the Alps of Glarus and Uri, and V. Wolf von Glanvell, *Dolomitenführer* (1898).

As regards the early history of Alpine exploration consult W. A. B. Coolidge, *Josias Simler et les origines de l'alpinisme jusqu'en 1600* (1904), and F. Gribble, *The Early Mountaineers* (1899). For the later period see, besides the more general works of travel mentioned above, the publications (that date from 1863) of the various Alpine Clubs—the *Alpine Journal* (English A. C.), the *Annuaire*, *Bulletin*, *La Montagne*, and *Revue alpine* (French A. C.), the *Jahrbuch*, *Mitteilungen*, *Verhandlungen*, and *Zeitschrift* (German and Austrian A. C.), the *Alpinista*, *Bollettino*, and *Rivista Mensile* (Italian A. C.), and the *Alpina*, *Écho des Alpes*, *Jahrbuch*, *Schweizer Alpen-Zeitung* (Swiss A. C.), besides those of the smaller societies, such as the *Österreichische Alpen-Zeitung* (Austrian A. C.), the *Annuaire* (Société des Touristes du Dauphiné), and the *Annuario* (Società degli Alpinisti Tridentini). Summaries of the Alpine history of the three great divisions of the Alps are given in (W. Alps) L. Vaccarone, *Statistica delle Prime Ascensioni nelle Alpi Occidentali* (3rd. ed., 1890—this work omits the Dauphiné Alps, as to which see the 1887 work or its Eng. version 1905, mentioned above); (Central and Swiss Alps) G. Studer, *Über Eis und Schnee* (2nd ed. 3 vols., 1896–1899); and (E. Alps) G. Gröger and J. Rabl, *Die Entwickelung der Hochtouristik in den österreichischen Alpen* (1890), and E. Richter, *Die Erschliessung der Ostalpen* (3 vols., 1894). The detailed history of Mont Blanc has been written by Ch. Durier, *Le Mont Blanc* (1877, 4th ed., 1897), and C. E. Mathews, *The Annals of Mont Blanc* (1898). Lives of some of the most celebrated mountain guides have been written in C. D. Cunningham and W. de W. Abney, *Pioneers of the Alps* (2nd ed., 1888).

(2) *Maps.*—There is no good modern and fairly large-scale map of the entire chain of the Alps. But L. Ravenstein's maps (scale 1:250,000) of the Swiss Alps (2 sheets) and of the Eastern Alps (8 sheets) include the whole chain, save that portion south of the range of Mont Blanc.

All the countries which include Alpine districts have now issued official Government maps. The French map on a scale of 1:80,000 is clearer and more accurate than that on a scale of 1:100,000. The Italian Government has published maps on scales of 1:50,000 and 1:100,000 the Austrian on a scale of 1:75,000, and the Bavarian on a scale of 1:50,000. But the most splendid Government map of all is that put forth by the Swiss Federal Topographical Bureau, under the title of *Siegfried Atlas* (scale 1:50,000 for the Alpine districts), which has quite superseded the Dufour Map (scale 1:100,000), the history of which was published in 1896. For maps of the Swiss Alps and their neighbours, see J. H. Graf, *Literatur der Landesvermessung* (1896, with a supplement).

A few of the best special maps of certain districts may be mentioned—such as H. Duhamel's maps of the Dauphiné Alps (4 sheets on a scale of 1:100,000, 1889, 2nd ed., 1892), and that of the range of Mont Blanc (scale 1:50,000, 1896, 2nd ed., 1905), by X. Imfeld and L. Kurz. The German and Austrian Alpine Club is publishing a very fine set of maps (scale 1:50,000) of the Eastern Alps, which are clearer and better than the Austrian Government's *Topographische Detailkarten* (11 sheets, scale 1:50,000).

(W. A. B. C.)

10. *Geology.*—The Alps form but a small portion of a great zone of crumpling which stretches, in a series of curves, from the Atlas Mountains to the Himalayas. Within this zone the crust of the earth has been ridged up into a complex system of creases or folds, out of which the great mountain chains of southern Europe and Asia have been carved by atmospheric agencies. Superficially, the continuity of the zone is broken at intervals by gaps of greater or less extent; but these are due, in part at least, to the subsidence of portions of the folded belt and their subsequent burial by more recent accumulations. Such a gap is that between the Alps and the Carpathians, but a glance at a geological map of the region will show that the folding was probably at one time continuous. Leaving, however, the larger question of the connexion between the great mountain ranges of Europe and Asia, we find that the Alps are formed of a series of wrinkles or folds, one behind another, frequently arranged *en échelon*. The folds run, in general, in the direction of the chain, and together they form an arc around the plain of Lombardy and Piedmont. Outside this arc lies a depression along which the waters of the upper Danube and the lower Rhone find their way towards the sea; and beyond rise the ancient crystalline masses of Bohemia, the Black Forest and the central plateau of France, together with the intervening Mesozoic beds of southern Germany and the Jura. The depression is filled by Miocene and later beds, which for the most part lie flat and undisturbed as they were laid down. Beyond the depression also, excepting in the Jura Mountains, there is no sign of the folding which has raised the Alpine chain. Some of the older beds indeed are crumpled, but the folding is altogether different in age and in direction from that of the Alps.

To assist in forming a clear idea of the relations of the Alps to the surrounding regions, a simple illustration will suffice. Upon a table covered by a cloth lay two books in the relative positions shown in figure. The book A represents the central plateau of France and the book B represents the rocks of Bohemia and southern Germany. If the two hands be placed flat upon the table, in the angle between the two books, and the cloth pushed towards the corner, it will at once be rucked up into a fold which will follow a curve not unlike that of the Alps. The precise character and form of the folds produced will depend upon the nature of the cloth and other accidental circumstances; but with a little adjustment not only a representation of the chain of the Alps, but even a subsidiary fold in front in the position of the Jura Mountains may be obtained. Imperfect though this illustration may be, it will serve to explain the modern conception of the forces concerned in the formation of the Alps. Within the crust of the earth, whether by the contraction of the interior or in any other way, tangential pressures were set up. Since the crust is not of uniform strength throughout, only the weaker portions yielded to the pressure; and these were crumpled up against the more resisting portions and sometimes were pushed over them. In the case of the Alps it seems natural enough that the crystalline masses of Bohemia, the Black Forest and the central plateau of France should be firmer than the more modern sedimentary deposits; but it is not so easy to understand why the Mesozoic rocks of southern Germany resisted the folding, while those of the Jura yielded. It should, however, be borne in mind that the resisting mass is not necessarily at the surface. Such is in outline the process by which the Alps were elevated; but when the chain is examined in detail, it is found that its history has not been uniform throughout; and it will be convenient, for purposes of description, to divide it into three portions, which may be called the Eastern Alps, the Swiss Alps, and the Western Alps.

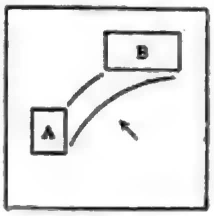


FIG. 1.—Looking down on the table.

Eastern Alps.

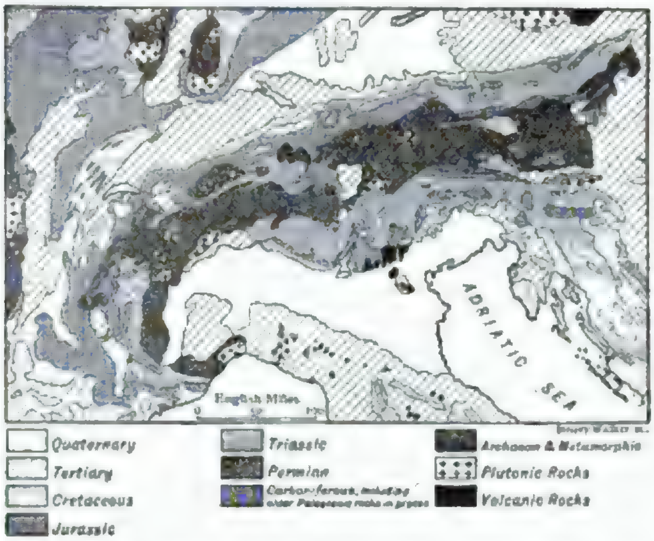
The Eastern Alps consist of a central mass of crystalline and schistose rocks flanked on each side by a zone of Mesozoic beds and on the north by an outer band of Tertiary deposits. On the Italian side there is usually no zone of folded Tertiaries and the Mesozoic band forms the southern border of the chain. Each of these zones is folded within itself, and the folding is more intense on the Bavarian side than on the Italian, the folds often leaning over towards the north. The Tertiary zone of the northern border is of especial significance and is remarkable for its extent and uniformity. It is divided longitudinally into an outer zone of *Molasse* and an inner zone of *Flysch*. The line of separation is very clearly defined; nowhere does the Molasse pass beyond it to the south and nowhere does the Flysch extend beyond it to the north. The Molasse, in the neighbourhood of the mountains, consists chiefly of conglomerates and sandstones, and the Flysch consists of sandstones and shales; but the Molasse is of Miocene and Oligocene age, while the Flysch is mainly Eocene. The relations of the two series are never normal. Along the line of contact, which is often a fault, the oldest beds of the Molasse crop out, and they are invariably overturned and plunge beneath the Flysch. A few miles farther north these same beds rise again to the surface at the summit of an anticlinal which runs parallel to the chain. Beyond this point all signs of folding gradually cease and the beds lie flat and undisturbed.

The Flysch is an extraordinarily thick and uniform mass of sandstones and shales with scarcely any fossils excepting fucoids. It is intensely folded and is constantly separated from the Mesozoic zone by a fault. Throughout the whole extent of the Eastern Alps it is strictly limited to the belt between this fault and the marginal zone of Molasse. Eocene beds, indeed, penetrate farther within the chain, but these are limestones with nummulites or lignite-bearing shales and have nothing in common with the Flysch. But although the Flysch is so uniform in character, and although it forms so well-defined a zone, it is not everywhere of the same age. In the west it seems to be entirely Eocene, but towards the east intercalated beds with *Inoceramus*, &c., indicate that it is partly of Cretaceous age. It is, in fact, a facies and nothing more. The most probable explanation is that the Flysch consists of the detritus washed down from the hills upon the flanks of which it was formed. It bears, indeed, very much the same relation to the Alps that the Siwalik beds of India bear to the Himalayas.

The Mesozoic belt of the Bavarian and Austrian Alps consists mainly of the Trias, Jurassic and Cretaceous beds playing a comparatively subordinate part. But between the Trias of the Eastern Alps and the Trias of the region beyond the Alpine folds there is a striking contrast. North of the Danube, in Germany as in England, red sandstones, shales and conglomerates predominate, together with beds of gypsum and salt. It was a continental formation, such as is now being formed within the desert belt of the globe. Only the Muschelkalk, which does not reach so far as England, and the uppermost beds, the Rhaetic, contain fossils in any abundance. The Trias of the Eastern Alps, on the other hand, consists chiefly of great masses of limestone with an abundant fauna, and is clearly of marine origin. The Jurassic and Cretaceous beds also differ, though in a less degree, from those of northern Europe. They consist largely of limestone; but marls and sandstones are by no means rare, and there are considerable gaps in the succession indicating that the region was not continuously beneath the sea. Tithonian fossils, characteristic of southern Europe, occur in the upper Jurassic, while the Gosau beds, belonging to the upper Cretaceous, contain many of the forms of the Hippuritic sea. Nevertheless, the difference between the deposits on the two sides of the chain shows that the central ridge was dry land during at least a part of the period.

The central zone of crystalline rock consists chiefly of gneisses and schists, but folded within it is a band of Palaeozoic rocks which divides it longitudinally into two parts. Palaeozoic beds also occur along the northern and southern margins of the crystalline zone. The age of a great part of the Palaeozoic belts is somewhat uncertain, but Permian, Carboniferous, Devonian and Silurian fossils have been found in various parts of the chain, and it is not unlikely that even the Cambrian may be represented.

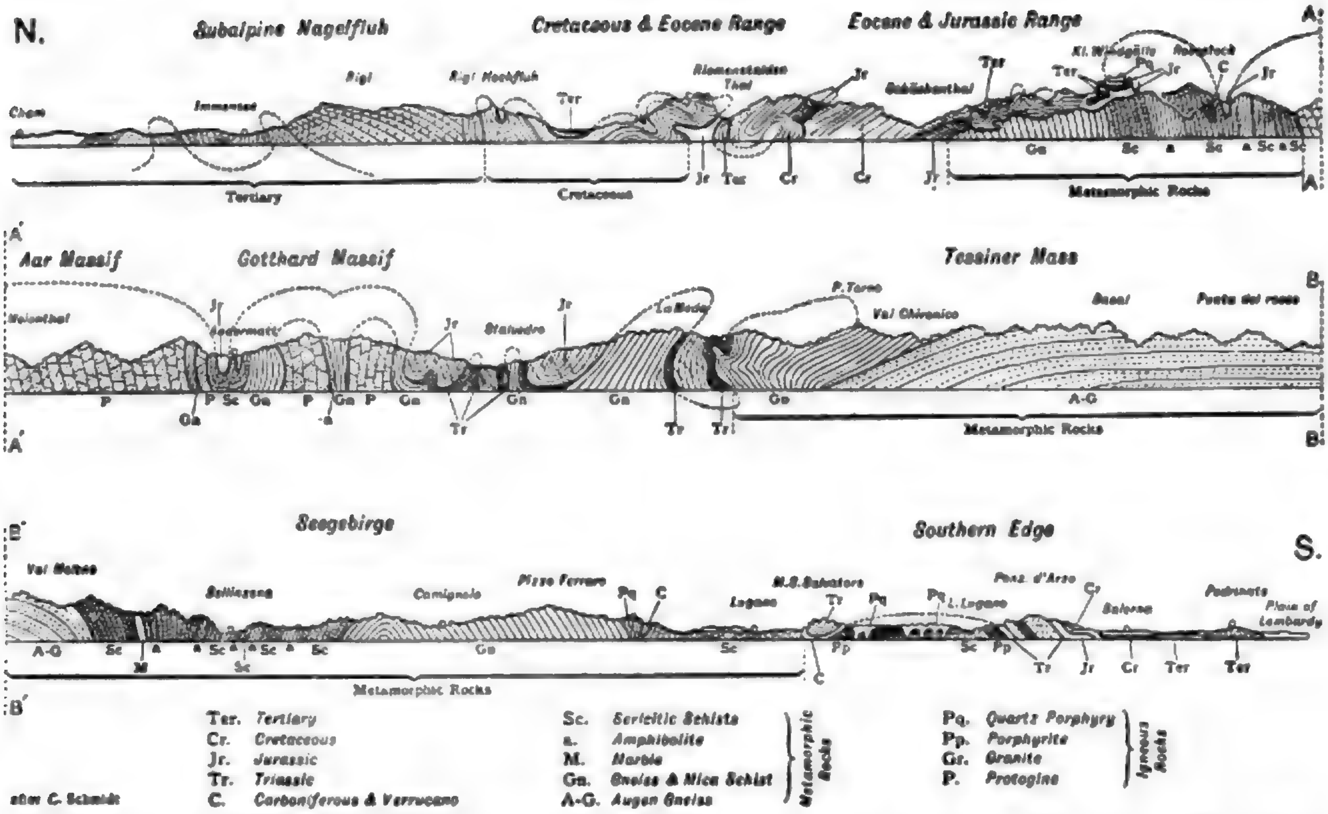
The Mesozoic belt of the southern border of the chain extends from Lago Maggiore eastwards. Jurassic and Cretaceous beds play a larger part than on the northern border, but the Trias still predominates. On the west the belt is narrow, but towards the east it gradually widens, and north of Lago di Garda its northern boundary is suddenly deflected to the north and the zone spreads out so as to include the whole of the Dolomite mountains of Tirol. The sudden widening is due to the great Judicaria fault, which runs from Lago d'Idro to the neighbourhood of Meran, where it bends round to the east. The throw of this fault may be as much as 2000 metres, and the drop is on its south-east side, *i.e.* towards the Adriatic. It is probable, indeed, that the fault took a large share in the formation of the Adriatic depression. On the whole, the Mesozoic beds of the southern border of the Alps points to a deeper and less troubled sea than those of the north. Clastic sediments are less abundant and there are fewer breaks in the succession. The folding, moreover, is less intense; but in the Dolomites of Tirol there are great outbursts of igneous rock, and faulting has occurred on an extensive scale.



Swiss Alps.

West of a line which runs from Lake Constance to Lago Maggiore the zones already described do not continue with the same simplicity. The zone of the Molasse is little changed, but the Flysch is partly folded in the Mesozoic belt and no longer forms an absolutely independent band. The Trias has almost disappeared, and what remains is not of the marine type characteristic of the Eastern Alps but belongs rather to the continental facies which occurs in Germany and France. Jurassic and Cretaceous beds form the greater part of the Mesozoic band. On the southern side of the chain the Mesozoic zone disappears entirely a little west of Lago Maggiore and the crystalline rocks rise directly from the plain.

Perhaps the strangest problem in the whole of Switzerland is that presented by the so-called *Klippen*. Within the Alps, when normally developed, we may trace the individual folds for long distances and observe how they arise, increase and die out, to be replaced by others of similar direction. But at times, within or on the border of the northern Eocene trough, the continuity of the folds is suddenly broken by mountain masses of quite different constitution. These are the Klippen, and they are especially important in the Chablais and between the Lakes of Geneva and Thun. Not only is the folding of the Klippen wholly independent of that of the zone in which they lie, but the rocks which form them are of foreign facies. They consist chiefly of Jurassic and Triassic beds, but it is the Trias and the Jura of the Eastern Alps and not of Switzerland. Moreover, although they interrupt the folding of the zone in which they occur, they do not disturb it: they do not, in fact, rise through the zone, but lie upon it like unconformable masses—in other words, they rest upon a thrust-plane. Whence they have come into their present position is by no means clear; but the character of the beds which form them indicates a distant origin. It is interesting to note, in this


N.
Subalpine Nagelfluh
Cretaceous & Eocene Range
Eocene & Jurassic Range
Cham
Immensee
Rigi
Rigi Hochfluh
Ter
Riemenstalden Thal
Jr
Schächenthal
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Kl. Windgälle
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Stalvedro
Jr
La Moda
P. Torno
Val Chironico
Basal
Punta del rosso
P
Gn
P
Sc
Gn
P
Ga
P
Gn
a
Tr
Gn
Gn
Tr
Tr
Gn
A-G
Metamorphic Rocks
B
B'
Seegebirge
Southern Edge
S.
Val Molena
Bellinzona
Camignolo
Pizzo Ferraro
Pq
C
Lugano
M. S. Salvatore
Tr
Pq
Pq
L. Lugano
Poaz. d'Arzo
Cr
Balerna
Pedrinate
Plain of Lombardy
A-G
Sc
M
a
a
Sc
Sc
a
Sc
a
Sc
Gn
Sc
C
Pp
Sc
Pp
Tr
Jr
Cr
Ter
Ter
Metamorphic Rocks
Ter. Tertiary
Cr. Cretaceous
Jr. Jurassic
Tr. Triassic
C. Carboniferous & Verrucano
Sc. Sericitic Schists
a. Amphibolite
M. Marble
Gn. Gneiss & Mica Schist
A-G. Augen Gneiss
Metamorphic Rocks
Pq. Quartz Porphyry
Pp. Porphyrite
Gr. Granite
P. Protogine
Igneous Rocks

after C. Schmidt

connexion, that the pebbles of the Swiss Molasse are not generally such as would be derived from the neighbouring mountains, but resemble the rocks of the Eastern Alps. The Klippen are, no doubt, the remains of a much larger mass brought into the region upon a thrust-plane, and much of the Molasse has been derived from its destruction. Although the explanation here given of the origin of the Swiss Klippen is that which now is usually accepted, it should be mentioned that other theories have been proposed to account for their peculiarities.

Western Alps.

In the Western Alps the outer border of Molasse persists; but it no longer forms so well-defined a zone, and strips are infolded amongst the older rocks. The Eocene has altogether lost its independence as a band and occurs only in patches within the Mesozoic zone. The latter, on the other hand, assumes a greater importance and forms nearly the whole of the subalpine ranges. It consists almost entirely of Jurassic and Cretaceous beds, the Trias in these outer ranges being of very limited extent. The main chain is formed chiefly of crystalline and schistose rocks, which on the Italian side rise directly from the plain without any intervening zone of Mesozoic beds. But it is divided longitudinally by a well-marked belt of stratified deposits, known as the zone of the Briançonnais, composed chiefly of Carboniferous, Triassic and Jurassic beds. The origin of the schistose rocks has long been under discussion, and controversy has centred more particularly around the *schistes lustrés*, which are held by some to be of Triassic age and by others to be pre-Carboniferous and even, perhaps, Archaean. Partly in consequence of the uncertainty as to the age of these and other rocks, there is considerable difference of opinion as to the structure of the Western Alps. According to the view most widely accepted in France the main chain as a whole forms a fan, the folds on the eastern side leaning towards Italy and those on the western side towards France. The zone of the Briançonnais lies in the middle of the fan.

Asymmetry of the Alps.

From the above account it will at once appear that between the convex and the concave margins of the Alpine chain there is a striking difference. Upon the outer side of the arc the central zone of crystalline rocks is flanked by Mesozoic and Tertiary belts; towards the west, indeed, the individuality of these belts is lost, to a large extent, but the rocks remain. Upon the inner side the Tertiary band is found only in the eastern part of the chain, while towards the west, first the Tertiary and then the Mesozoic band disappears against the modern deposits of the low land. The appearance is strongly suggestive of faulting; and probably the southern margin of the chain lies buried beneath the plain of northern Italy.

Age of the Alps.

The chain of the Alps was not raised by a single movement nor in a single geological period. Its growth was gradual and has not been uniform throughout. In the Eastern Alps the central ridge seems to have been in existence at least as early as Triassic times, but it has since been subject to several oscillations. The most conspicuous folding, that of the Mesozoic and Tertiary belts, must have occurred in Tertiary times, and it was not completed till the Miocene period. The structure of the zones in the Bavarian Alps seems to suggest that the chain grew outwards in successive stages, each stage being marked by the formation of a boundary fault. A precisely similar structure is seen in the Himalayas.

AUTHORITIES.—The literature is very extensive. The following list includes a few selected works on each portion of the chain:—F. Frech, "Die karnischen Alpen," *Abh. naturf. Ges. Halle*, vol. xviii. (1892 and 1894); A. Rothpletz, *Ein geologischer Querschnitt durch die Ost-Alpen* (Stuttgart, 1894); C. Diener, "Bau und Bild der Ostalpen und des Karstgebietes," in *Bau und Bild Osterreichs* (Vienna and Leipzig, 1903); *Livret-guide géologique dans le Jura et les Alpes de la Suisse* (Paris and Lausanne, 1894); A. Heim, *Mechanismus der Gebirgsbildung* (Basel, 1878); D. Zaccagna, "Riassunto di osservazioni geologiche fatte sul versante occidentale delle Alpi Graie," *Boll. R. Com. Geol. Ital.* vol. xxiii. (1892), pp. 175-244; C. Diener, *Der Gebirgsbau der West-Alpen* (1894); M. Bertrand, "Études dans les Alpes françaises," *Bull. Soc. Géol. France*, ser. 3, vol. xxii (1894), pp. 69-162; S. Franchi, "Sull' età mesozoica della zona delle pietri verdi nelle Alpi Occidentali," *Boll. R. Geol. Ital.* vol. xxix. (1898), pp. 173-247, 325-482, pts. v.-ix. For the broader question of the relation of the Alps to other regions, E. Suess, *Das Antlitz der Erde* (Vienna, 1885) (English translation, Oxford, 1904) should be consulted. The *Geologischer Führer durch die Alpen*, published by Borntraeger, Berlin, are handy guides. (P. La.)

11. *Flora.*—The Alps owe the richness and beauty of their plant life partly to their position as the natural boundary between the

"Baltic" flora on the north and the "Mediterranean" flora on the south, but chiefly to the presence on their heights of a third flora which has but little in common with either of the others. The stronghold of this last, the distinctively "Alpine" flora, is the region above the tree-limit. Its closest relationship is with the flora of the Pyrenees; but an alpine flora is characteristic of all the lofty mountains of central Europe. According to J. Ball, 2010 well-marked species of flowering plants occur within the limits of the Alps. If now we confine our attention to the alpine and higher regions of the Alps and exclude from our list all those plants which, however abundant in these regions, are not less so in the adjacent lowlands, we have left some 700 species (693, according to Dr Christ). We must observe, as regards the plants of the lower alpine region, that it is the actual presence of a forest vegetation, rather than the theoretical tree-limit, which affects their vertical distribution; so that, *e.g.* they overflow into the extensive clearings made by man in the primeval mountain forests. Indeed, an analysis of the composition of the alpine flora as a whole leads to the conclusion that the chief bond of union between its members consists in the treeless character of their habitat.

We may broadly distinguish two main geographical elements in the alpine flora, namely, the northern element and the endemic element. This division (which is not, however, strictly exhaustive) directs special attention to what is undoubtedly the most striking feature of the flora—namely, that of its 693 species no less than 271 reappear in the extreme north. This relation of the arctic to the alpine flora is all the more remarkable in view of the very important differences between the arctic and alpine climates. The following circumpolar species are common, and widely diffused throughout the whole of the Alps: *Silene acaulis, Dryas octopetala, Saxifraga oppositifolia, S. aizoides, S. stellaris, Erigeron alpinus, Azalea procumbens, Myosotis alpestris, Polygonum viviparum, Salix retusa, S. herbacea, Phleum alpinum, Juniperus nana.* The proportion of northern forms, as regards both species and individuals, increases as we ascend to the higher regions. In the highest vegetation-zone, the snow-region—*i.e.* on islands of rock above the snow-line—they attain to an equality with the endemic forms. As examples of northern flowers which are characteristic of the snow-region, we may mention *Silene acaulis, Eritrichium nanum* and *Arenaria ciliata*. On the other hand, typical endemic species of this highest zone are *Androsace helvetica, A. glacialis, Petrocallis pyrenaica* and *Cherleria sedoides*. All the plants just named, we may observe, are "cushion-plants." Their compact, moss-like growth and general structural peculiarities are not an expression of mutual affinity, but are in adaptation to the combined cold and dryness of their habitat. It is noteworthy that among the northern plants of the alpine zone, in the narrower sense of the term (*i.e.* of the region between the tree-limit and the snow-line), there is a marked predominance of species that affect moist localities; and conversely, the majority of alpine flowers of wet habitat are found also in the north. For example, in the genus *Primula*, a highly characteristic genus of the alpine flora, whose members are among the most striking ornaments of the rocks, the single northern species, *P. farinosa*, grows only in marshy meadows. On the whole, then, adaptation to cold and wet is the note of the northern element.

As for the explanation of the community between the alpine and arctic floras, all authorities are agreed that the key to the problem is furnished by the occurrence of the glacial period. In the ice-free belt, between the northern ice-sheet and the vastly extended glaciers of the Alps, the two floras must have found a common refuge and congenial conditions of existence; and this view is confirmed by direct palaeontological evidence. With the return of a milder climate, the so-called northern forms of the present alpine flora were split in two, one portion following close on the northern ice in its gradual retreat to the Arctic, the other following the shrinking glaciers till the plants were able to establish (or re-establish) themselves on the slopes of the Alps. The same explanation covers the case of the similarity of the flora (not merely as regards the northern element) on all the high mountains of central Europe. So much seems to be beyond reasonable doubt. But at this point disagreement begins between the most eminent writers on the subject. While some (*e.g.* Sir J. D. Hooker, Heer) regard the Arctic, and some (*e.g.* Wettstein) the Alps, as the original home of at least the bulk of the "northern" element, others (*e.g.* Ball, Christ) locate this in the highlands of temperate Asia. For it is a remarkable fact that, of the 230 northern species which are most typical of the far north, 182 are found also in the Altai (taking this as a collective name for the mountains that form the southern boundary of Siberia). In any case, however, the migration of these plants to the Alps must for the most part have taken place *via* the Arctic. The possibility of any extensive east to west migration having taken place direct from the Altai to the Alps seems excluded by the fact that 50% of the arctico-altaic alpine plants are absent from the Caucasus. A score of species, it is true—not such a number, be it observed, as was formerly supposed—are common to the Alps and Altai, but absent from the Arctic. But the species composing this Altaic element are not so numerous as the arctico-alpine species that are absent from the Altai. On the whole, a common origin in the north for at least the arctico-altaic group of alpine plants seems to be the most reasonable hypothesis.

Side by side with the northern element (which in some respects, we may observe to point the contrast, would be better named the tundra-element) we find a group of species usually spoken of as the xerothermic or meridional element. These do not, however, form an "element," in the strict geographical sense in which this term is otherwise used here. They are those species which, on general phyto-geographical grounds, must be regarded as having originated under steppe-like conditions. Their affinities are chiefly, though not exclusively, with the present Mediterranean flora—about fifty are of presumably Mediterranean origin—and a large proportion of them are restricted to the southern slopes of the Alps. The following, however, among others, are distributed throughout the whole, or a great part, of the range: *Colchicum alpinum, Crocus vernus, Orchis globosa, Petrocallis pyrenaica, Astragalus depressus, A. aristatus, Oxytropis Halleri, Eryngium alpinum, Erica carnea, Linaria alpina, Globularia nudicaulis, G. cordifolia, Leontopodium alpinum.* The last named (the well-known "edelweiss") is at the present day characteristic of the Siberian steppes. The presence of these plants among the alpine flora is traceable to the steppe-like conditions which prevailed in central Europe both during the warmer inter-glacial periods and (probably) for a time after the close of the ice-age. Subsequently, as the climate of the plains assumed a colder and more humid character, they retired before the invading forests to the high mountains. Here, in the intenser insolation which they enjoy on the alpine slopes, they seem to find a compensation for the drawbacks incidental to the altitude of their present station.

As regards now the endemic element as a whole, the question as to the time and place of its origin is of a highly complicated and controversial nature. The question, too, in the case of this element, is necessarily of genetic rather than purely geographical scope. It must suffice to say that the weight of scientific opinion inclines to the view that at least the majority of endemic species are of pre-glacial origin, and are either strictly indigenous or products of the neighbouring lowlands. About 40% of the endemic element in the alpine flora are endemic also in the narrower sense, *i.e.* they are confined to the Alps. Many of them are restricted to some one small portion of the chain; these occur chiefly in the southern and eastern Alps. It is an interesting fact that the centrally situated Bernese Alps produce hardly a single peculiar species. The greater richness of certain districts in the matter of species is partly due to the variety of soils encountered therein; but in part may be explained by the fact that these districts were the first to be freed from the ice-sheet at the end of the glacial period.

The following is a list of the most thoroughly characteristic alpine plants—all of them *ipso facto* members of the endemic element—which are at once peculiar to the Alps (or practically so) and widely distributed within the limits of the chain. These are: *Festuca pulchella*, *Carex microstyla*, *Salix caesia*, *Rumex nivalis*, *Alsine aretioides*, *Aquilegia alpina*, *Thlaspi rotundifolium*, *Saxifraga Seguieri*, *S. aphylla*, *Astragalus leontinus*, *Daphne striata*, *Eryngium alpinum*, *Bupleurum stellatum*, *Androsace helvetica*, *A. glacialis*, *Gentiana bavarica*, *Phyteuma humile*, *Campanula thyrsoidea*, *C. cenisia*, *Achillea atrata*, *Cirsium spinosissimum*, *Crepis Terglouensis*.

Authorities.—Among the voluminous literature on alpine flora, the following works are particularly noteworthy:—Ball, "On the Origin of the Flora of the European Alps," in *Proceed. of the Roy. Geog. Soc.*, 1879; Bennett, *The Flora of the Alps*, 2 vols. with 120 coloured plates (1896); Briquet, "Les Colonies végétales xérothermiques des alpes lémaniennes," in *Bull. d. l. Murithienne, soc. valaisienne des sciences nat.*, xxvii. and xxviii. (1898–1899); Alph. de Candolle, "Sur les causes de l'inégale distribution des plantes rares dans la chaine des Alpes," *Extr. des Actes du Congrès botan. internat. de Florence* (1875); Chodat u. Pampanini, "Sur la distribution des plantes des alpes austro-orientales," *Extr. du Globe, organe de la soc. de géographie de Genève*, tome xli. (1902); H. Christ, *Das Pflanzenleben der Schweis* (1882)—the chief classic on the subject; Engler, *Die Pflanzenformationen und die pflanzengeographische Gliederung der Alpenkette* (1901); Heer, *Ueber die nivale Flora der Schweis* (1885); Jerosch, *Geschichte und Herkunft der schweizerischen Alpenflora; eine Übersicht über den gegenwärtigen Stand der Frage* (1903); Schröter, *Das Pflanzenleben der Alpen* (Zürich, 1908); R. von Wettstein, *Die Geschichte unserer Alpenflora* (1896). The best book of coloured plates is the *Atlas der Alpenflora*, in 5 vols., pub. by the Deutscher u. Oesterreichischer Alpenverein (2nd. ed., 1897).

12. *Fauna.*— The fauna of the lower zones in the Alps is, on the northern side of the chain, practically identical with that of central Europe, and on the southern side with that of the Mediterranean basin. But in the higher regions it presents many features of special interest alike to the zoologist and the traveller. It seems therefore best to treat here principally of the animal inhabitants of the high Alps.

Though among mammalia— as also in the case of the birds—there are but few forms peculiar to the Alps, many interesting animals have found in the high mountains at least a temporary refuge from man. The European bison, the urus, the elk and the wild swine have disappeared since Roman times. But the lynx (*Lynx vulgaris*) perhaps lingers in remote parts, and the brown bear (*Ursus arctos*) still survives in the dense forests of the Lower Engadine. The fox (*Canis vulpes*), the stonemarten (*Martes foina*) and the stoat or ermine (*Putorius erminea*) range in summer above the tree-limit. The Ungulata are represented by the chamois (*Rupicapra tragus*) and the bouquetin or steinbock (*Capra ibex*). The former—the sole representative, in western Europe, of the antelopes—is found elsewhere only in the Pyrenees, Carpathians, Caucasus and the mountains of eastern Turkey; the latter survives only in the eastern Graian Alps. Of the Rodentia the most interesting and conspicuous is the marmot (*Arctomys marmota*), which lives in colonies close to the snow-line. The snow-mouse (*Arvicola nivalis*) is confined to the alpine and snow regions, and is abundant at these levels throughout the whole chain of the Alps. The mountain hare (*Lepus variabilis* or *timidus*) replaces the common hare (*Lepus europaeus*) in the higher regions; though absent from the intervening plains it again appears in the north of Europe and in Scotland. Among the Insectivora, the alpine shrew (*Sorex alpinus*) is restricted to the Alps. Of the Cheiroptera (bats) only *Vesperugo maurus* is characteristically alpine.

The birds of the Alps are proportionately very numerous. The lammergeyer (*Gypaetus barbatus*), once common, is now extremely rare, even if it has not already become extinct in the Alps; but the golden eagle (*Aquila chrysaetos*) still holds its own. Some of the smaller birds of prey are not uncommon, but there is none that can be regarded as specially characteristic either of the Alps as a whole or of the alpine region. As characteristic birds of the snow-region may be mentioned the alpine chough (*Pyrrhocorax alpinus*), which is frequently seen at the summits even of the loftiest mountains, the alpine swift (*Cypselus melba*), the wall-creeper (*Tichodroma muraria*), snow-finch (*Montifringilla nivalis*) and ptarmigan (*Lagopus mutus*); the geographical distribution of this last being similar to that of the mountain hare. The black redstart (*Ruticilla titys*), though common in the lower regions, is also met with in fair numbers almost up to the snow-line. The raven (*Corvus corax*) is fairly common in the alpine and sub-alpine regions. On the highest pastures we find, further, the alpine accentor (*Accentor collaris*) and the alpine pipit (*Anthus spipoletta*). The crag-martin (*Cotyle rupestris*) haunts lofty cliffs in the alpine region. On the upper verge of the pine forests, or in the scrubby vegetation just beyond, the following are not uncommon—black woodpecker (*Picus martius*), ring-ousel (*Turdus torquatus*), Bonelli's warbler (*Phylloscopus Bonellii*), crested tit (*Parus cristatus*), citril finch (*Citrinella alpina*), siskin (*Chrysomitris spinus*), crossbill (*Loxia curvirostra*), nutcracker (*Nucifraga caryocatactes*), blackcock (*Tetrao tetrix*), and the alpine varieties of the marsh-tit (*Parus palustris, borealis*) and tree-creeper (*Certhia familiaris, costae*).

The remaining classes of Vertebrata are very sparsely represented in the high Alps; and what few species occur are mostly common to the plains as well. In fact, among the remaining land vertebrates, only the black salamander (*Salamandra atra*) is exclusively alpine. This interesting animal, though a member of the Amphibia, is terrestrial and viviparous.

The former connexion between the Arctic and the Alps, which has left such unmistakable traces in the present alpine flora, affords, as regards the fauna also, the only possible explanation of the present geographical distribution of many alpine forms; but it is chiefly among the Invertebrata that we find this collateral testimony to the influence of the glacial period. In this respect we may note that two small crustaceans, *Diaptomus bacillifer* and *D. denticornis*, swarm in the ice-cold waters of the highest alpine tarns throughout the entire chain; and the former of these is also a characteristic inhabitant of pools formed from melting snow in the extreme north. Among the remaining divisions of Invertebrata special mention may be made of the air-breathing Arthropoda—on the whole the most important and interesting group. About one-third of the animals belonging thereto that occur in the higher regions are exclusively alpine (or alpine and northern); these characteristically alpine forms being furnished chiefly by the spiders, beetles and butterflies. Most numerous are the beetles. Those of the highest zone are remarkable for the great predominance of predaceous species and of wingless forms. In this last respect they present a striking analogy with the endemic coleopterous fauna of oceanic islands. As for the butterflies, not more than one-third of the species found in the alpine region occur in the neighbouring lowlands. The relations between alpine butterflies and plants are especially interesting, as regards not only their bionomic interdependence but also the analogies of their geographical distribution. It should be noted that butterflies are the chief agents in securing the continued existence of such alpine flowers as depend on insect fertilization, the other insect fertilizers being mostly wanting at great heights.

The classic of alpine zoology is F. von Tschudi's *Das Tierleben der Alpenwelt* (11th ed., 1890). See also zoological section, by K. W. v. Dalla Torre, of *Anleitung zu wissenschaftlichen Beobachtungen auf Alpenreisen*. For the Vertebrata, see V. Fatio's *Faune des vertébrés de la Suisse* (5 vols., 1869–1904). *Die Tierwelt der Hochgebirgsseen*, by F. Zschokke (1900) is an important treatise on an interesting department of alpine natural history. C. Zeller's *Alpentiere im Wechsel der Zeit* (1892) gives a reliable account of the gradual disappearance of some of the larger forms of life from the Alps. For the inter-relations of alpine insects and flowers, see H. Müller's *Alpenblumen, ihre Befruchtung durch Insekten, und ihre Anpassung an dieselben* (1881). (H. V. K.)

ALPUJARRAS, or Alpuxarras, **THE** (Moorish *al Busherat*, "the grass-land"), a mountainous district of southern Spain, in the province of Granada, consisting principally of valleys which descend at right angles from the crest of the Sierra Nevada on the north, to the Sierras Almijara, Contraviesa and Gádor, which sever it from the Mediterranean Sea, on the south. These valleys are among the most beautiful and fertile in Spain. They contain a rich abundance of fruit trees, especially vines, oranges, lemons and figs, and in some parts present scenes of almost Alpine grandeur. The inhabitants are the descendants of the Moors, who, after the Spanish conquest of Granada in 1492, vainly sought to preserve the last relics of their independence in their mountain fastnesses. Many of the names of places in the

Alpujarras are of Moorish origin. The district contains many villages of 1000 to 4000 inhabitants, the four largest being Lanjaron, with its ruined castle and chalybeate baths, Orgiba, Trevelez and Ugijar; all situated at a considerable elevation. Trevelez, the highest, stands 5332 ft. above the sea.

'ALQAMA IBN 'ABADA, generally known as 'ALQAMA AL-FAHL, an Arabian poet of the tribe Tamim, who flourished in the second half of the 6th century. Of his life we know practically nothing except that his chief poem concerns an incident in the wars between the Lakhmids and the Ghassānids (see ARABIA, *History*). Even the date of this is doubtful, but it is generally referred to the period after the middle of the 6th century. His poetic description of ostriches is said to have been famous among the Arabs. His diwān consists of three qasidas (elegies) and eleven fragments. Asma' I considered three of the poems genuine.

The poems were edited by A. Socin with Latin translation as *Die Gedichte des 'Alkama Alfahl* (Leipzig, 1867), and are contained in W. Ahlwardt's *The Diwans of the six ancient Arabic Poets* (Lond., 1870); cf. W. Ahlwardt's *Bemerkungen über die Aechtheit der alten arabischen Gedichte* (Greifswald, 1872), pp. 65-71 and 146-168. (G. W. T.)

ALQUIFOU (etymologically the same word as "alcohol"), a lead ore found in Cornwall, used by potters for its green glaze.

ALREDUS, ALURED or ALUREDUS, **OF BEVERLEY,** was sacristan of the church of Beverley in the first half of the 12th century. He wrote, apparently about the year 1143, a chronicle entitled *Annales sive Historia de gestis regum Britanniae*, which begins with Brutus and carries the history of England down to 1129. This work was edited by T. Hearne (Oxford, 1716), and at one time enjoyed some reputation as an authority. It is, however, a mere compilation and of no value. Geoffrey of Monmouth and Simeon of Durham are Alured's chief sources. Among the Cottonian MSS. there is a collection of records relating to Beverley, *Libertates Ecclesiae S. Johannis de Beverlae*, which is attributed to Alured, but on no good authority. (H. W. C. D.)

ALSACE (Ger. *Elsass*), a former province of France, divided after the Revolution into the departments of Haut-Rhin and Bas-Rhin, and incorporated since the war of 1870 with the German empire (see ALSACE-LORRAINE). It is bounded on the north by the Rhenish Palatinate, on the east by the Rhine, on the south by Switzerland and on the west by the Vosges Mountains; and it comprises an area of 3344 English sq. m. The district possesses many natural attractions, and is one of the most fertile in central Europe. There are several ranges of hills, but no point within the province attains a great elevation. The only river of importance is the Ill, which falls into the Rhine after a course of more than 100 m., and is navigable below Colmar. The hills are generally richly wooded, chiefly with fir, beech and oak. The agricultural products are corn, flax, tobacco, grapes and various other fruits. The country has a great wealth of minerals, silver having been found, and copper, lead, iron, coal and rock-salt being wrought with profit. There are considerable manufactures, chiefly of cotton and linen. The chief towns are Mülhausen and Colmar in the upper district and Strassburg in the lower. The province is traversed from east to west by the railway from Strassburg to Nancy, and the main line north and south runs between Basel and Strassburg.

History.—From a very early period Alsace has been a disputed territory, and has suffered in the contentions of rival races. Inhabited by the Rauraci and the Sequani, it formed part of ancient Gaul, and was therefore included in the Roman empire in the provinces of Germania Superior and Maxima Sequanorum. The Romans held it nearly five hundred years, and on the dissolution of their power it passed under the sway of the Franks. In the Merovingian period it formed a duchy attached to the kingdom of Austrasia, and was governed by the descendants of duke Eticho, one of whom was St Odilia. After the death of Charlemagne, Alsace, like the rest of the empire, was divided into countships. But the duchy was re-established after the death of the German king Henry I., and became hereditary in the Hohenstaufen family, and then in the house of Austria, which succeeded in 1273 to the imperial dignity. In the beginning of the 12th century the country was divided between the two landgraviates of Upper and Lower Alsace, but to counteract the power of the nobles the emperors established in Alsace a great number of free towns. This state of things continued until 1648, when a large part of Alsace, comprising the two landgraviates of Upper and Lower Alsace and the prefecture of the ten free imperial towns, was ceded to France by the treaty of Westphalia. In the war which preceded this peace (generally known as the Thirty Years' War) Alsace had been so terribly devastated by the Swedes and the French that the German emperor found himself unable to hold it. The population was greatly reduced in numbers, and much of the land was left uncultivated. In the war between France and the Empire, arising out of the attempt of Louis XIV. to seize Holland, that part of Alsace which remained to Germany was again overrun by the French. Although this war was terminated in 1678 by the treaty of Nijmwegen, the French monarch was desirous of incorporating a still larger amount of Rhine territory; and accordingly in 1680 he laid claim to a number of territories, belonging to princes of the Empire, which he alleged had been dismembered from Alsace. It was ordered that these territories should be at once restored to that province under the crown of France, and several independent sovereigns were cited to appear before two chambers of inquiry, called *chambres de réunion*, which Louis had established at Brisach and Metz. The princes appealed to the emperor and to the diet; but the previous wars had so exhausted the power of the former that nothing could be done to resist the aggression. In 1681 the French troops under Louvois seized Strassburg, aided by the treachery of the bishop and other great men of the city. A further war broke out, but by the treaty of Ratisbon (Regensburg) in 1684, Strassburg was secured to France. The war was renewed in 1688 and continued until 1697, when the peace of Ryswick confirmed definitively the annexation of Strassburg to France. Some remaining territories of small extent were acquired by the French after the revolution of 1789, including Mülhausen, which had been a republic allied to Switzerland.

Originally Celtic, the population was modified during the Roman period by the arrival of a Germanic people, the Triboci. In the 5th century came other German tribes, the Alamanni, and then the Franks, who drove the Alamanni into the south. Since that period the population has in the main been Teutonic; and the French conquests of the 17th century, while modifying this element, still left it predominant. The people continued to use a German dialect as their native tongue, though the educated classes also spoke French. Protestantism was professed by a large number of the inhabitants; and in many respects their characteristics identified them rather with the race to the east than that to the west of the Rhine. In process of time, however, they considered themselves French, and lost all desire for reannexation to any of the German states.

Alsace suffered a good deal in the war of 1870–71. The earlier battles of the campaign were fought there; Strassburg and other of its fortified towns were besieged and taken; and its people were compelled to submit to very severe exactions. The civil and military government of the province, as well as that of Lorraine, was assumed by the Germans as soon as they obtained possession of those parts of France, which was very shortly after the commencement of the war. The Alsatian railways were reorganized and provided with a staff of German officials. German stamps were introduced from Berlin; the occupied towns were garrisoned by the *Landwehr*; and requisitions on a large scale were demanded, and paid for in cheques which, at the close of the war, were to be honoured by whichever side should stand in the unpleasant position of the conquered. The people, notwithstanding their German origin, showed a very strong feeling against the invaders, and in no part of France was the enemy resisted with greater stubbornness. It was evident from an early period of the war, however, that Prussia was resolved to reannex Alsace to German territory. When the preliminaries of peace came to be discussed at Versailles in

February 1871, the cession of Alsace, together with what is called German Lorraine, was one of the earliest conditions laid down by Bismarck and accepted by Thiers. This sacrifice of territory was afterwards ratified by the National Assembly at Bordeaux, though not without a protest from the representatives of the departments about to be given up; and thus Alsace once more became German. By the bill for the incorporation of Alsace and German Lorraine, introduced into the German parliament in May 1871, it was provided that the sole and supreme control of the two provinces should be vested in the German emperor and the federal council until the 1st of January 1874, when the constitution of the German empire was established. Bismarck admitted the aversion of the population to Prussian rule, but said that everything would be done to conciliate the people. This policy appears really to have been carried out, and it was not long in bearing fruit. Many of the inhabitants of the conquered districts, however, still clung to the old connexion, and on the 30th of September 1872—the day by which the people were required to determine whether they would consider themselves German subjects and remain, or French subjects and transfer their domicile to France—45,000 elected to be still French, and sorrowfully took their departure. The German system of compulsory education of every child above the age of six was introduced directly after the annexation.

ALSACE-LORRAINE (Ger. *Elsass-Lothringen*), a German imperial territory (since 1871), consisting of the former French province Alsace (then divided into the departments of Haut-Rhin and Bas-Rhin), together with its capital Strassburg, and German Lorraine (which included the department of the Moselle and portions of the departments of Meurthe and Vosges), together with the capital and fortress of Metz. The imperial territory (*Reichsland*) is bounded S. by Switzerland; E. by Baden, from which it is separated by the Rhine; N.E. and N. by the Bavarian Palatinate, the Prussian Rhine Province and Luxemburg, and W. by France. Its area is 5601 sq. m. The maximum length from N. to S. is 145 m.; the maximum breadth E. to W. 105 m., and the minimum breadth, on a line drawn through Schlettstadt, 24 m. In respect of its physical features, Alsace-Lorraine falls into three parts—mountain land, plain and plateau. The first, practically co-extensive with the western half of Alsace, consists of the Vosges range, which running in a northerly direction from the deep gap or pass of Belfort (*trouée de Belfort*) forms in its highest ridges the natural frontier line between Germany and France. Between this mountain chain and its spurs, which fall steeply to the E., and the Rhine, stretches a fertile plain forming the eastern half of Alsace. In the N.W. a high and undulating plateau, which gently descends in the W. to the valley of the Moselle, occupies nearly the whole area of Lorraine. The drainage of the Vosges valleys and of the Rhine valley is collected and carried into the Rhine about 10 m. below Strassburg by the Ill, which has a course of more than 100 m. and is navigable below Colmar. With the exception of a few streams which run to the Rhone, all the waters of Alsace flow into the Rhine. The climate is on the whole temperate—warmest in the lowest districts (460 ft. above sea-level) of N. Alsace, and coldest on the summits of the Vosges, where snow lies six months in the year. The mean annual temperature at Strassburg is 49·8° F., at Metz 48·2°; the rainfall at Strassburg 26½ in., and at Metz 27½ in. The Rhine valley is in great part fertile, yielding good crops of potatoes, cereals (including maize), sugar beet, hops, tobacco, flax, hemp and products of oleaginous plants. But grapes and fruit are amongst the most valuable of the crops. The cereals chiefly grown are wheat, oats, barley and rye. Great quantities of hay are harvested. This description embraces also the production of Lorraine, where agriculture is less strenuously carried on, and the fertility of the soil is less. But Lorraine possesses, in compensation, greater riches *in* the earth, in coal and iron and salt mines. Cows are grazed on the S. Vosges in summer, and large quantities of cheese (Münster cheese) are made and exported. Total population (1905) 1,814,626.

The farms in Alsace are mostly small and are held partly as a private possession, partly on the communal system; in Lorraine there are some larger occupations. The manufacture of cottons, and on a smaller scale of woollens, is special to Alsace, the chief centres of the industry being Mülhausen, Colmar and the valleys of the Vosges. The territory has always been the centre of an active commerce, owing to its situation on the confines of Germany, France and Switzerland, and alongside the great highway of the Rhine. The communications embraced some 1249 m. of railway (1903), of which 1108 m. belonged to the state, a good system of roads, and several canals (notably the Rhine-Rhone, the Rhine-Marie and the Saar Canals), in addition to the rivers. Administratively the territory is divided into the following three districts, showing a density of population of about 316 to the sq. m.:—

Districts.	Area in sq. miles.	Population.	
		1885.	1905.
Upper Alsace . .	1354	462,549	512,709
Lower Alsace . .	1845	612,077	686,359
Lorraine . . .	2402	489,729	615,558

On the sex division, 935,305 were in 1905 males, and 879,321 females. The percentage of illegitimacy is about 7. The rural population embraces 51% of the whole, the urban population 48 %. The largest towns are Strassburg (the capital of the territory), Mülhausen, Metz, Colmar, all above 20,000 inhabitants each. Classified according to religion there were, in 1904, 372,078 Protestants, 1,310,391 Roman Catholics, and 32,379 Jews. Education is provided for at the university of Strassburg, in 21 classical and pro-classical schools, in 18 modern schools, and in nearly 4000 elementary schools. Over 85 % of the people speak German as their mother-tongue, the rest French, or a patois of French. The annual revenue and expenditure are each somewhat in excess of £3,000,000. Customs and indirect taxes yield more than three-fifths of the total revenue, and direct taxes less than one-fourth. The state forests give about one-ninth of the whole. The higher administration of justice is devolved upon six provincial courts and a supreme court, sitting at Colmar. Moreover, there are purely industrial tribunals at Mülhausen, Thann, Markirch, Strassburg and Metz. The fish-breeding establishment at Hüningen in Upper Alsace should be mentioned.

Constitution.—The sovereignty over the territory was by a law (*Reichsgesetz*) of the 9th of June 1871 vested in the German emperor, who, until the introduction of the imperial constitution on the 1st of January 1874, had, with the assent of the federal council (*Bundesrat*) and, in a few cases, that of the imperial diet (*Reichstag*), the sole right of initiating legislation. In October of this last year a committee (*Landesausschuss*) of the whole territory was appointed to deliberate on laws proposed to it before they received the final sanction of the emperor. On the 2nd of May 1877, the *Landesausschuss* was itself empowered to initiate legislation within the competence of the territory, and in 1879 the imperial viceroy (*Statthalter*), representing the imperial chancellor, who had until then been the responsible minister, took up his residence in Strassburg. He is assisted in the government by 4 ministers of departments, under the presidency of a secretary of state, and, when occasion demands the extraordinary discussion of legislative proposals, by a council of state (*Staatsrat*), consisting of the secretary of state, under secretaries, the president of the supreme court of justice of the territory and, as a rule, of 12 nominees of the emperor. The *Landesausschuss*, a constitutional body with parliamentary privileges, consists of 58 members, 34 being appointed out of their number by the various district councils (*Bezirkstage*), 4 by the large towns, and 20 by the rural districts. Alsace-Lorraine is represented in the Bundesrat by two commissioners, who have, however, but one voice; and the territory returns 15 members to the Reichstag.

See A. Schmidt, *Elsass und Lothringen* (Leip., 1859); Spach, *Histoire de la basse Alsace et de la ville de Strasbourg* (Stras., 1860); von Müllenheim Rechberg, *Die Annexion des Elsass durch*

Frankreich und Rückblick auf die Verwaltung des Landes, 1648–1697 (Stras., 1897); Du Prel, *Die deutsche Verwaltung in Elsass, 1870–1879* (Stras., 1879); L. Petersen, *Das Deutschtum in Elsass-Lothringen* (Munich, 1902). (P. A. A.)

ALSATIA (the old French province of Alsace), long a "debatable ground" between France and Germany, and hence a name applied in the 17th century to the district of Whitefriars, between the Thames and Fleet Street, in London, which afforded sanctuary (*q.v.*) to debtors and criminals. The privileges were abolished in 1697. The term is also used generally of any refuge for criminals.

ALSEN (Danish *Als*), an island in the Baltic, off the coast of Schleswig, in the Little Belt. It formerly belonged to Denmark, but, as a result of the Danish war of 1864, was incorporated with Germany. Its area is 105 sq. m.; the length nearly 20, and the breadth from 3 to 12 m. Pop. (1900) 25,000, most of whom speak Danish. The island is fertile, richly wooded, and yields grain and fruit. Sonderburg, the capital, with a good harbour and a considerable trade, is connected with the mainland by a pontoon bridge. Other places of note are Norburg and Augustenburg. On the peninsula Kekenis at the S.W. end of Alsen there is a lighthouse. Here, in 1848, the Danes directed their main attack against Field-marshal Wrangel's army. In 1864 the Prussians under Herwarth von Bittenfeld took Alsen, which was occupied by 9000 Danish troops under Steinmann, thus bringing the Danish war to a close. Since 1870 Alsen has been fortified.

'ALSHEKH, MOSES, Jewish rabbi in Safed (Palestine) in the later part of the 16th century. He was the author of many homiletical commentaries on the Hebrew Bible. His works still justly enjoy much popularity, largely because of their powerful influence as practical exhortations to virtuous life.

ALSIETINUS LACUS (mod. *Lago di Martignano*), a small lake in southern Etruria, 15 m. due N.N.W. of Rome, in an extinct crater. Augustus drew from it the Aqua Alsietina; the water was hardly fit to drink, and was mainly intended to supply his naumachia (lake made for a sham naval battle) at Rome, near S. Francesco a Ripa, on the right bank of the Tiber, where some traces of the aqueduct were perhaps found in 1720. The course of the aqueduct, which was mainly subterranean, is practically unknown: Frontinus tells us that it received a branch from the lake of Bracciano near Careiae (Galera): and an inscription relating to it was found in this district in 1887 (F. Barnabei, *Notizie degli Scavi*, 1887, 181).

ALSIUM (mod. *Palo*), an ancient town of Etruria, 29 m. W. by N. of Rome by rail, on the Via Aurelia, by which it is about 22 m. from Rome. It was one of the oldest cities of Etruria, but does not appear in history till the Roman colonization of 247 B.C., and was never of great importance, except as a resort of wealthy Romans, many of whom (Pompey, the Antonine emperors) had villas there. About 1¼ m. N.E. of Palo is a row of large mounds called I Monteroni, which belong to tombs of the Etruscan cemetery. Considerable remains of ancient villas still exist along the low sandy coast, one of which, about 1 m. E. of Palo, occupies an area of some 400 by 250 yds. The medieval castle belongs to the Odescalchi family. Near Palo is the modern sea-bathing resort Ladispoli, founded by Prince Odescalchi.

See G. Dennis, *Cities and Cemeteries of Etruria*, i. 219.

ALSOP, VINCENT (*c.* 1630–1703), English Nonconformist divine, was of Northamptonshire origin and was educated at St John's College, Cambridge. He received deacon's orders from a bishop, whereupon he settled as assistant-master in the free school of Oakham, Rutland. He was reclaimed from indifferent courses and associates here by a very "painful" minister, the Rev. Benjamin King. Subsequently he married Mr King's daughter, and "becoming a convert to his principles, received ordination in the Presbyterian way, not being satisfied with that which he had from the bishop." He was presented to the living of Wilby in Northamptonshire; but was thence ejected under the act of Uniformity in 1662. After his ejection he preached privately at Oakham and Wellingborough, sharing the common pains and penalties of nonconformists,—*e.g.* he was imprisoned six months for praying with a sick person. A book against William Sherlock, dean of St Paul's, called *Antisozzo* (against Socinus), written in the vein of Andrew Marvell's *Rehearsal Transprosed*, procured him much celebrity as a wit. Dr Robert South, no friend to nonconformists, publicly pronounced that Alsop had the advantage of Sherlock in every way. Besides fame, *Antisozzo* procured for its author an invitation to succeed the venerable Thomas Cawton (the younger) as independent minister in Westminster. He accepted the call and drew great multitudes to his chapel. He published other books which showed a fecundity of wit, a playful strength of reasoning, and a provoking indomitableness of raillery. Even with Dr Goodman and Dr Stillingfleet for antagonists, he more than held his own. His *Mischief of Impositions* (1680) in answer to Stillingfleet's *Mischief of Separation*, and *Melius Inquirendum* (1679) in answer to Goodman's *Compassionate Inquiry*, remain historical landmarks in the history of nonconformity. Later on, from the entanglements of a son in alleged treasonable practices, he had to sue for and obtained pardon from King James II. This seems to have given a somewhat diplomatic character to his closing years, inasmuch as, while remaining a nonconformist, he had a good deal to do with proposed political-ecclesiastical compromises. He died on the 8th of May 1703, having preserved his "spirits and smartness" to the last.

See Wood's *Athenae* (Bliss) iv. 106; Calamy's *Life of Baxter*, ii. 487; Wilson's *History and Ant. of Dissenting Churches*, iv. 63-66. (A. J. G.)

ALSTED, JOHANN HEINRICH (1588–1638), German Protestant divine. He was some time professor of philosophy and theology at Herborn, in Nassau, and afterwards at Weissenburg in Transylvania, where he remained till his death in 1638. He was a marvellously prolific writer. His *Encyclopaedia* (1630), the most considerable of the earlier works of that class, was long held in high estimation.

ALSTON, CHARLES (1683–1760), Scottish botanist, was born at Eddlewood, near Hamilton, in 1683, and became lecturer in *materia medica* and botany at Edinburgh and also superintendent of the botanical gardens, of the plants in which he published a catalogue in 1740. He was a critic of Linnaeus's system of plant-classification (see BOTANY). He died on the 22nd of November 1760 at Edinburgh. His *Lectures on Materia Medica* were published posthumously in 1770.

ALSTON, a market-town in the Penrith parliamentary division of Cumberland, England, 29 m. by road E.S.E. of Carlisle, on a branch of the North-Eastern railway from Haltwhistle. Pop. (1901) 3133. It lies in the uppermost part of the valley of the South Tyne, among the high bleak moors of the Pennines. Copper and blende are found, and there are limestone quarries. The mines of argentiferous lead, belonging to Greenwich Hospital, London, were formerly of great value, and it was in order that royalties on the Alston lead mines and on those elsewhere in the county might be jointly collected that the parish was first included within the borders of Cumberland, in the 18th century. As many as 119 lead mines were worked in the parish in 1768, but the supply of metal has been almost exhausted. Coal is worked chiefly for lime-burning, and umber is prepared for the manufacture of colours. Thread and flannels are also made. Whitley Castle, 2 m. N., was a Roman fort, the original name of which is not known, guarding the road which ran along the South Tyne valley and over the Pennines. It has no connexion with Alston itself.

ALSTRÖMER, JONAS (1685–1761), Swedish industrial reformer, was born at Alingsås in Vestergötland, on the 7th of January 1685. He left his native village at an early age, and in 1707 became clerk to Alberg, a merchant of Stockholm, whom he accompanied to London. After carrying on business for three years, Alberg failed, and Alström (as his name was before his ennoblement) engaged in the business of shipbroker on his own account, and eventually proved very successful. After travelling for several years on the continent, he was seized with the patriotic desire to transplant to his native country some of the industries he had seen flourishing in Britain. He accordingly returned to Alingsås, and in 1724 established a woollen factory in the village. After preliminary difficulties it became a very profitable business. He next established a sugar refinery at Gothenburg, introduced improvements in the cultivation of potatoes and of plants suitable for dyeing, and directed attention to improved methods in shipbuilding, tanning and the manufacture of cutlery. But his most successful undertaking was the importation of sheep from England, Spain and Angora. He received many marks of distinction, was created (1748) knight of the order of the North Star, and a few years later received letters of nobility, with permission to change his name to Alströmer. He died on the 2nd of June 1761, leaving several works on practical industrial subjects. A statue was erected in his honour in the exchange at Stockholm. One of his sons, Clas (Claude) (1736–1794), was a naturalist of considerable eminence. During a voyage to Spain he noticed a native Peruvian plant known in Peru as the lily of the Incas, at the Swedish counsul's at Cadiz; he sent a few seeds to his master and friend, Linnaeus, who named the genus in his honour *Alströmeria*. He also wrote a work on sheep-breeding.

ALTAI (in Mongolian *Altain-ula*, the "Mountains of Gold"), a term used in Asiatic geography with various significations. The *Altai region*, in West Siberia and Mongolia, is similar in character to Switzerland, but covers a very much greater area. It extends from the river Irtysh and the Dzungarian depression (46°-47° N.) northwards to the Siberian railway and to the Sayan mountains. The backbone of the region is the Sailughem or Silyughema mountains, also known as Kolyvan Altai, which stretch north-eastwards from 49° N. and 86° E. towards the western extremity of the Sayan mountains in 51° 60′ N. and 89° E. Their mean elevation is 5000–5500 ft. The snow-line runs at 6700 ft. on the northern versant and at 7800 ft. on the southern, and above it the rugged peaks tower up some 3200 ft. more. Passes across the range are few and difficult, the chief being the Ulan-daban at 9275 ft. (9445 ft. according to Kozlov), and the Chapchan-daban, at 10,555 ft., in the south and north respectively. On the east and south-east this range is flanked by the great plateau of Mongolia, the transition being effected gradually by means of several minor plateaus, such as Ukök (7800 ft.), Chuya (6000 ft.), Kendykty (8200 ft.), Kak (8270 ft.), Suok (8500 ft.), and Juvlu-kul (7900 ft.). This region, which is not accurately known, is studded with large lakes, *i.e.* Ubsa-nor (2370 ft. above sea-level), Kirghiz-nor, Durga-nor and Kobdo-nor (3840 ft.), and traversed by various mountain ranges, of which the principal are the Tannu-ola, running roughly parallel with the Sayan mountains as far east as the Kosso-gol (100°–101° E. long.), and the Khan-khu mountains, also stretching west and east.

The range of the *Altai proper*, known also as the Ek-tagh, Mongolian Altai, Great Altai and Southern Altai, likewise extend in two twin parallel chains eastwards as far as 99°, if not farther. The Ek-tagh or Mongolian Altai, which separates the Kobdo basin on the north from the Irtysh basin on the south, is a true border-range, in that it rises in a steep and lofty escarpment from the Dzungarian depression (1550 to 3000 ft.), but descends on the north by a relatively short slope to the plateau (4000-5500 ft.) of north-western Mongolia. East of 94° the range is continued by a double series of mountain chains, all of which exhibit less sharply marked orographical features and are at considerably lower elevations. The southern chain bears the names of Karaadzirga and Burkhan-ola, and terminates in about 99°; but the northern range, the principal names of which are Artsi-bogdo and Saikhat, extends probably most of the way to the great northward bend of the Hwang-ho or Yellow River round the desert of Ordos. Whereas the western Ek-tagh Altai rises above the snow-line and is destitute of timber, the eastern double ranges barely touch the snow-line and are clothed with thick forests up to an altitude of 6250 ft. The slopes of the constituent chains of the system are inhabited principally by nomad Kirghiz.

The north-western and northern slopes of the Sailughem mountains are extremely steep and very difficult of access. On this side lies the culminating summit of the range, the double-headed Byelukha (the Mont Blanc of the Altai), whose summits reach 14,890 and 14,560 ft. respectively,[1] and give origin to several glaciers (30 sq. m. in aggregate area). Here also are the Kuitun (12,000 ft.) and several other lofty peaks. Numerous spurs, striking in all directions from the Sailughem mountains, fill up the space between that range and the lowlands of Tomsk, but their mutual relations are far from being well known. Such are the Chuya Alps, having an average altitude of 9000 ft., with summits from 11,500 to 12,000 ft., and at least ten glaciers on their northern slope; the Katun Alps, which have a mean elevation of about 10,000 ft. and are mostly snow-clad; the Kholzun range; the Korgon (6300 to 7600 ft.), Talitsk and Selitsk ranges; the Tigeretsk Alps, and so on. Several secondary plateaus of lower altitude are also distinguished by geographers. The Katun valley begins as a wild gorge on the south-west slope of Byelukha; then, after a big bend, the river (400 m. long) pierces the Katun Alps, and enters a wider valley, lying at an altitude of from 2000 to 3500 ft., which it follows until it emerges from the Altai highlands to join the Biya in a most picturesque region. The Katun and the Biya together form the Ob. The next valley is that of the Charysh, which has the Korgon and Tigeretsk Alps on one side and the Talitsk and Bashalatsk Alps on the other. This, too, is very fertile. The Altai, seen from this valley, presents the most romantic scenes, including the small but deep Kolyvan lake (altitude, 1180 ft.), which is surrounded by fantastic granite domes and towers. Farther west the valleys of the Uba, the Ulba and the Bukhtarma open south-westwards towards the Irtysh. The lower part of the first, like the lower valley of the Charysh, is thickly populated; in the valley of the Ulba is the Riddersk mine, at the foot of the Ivanovsk peak (6770 ft.), clothed with beautiful alpine meadows. The valley of the Bukhtarma, which has a length of 200 m., also has its origin at the foot of the Byelukha and the Kuitun peaks, and as it falls some 5000 ft. in less than 200 m., from an alpine plateau at an elevation of 6200 ft. to the Bukhtarma fortress (1130 ft.), it offers the most striking contrasts of landscape and vegetation. Its upper parts abound in glaciers, the best known of which is the Berel, which comes down from the Byelukha. On the northern side of the range which separates the upper Bukhtarma from the upper Katun is the Katun glacier, which after two ice-falls widens out to 700-900 yards. From a grotto in this glacier bursts tumultuously the Katun river. The middle and lower parts of the Bukhtarma valley have been colonized since the 18th century by runaway Russian peasants—serfs and nonconformists (Raskolniks)—who created there a free republic on Chinese territory; and after this part of the valley was annexed to Russia in 1869, it was rapidly colonized. The high valleys farther north, on the same western face of the Sailughem range, are but little known, their only visitors being Kirghiz shepherds. Those of Bashkaus, Chulyshman, and Chulcha, all three leading to the beautiful alpine lake of Teletskoye (length, 48 m.; maximum width, 3 m.; altitude, 1700 ft.; area, 87 sq. m.; maximum depth, 1020 ft.; mean depth, 660 ft.), are only inhabited by nomad Telenghites or Teleuts. The shores of the lake—reminding a visitor somewhat of the Swiss lake of Lucerne—rise almost sheer to over 6000 ft. and are too wild to accommodate a numerous population. From this lake issues the Biya, which joins the Katun at Biysk, and then meanders through the beautiful prairies of the north-west of the Altai. Farther north the Altai highlands are continued in the Kuznetsk district, which has a slightly different geological aspect, but still belongs to the Altai system. But the Abakan river, which rises on the western shoulder of the Sayan mountains, belongs to the system of the Yenisei. The Kuznetsk Ala-tau range, on the left bank of the Abakan, runs north-east into the government of Yeniseisk, while a complexus of imperfectly mapped mountains (Chukchut, Salair, Abakan) fills up the country northwards towards the Siberian railway and westwards towards the Ob. The Tom and its numerous tributaries rise on the northern slopes of the Kuznetsk Ala-tau, and their fertile valleys are occupied by a dense Russian population, the centre of which is Kuznetsk, on the Tom.

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[1] Mr S. Turner estimates the culminating peak of Mt. Byelukha at 14,800 ft., but to Willer's Peak, a little to the N. W. of Byelukha, he assigns an altitude of 17,800 ft. (p. 205 of *Siberia*).

Geology.—Geologically the Altai mountains consist of two distinct elements which differ considerably from each other in composition and structure. The Russian Altai is composed mainly of mica and chlorite schists and slates, together with beds of limestone, and in the higher horizons Devonian and Carboniferous fossils occur in many places. There is no axial zone of gneiss, but intrusions of granite and other plutonic rocks occur, and the famous ore deposits are found chiefly near the contact of these intrusions with the schists. The strata are thrown into folds which run in the direction of the mountain ridges, forming a curve with the convexity facing the south-east. The Mongolian or Great Altai, on the other hand, consists mainly of gneiss and Archaean rocks. The strike of the rocks is independent of the direction of the chain, and the chain is bounded by faults. It is, in fact, a horst and not a zone of folding.

Flora.—The flora of the Altai, explored chiefly by Karl F. von Ledebour (1785–1851), is rich and very beautiful. Up to a level of 1000 ft. on the northern and 2000 ft. on the southern slopes, plant life belongs to the European flora, which extends into Siberia as far as the Yenisei. The steppe flora penetrates into the mountains, ascending some 1100-1200 ft., and in sheltered valleys even up to 5500 ft., when it of course comes into contact with the purely alpine flora. Tree vegetation, which reaches up as high as 6500 and 8150 ft., the latter limit on the north and west, consists of magnificent forests of birch, poplar, aspen, and Coniferae, such as *Pinus cembra*, *Abies sibirica*, *Larix sibirica*, *Picea obovata*, and so on, though the fir is not found above 2500 ft., while the meadows are abundantly clothed with brightly-coloured, typical assortments of herbaceous plants. The alpine meadows, which have many species in common with the European Alps, have also a number of their own peculiar Altaian species.

Mineral wealth.—The Altai proper is rich in silver, copper, lead and zinc ores, while in the Kuznetsk Ala-tau, gold, iron and coal are the chief mineral resources. The Kuznetsk Ala-tau mines are only now beginning to be explored, while the copper, and perhaps also the silver, ores of the Altai proper were worked by the mysterious prehistoric race of the Chudes at a time when the use of iron was not yet known. Russians began to mine in 1727 at Kolyvan, and in 1739 at Barnaul. Most of the Altai region, covering an area of some 170,000 sq. m. and including the Kuznetsk district, has since 1746 formed a domain of the imperial family under the name of the *Altai Mining District*. The ores of the Altai proper nearly always appear in irregular veins, containing silver, lead, copper and gold—sometimes all together,—and they are, or were, worked chiefly by Zmeinogorsk (or Zmeiev), Zyryanovsk, Ust-Kamenogorsk and Riddersk (abandoned in 1861). They offer, however, great difficulties, especially on account of their continually varying productivity and temperature of fusion. The beautiful varieties of porphyry—green, red, striped—which are obtained, often in big monoliths, near Kolyvan, are cut at the imperial stone-cutting factory into vases and other ornaments, familiar in the art galleries and palaces of Europe. Aquamarines of mediocre quality but enormous size (up to 3 in. in diameter) are found in the Korgon mine. The northern, or Salair, mining region is rich in silver ores, and the mine of this name used formerly to yield up to 93,300 oz. of silver in the year. But the chief wealth of the northern Altai is in the Kuznetsk coal-basin, also containing iron-ores, which fills up a valley between the Kuznetsk Ala-tau and the Salair range for a length of about 270 m., with a width of about 65 m. The coal is considered equal to the best coal of England and south Russia. The country is also covered with thick diluvial and alluvial deposits containing gold. However, all the mining is now on the decline.

Population.—The Russian population has rapidly increased since the fertile valleys belonging to the imperial family have been thrown open to settlement, and it has been estimated that in 1908 the population of the region (Biysk, Barnaul and Kuznetsk districts) reached about 800,000. Their chief occupations are agriculture (about 3,500,000 acres under culture), cattle-breeding, bee-keeping, mining, gathering of cedar-nuts and hunting. All this produce is exported partly to Tomsk and partly to Kobdo in Mongolia. The natives may represent a population of about 45,000. They are Altaians in the west and Telenghites or Teleuts in the east, with a few Kalmucks and Tatars. Although all are called Kalmucks by the Russians, they speak a Turkish language. Both the Telenghites and the Altaians are Shamanists in religion, but many of the former are already quite Russified. The virgin forests of the Kuznetsk Ala-tau—the Chern, or Black Forest of the Russians—are peopled by Tatars, who live in very small settlements, sometimes of the Russian type, but mostly in wooden *yurts* or huts of the Mongolian fashion. They can hardly keep any cattle, and lead the precarious life of forest-dwellers, living upon various wild roots when there is no grain in the spring. Hunting and fishing are resorted to, and the skins and furs are tanned.

Towns.—The capital of the Altai region is Barnaul, the centre of the mining administration and an animated commercial town; Biysk is the commercial centre; Kuznetsk, Ust-Kamenogorsk, and the mining towns of Kolyvan, Zmeinogorsk, Riddersk and Salairsk are the next largest places.

AUTHORITIES.—P. Semenov and G. N. Potanin, in supplementary vol. of Russian ed. of Ritter's *Asien* (1877); Ledebour, *Reise durch das Altaigebirge* (1829–1830); P. Chikhatchev, *Voyage scientifique dans l'Altai oriental* (1845); Gebler, *Übersicht des katunischen Gebirges* (1837); G. von Helmersen, *Reise nach dem Altai* (St Petersburg, 1848); T. W. Atkinson, *Oriental and Western Siberia* (1858); and Cotta, *Der Altai* (1871), are still worth consulting. Of modern works see Adrianov, "Journey to the Altai," in *Zapiski Russ. Geogr. Soc.* xi.; Yadrintsev, "Journey in West Siberia," in *Zapiski West Sib. Geogr. Soc.* ii.; Golubev, *Altai* (1890, Russian); Schmurlo, "Passes in S. Altai" (Sailughem), in *Izvestia Russ. Geogr. Soc.* (1898), xxxiv. 5; V. Saposhnikov, various articles in same periodical (1897), xxxiii. and (1899) xxxv., and, by the same, *Katun i yeya Istoki* (Tomsk, 1901); S. Turner, *Siberia* (1905); Deniker, on Kozlov's explorations, in *La Géographie* (1901, pp. 41, &c.); and P. Ignatov, in *Izvestia Russ. Geog. Soc.* (1902, No. 2). (P. A. K.; J. T. BE.)

ALTAMURA, a town of Apulia, Italy, in the province of Bari, 28 m. S.S.W. of the town of that name, and 56 m. by rail *via* Gioia del Colle. Pop. (1901) 22,729. It possesses a fine Romanesque cathedral begun in 1232 and restored in 1330 and 1531, the portal being especially remarkable. It is one of the four Palatine churches of Apulia. The surrounding territory is fertile. The medieval walls, erected by the emperor Frederick II., rest upon the walls of an ancient city of unknown name. These early walls are of rough blocks of stone without mortar. Ancient tombs with fragments of vases have also been found, and there are caves which have been used as primitive tombs or dwellings, and a group of some fifty tumuli near Altamura.

ALTAR (Lat. *altare*, from *altus*, high; some ancient etymological guesses are recorded by St Isidore of Seville in *Etymologiae* xv. 4), strictly a base or pedestal used for supplication and sacrifice to gods or to deified heroes. The necessity for such sacrificial furniture has been felt in most religions, and consequently we find its use widespread among races and nations which have no mutual connexion.

Mesopotamia.—Altars are found from the earliest times in the remains of Babylonian cities; the oldest are square erections of sun-dried bricks. In Assyrian mounds limestone and alabaster are the chief material. They are of varying form; an altar shown in a relief at Khorsabad is ornamented with stepped battlements, which are the equivalent of the familiar "altar-horns" in Hebrew ritual. An altar also from Khorsabad (now in the British Museum) has a circular table and a solid base triangular on plan, with pilasters ornamented with animals' paws at the angles. A third variety, of which an 8th century B.C. example from Nimrûd exists in the British Museum, is a rectangular block ornamented at the ends by cylindrical rolls. These altars are in height from 2 to 3 ft. According to Herodotus (i. 183) the great altars of Babylonia were made of gold.

Egypt.—In Egypt altars took the form of a truncated cone or of a cubical block of polished granite or of basalt, with one or more basin-like depressions in the upper surface for receiving fluid libations. These had channels whereby fluids poured into the receptacles could be drained off. The surface was plain, inscribed with dedicatory or other legends, or adorned with symbolical carving.

Palestine.—Recent excavations, especially at Gezer, have shown that the earliest altars, or rather sacrifice hearths, in Palestine were circular spaces marked out by small stones set on end. At Gezer a pre-Semitic place of worship was found in which three such hearths stood together, and drained into a cave which may reasonably be supposed to have been regarded as the residence of the divinity. These circular hearths persisted into the Canaanite period, but were ultimately superseded by the Semitic developments. To the primitive nomadic Semite the presence of the divinity was indicated by springs, shady trees, remarkable rocks and other landmarks; and from this earliest conception grew the theory that a *numen* might be induced to take up an abode in an artificial heap of stones, or a pillar set upright for the purpose. The blood of the victim was poured over the stone as an offering to the divinity dwelling within it; and from this conception of the stone arose the further and final view, that the stone was a table on which the victim was to be burned.

Very few specimens of early Palestinian altars remain. The megalithic structures common in the Hauran and Moab *may* be entirely sepulchral. At Gezer no definite altar was discovered in the great High Place; though it is possible that a bank of intensely hard compact earth, in which were embedded a large number of human skulls, took its place. A very remarkable altar, at present unique, was found at Taanach by the Austrian excavators. It is pyramidal in shape, and the surface is ornamented with human-headed animals in relief. This, like the earliest Babylonian altars, is of baked earth.

The Old Testament conception of the altar varies with the stage of religious development. In the pre-Deuteronomic period altars are erected in any place where there had appeared to be a manifestation of deity, or under any circumstance in which the aid of deity was invoked; not by heretical individuals, but by the acknowledged religious leaders, such as Noah at Ararat, Abraham at Shechem, Bethel &c., Isaac at Beersheba, Jacob at Bethel, Moses at Rephidim, Joshua at Ebal, Gideon at Ophrah, Samuel at Ramah, Elijah at Carmel, and others. These primitive altars were of the simplest possible description —in fact they were required to be so by the regulation affecting them, preserved in Exodus xx. 24, which prescribes that *in every place where Yahweh records his name* an altar of earth or of unhewn stone, without steps or other extraneous ornamentation, shall be erected.

The priestly regulations affecting altars are of a very elaborate nature, and are framed with a single eye to the essential theory of later Hebrew worship—the centralization of all worship at one shrine. These recognize two altars, which by the authors of this portion of the Pentateuch are placed from the first in the tabernacle in the wilderness—a theory which is inconsistent with the other evidences of the nature of the earlier Hebrew worship, to which we have just alluded.

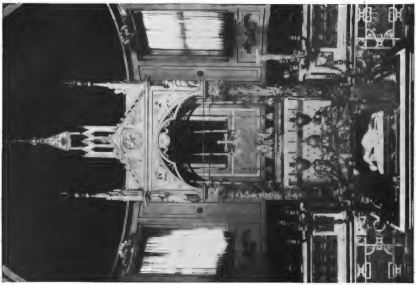
The first of these altars is that for burnt-offering. This altar was in the centre of the court of the tabernacle, of acacia wood, 3 cubits high and 5 square. It was covered with copper, was provided with "horns" at the corners (like those of Assyria), hollow in the middle, and with rings on the sides into which the staves for its transportation could be run (Ex. xxvii. 1-8). The altar of the Solomonic temple is on similar lines, but much larger. It is now generally recognized that the description of the tabernacle altar is intended to provide a precedent for this vast structure, which would otherwise be inconsistent with the traditional view of the simple Hebrew altars. In the second temple a new altar was built after the fashion of the former (1 Macc. iv. 47) of "whole stones from the mountain." In Herod's temple the altar was again built after the same model. It is described by Josephus (v. 5. 6) as 15 cubits high and 50 cubits square, with angle horns, and with an "insensible acclivity" leading up to it (a device to evade the pre-Deuteronomic regulation about steps). It was made without any use of iron, and no iron tool was ever allowed to touch it. The blood and refuse were discharged through a drain into the brook Kedron; this drain probably still remains, in the *Bir el-Arwah*, under the "Dome of the Rock" in the mosque which covers the site of the temple.

The second altar was the altar of incense, which was in the holy place of the tabernacle. It was of similar construction to the altar of burnt-offering, but smaller, being 2 cubits high and 1 cubit square (Ex. xxx. 1-5). It was overlaid with gold. Solomon's altar of incense (1 K. vi. 20) is referred to in a problematical passage from which it would appear to have been of cedar. But the authenticity of the passages describing the altar of incense in the tabernacle, and the historicity of the corresponding altar in Solomon's temple, are matters of keen dispute among critics. The incense altar in the second temple was removed by Antiochus Epiphanes (1 Macc. i. 21) and restored by Judas Maccabaeus (1 Macc. iv. 49). That in the temple of Herod is referred to in Luke i. 11.

The ritual uses of these altars are sufficiently explained by their names. On the first was a fire continually burning, in which the burnt-offerings were consumed. On the second an offering of incense was made twice a day.

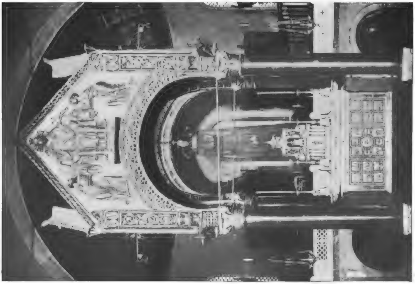
In the pre-Deuteronomic passage, Exodus xxi. 14, the use of the altar as an asylum is postulated, though denied to the wilful murderer. This is a survival of the ancient belief that the deity resided in the pillar or stone-heap, and that the fugitive was placing himself under the protection of the local *numen* by seeking sanctuary. From 1 Kings i. 50 it would appear that the suppliant caught hold of the altar-horns (compare 1 Kings ii. 28), as though special protective virtue resided in this important though obscure part of the structure.

Greece and Rome.—According to the difference in the service for which they were employed, altars fell into two classes. Those of the first class were pedestals, so small and low that the suppliant could kneel upon them; these stood inside the temples, in front of the sacred image. The second class consisted of larger tables destined for burnt sacrifice; these were placed in the open air, and, if connected with a temple, in front of the entrance. Possibly altars of the former class were in historical times substitutes for, and rendered the same service as, the bases of the sacred images within the temples in earlier ages. In this case the altar of Apollo at Delphi, upon which on the Greek vases Neoptolemus is frequently represented as taking refuge from Orestes, might be regarded as the pedestal of an invisible image of the god, and as fulfilling the same function as did the base of the actual image of Athene in Troy, towards which Cassandra fled from Ajax. The second class of altars, called *βωμοί* by the Greeks and *altaria* by the Romans, appears to have originated in temporary constructions such as heaps of earth, turf or stone, made for kindling a sacrificial fire as occasion required. But sacrifices to earth divinities were made on the earth itself, and those to the infernal deities in sunk hollows (*Odyss.* x. 25; Festus *s. v. Altaria*). The note of Eustathius (*Odyss.* xii. 252) perhaps indicates some customs reminiscent of a primitive antiquity in which the sacrifice was made without an altar at all. He says *ἀποβώμιά τινα ἱερὰ ὧν οὐκ ἐπὶ βωμοῦ ὁ καθαγισμὸς ἀλλ' ἐπὶ ἐδάφους*—"some holy places *away from altars*, whose offering is made not on an altar but on the floor." Pausanias (vi. 20. 7) speaks of an altar at Olympia made of unbaked bricks. In some primitive holy shrines the bones and ashes of the victims sacrificed were allowed to accumulate, and upon this new fires were kindled. Altars so raised were, like most religious survivals, considered as endowed with particular sanctity; the most remarkable recorded instances of such are the altars of Hera at Samos, and of Pan at Olympia (Paus. v. 14. 6; v. 15. 5), of Heracles at Thebes (Paus. ix. 11. 7), and of Zeus at Olympia (Paus. v. 13. 5). The last-mentioned stood on a platform (*πρόθυσις*) measuring 125 ft. in circumference, and led up to by steps, the altar itself being 22 ft. high. Women were excluded from the platform. Where hecatombs were sacrificed, the *πρόθυσις* necessarily assumed colossal proportions, as in the case of the altar at Parion, where it measured on each side 600 ft. The altar of Apollo at Delos (*ὁ κεράτινος βωμός*) was made



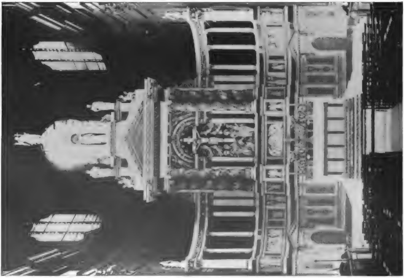
Photo, Alinari.

FIG. 2.—SANTA CECILIA, ROME.



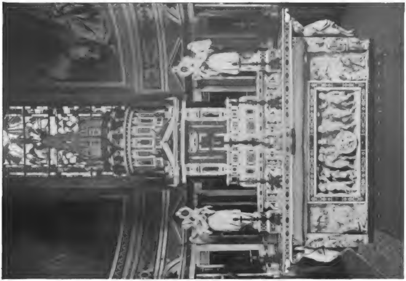
Photo, Brogi.

FIG. 1.—SANT' AMBROGIO, MILAN.



Photo, G. W. Wilson & Co.

FIG. 3.—ST PAUL'S, LONDON.



Photo, Brogi.

FIG. 4.—CERTOSA, PAVIA.

of the horns of goats believed to have been slain by Diana; while at Miletus was an altar composed of the blood of victims sacrificed (Paus. v. 13. 6). The altar at Phorae in Achaea was of unhewn stones (Paus. vii. 22. 3). The altar used at the festival in honour of Daedalus on Mt. Cithaeron was of wood, and was consumed along with the sacrifice (Paus. ix. 3. 4). Others of bronze are mentioned. But these were exceptional, the usual material of an altar was marble, and its form, both among the Greeks and Romans, was either square or round; polygonal altars, of which examples still exist, being exceptions. When sculptured decorations were added they frequently took the form of imitations of the actual festoons with which it was usual to ornament altars, or of symbols, such as crania and horns of oxen, referring to the victims sacrificed. As a rule, the altars which existed apart from temples bore the name of the person by whom they were dedicated and the names of the deities in whose service they were, or, if not the name, some obvious representation of the deity. Such, for example, is the purpose of the figures of the Muses on an altar dedicated to them, now to be seen in the British Museum. An altar was retained for the service of one particular god, except where through local tradition two or more deities had become intimately associated, as in the case of the altar at Olympia to Artemis and Alpheus jointly, or that of Poseidon and Erechtheus in the Erechtheum at Athens. The most remarkable instance of multiple dedication was, however, at Oropus, where the altar was divided into five parts, one dedicated to Heracles, Zeus and Paean Apollo, a second to heroes and their wives, a third to Hestia, Hermes, Amphiaraus and the children of Amphilochus, a fourth to Aphrodite Panacea, Jason, Health, and Healing Athene, and the fifth to the Nymphs, Pan, and the rivers Archelous and Cephissus (Paus. i. 34. 2). Such deities were styled *σύμβωμοι*, each having a separate part of the altar (Paus. i. 34. 2). Other terms are *ἀγώνιοι*, or *ὁμοβώμιοι*. Deities of an inferior order, who were conceived as working together—*e.g.* the wind gods—had an altar in common. In the same way, the "unknown gods" were regarded as a unit, and had in Athens and at Olympia one altar for all (Paus. i. 1. 4; v. 14. 5; cf. Acts of Apostles, xvii. 18). An altar to all the gods is mentioned by Aeschylus (*Suppl.* 222). Among the exceptional classes of altars are also to be mentioned those on which fire could not be kindled (*βωμοὶ ἄπυροι*), and those which were kept free from blood (*βωμοὶ ἀναίμακτοι*), of which in both respects the altar of Zeus Hypatos at Athens was an example. The *ἑστία* was a round altar; the *ἐσχάρα*, one employed apparently for sacrifice to inferior deities or heroes (but *ἐσχάρα Φοίβου*, Aesch. *Pers.* 205). In Rome an altar erected in front of a statue of a god was always required to be lower than the statue itself (Vitruvius iv. 9). Altars were always places of refuge, and even criminals and slaves were there safe, violence offered to them being insults to the gods whose suppliants the refugees were for the time being. They were also taken hold of by the Greeks when making their most solemn oaths.

Ancient America.—As a single specimen of an altar, wholly unrelated to any of the foregoing, we may cite the ancient Mexican example described by W. Bullock (*Six Months in Mexico*, London, 1824, p. 335). This was cylindrical, 25 ft. in circumference, with sculpture representing the conquests of the national warriors in fifteen different groups round the side.[1]

Portable altars and tables of offerings were used in pre-Christian as well as in Christian ritual. One such was discovered in the Gezer excavations, dating about 200 B.C. It was a slab of polished limestone about 6 in. square with five cups in its upper surface. Another from the same place was a small cubical block of limestone bearing a dedication to Heracles. They have also been found in Assyria. Pocket altars are still used in some forms of worship in India. See the *Journal of the Royal Asiatic Society*, 1852, p. 71.

Altars in the Christian Church

I. *The Early Church.*—The altar is spoken of by the early Greek and Latin ecclesiastical writers under a variety of names:—*τράπεζα*, the principal name in the Greek fathers and the liturgies; *θυσιαστήριον* (rarer; used in the Septuagint for Hebrew altars); *ἱλαστήριον*; *βωμός* (usually avoided, as it is a word with heathen associations); *mensa Domini*; *ara* (avoided like *βωμός*, and for the same reason); and, most regularly, *altare*. After the 4th century other names or expressions come into use, such as *mensa tremenda*, *sedes corporis et sanguinis Christi*.

The earliest Christians had no altars, and were taunted by the pagans for this. It is admitted by Origen in his reply to Celsus (p. 389), who has charged the Christians with being a secret society "because they forbid to build temples, to raise altars." "The altars," says Origen, "are the heart of every Christian." The same appears from a passage in Lactantius, *De Origine Erroris*, ii. 2. We gather from these passages that down to about A.D. 250, or perhaps a little later, the communion was administered on a movable wooden table. In the Catacombs, the *arcosolia* or bench-like tombs are said (though the statement is doubtful) to have been used to serve this purpose. The earliest church altars were certainly made of wood; and it would appear from a passage in William of Malmesbury (*De Gest. Pontif. Angl.* iii. 14) that English altars were of wood down to the middle of the 11th century, at least in the diocese of Worcester.

The cessation of persecution, and consequent gradual elaboration of church furniture and ritual, led to the employment of more costly materials for the altar as for the other fittings of ecclesiastical buildings. Already in the 4th century we find reference to stone altars in the writings of Gregory of Nyssa. In 517 the council of Epaone in Burgundy forbade any but stone pillars to be consecrated with chrism; but of course the decrees of this provincial council would not necessarily be received throughout the church.

Pope Felix I. (A.D. 269–274) decreed that "mass should be celebrated above the tombs of martyrs"—an observance probably suggested by the passage in Revelation vi. 9, "I saw under the altar the souls of them that were slain for the word of God." This practice developed into the medieval rule that no altar can be consecrated unless it contain a relic or relics.

The form of the altar was originally table-shaped, consisting of a plane surface supported by columns. There were usually four, but examples with one, two and five columns are also recorded. But the development of the relic-custom led to the adoption of another form, the square box shape of an "altar-tomb." Transitional examples, combining the box with the earlier table shape, are found dating about 450. Mention is made occasionally of silver and gold altars in the 5th to the 8th centuries. This means no doubt that gold and silver were copiously used in its decoration. Such an altar still remains in Sant' Ambrogio at Milan, dating from the 9th century (see fig. 1).

II. *The Medieval Church.*—It will be convenient now to pass to the fully-developed altar of the Western Church with its accessories, though the rudiments of most of the additional details are traceable in the earlier period.

In the Roman Catholic Church, which preserves in this respect the tradition that had become established during the middle ages, the component parts of a fixed altar in the liturgical sense are the table (*mensa*), or super-altar, consisting of a stone slab; the support (*stipes*), consisting either of a solid mass or of four or more columns; the *sepulchrum*, or altar-cavity, a small chamber for the reception of the relics of martyrs. The support, in the technical sense, must be of stone solidly joined to the table; but, if this support consist of columns, the intervals may be filled with other materials, *e.g.* brick or cement. The altar-slab or "table" alone is consecrated, and in sign of this are cut in its upper surface five Greek crosses, one in the centre and one in each corner. These crosses must have been anointed by the bishop with chrism in the ritual of consecration before the altar can be used. Crosses appear on the portable altar buried with

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[1] Bullock also says (p. 354) that the altar in the church of the Indian village of S. Miguel de los Ranchos which he visited was "of the same nature as those in use before the introduction of Christianity."

St Cuthbert (A.D. 687), but the history of the origin and development of this practice is not fully worked out.

According to the *Caeromoniale* (i. 12. 13) a canopy (*baldachinum*) should be suspended over the altar; this should be square, and of sufficient size to cover the altar and the *predella* on which the officiating priest stands. This baldachin, called liturgically the *ciborium*, is sometimes hung from the roof by chains in such a way that it can be lowered or raised; sometimes it is fixed to the wall or reredos; sometimes it is a solid structure of wood covered with metal or of marble supported on four columns. The latter form is, however, usual only in large churches, more especially of the basilica type, *e.g.* St Peter's at Rome or the Roman Catholic cathedral at Westminster. The origin of the *ciborium* is not certain, but it is represented in a mosaic at Thessalonica of a date not later than A.D. 500. Even at the present day, in spite of a decree of the Congregation of Rites (27th of May 1697) ordering it to be placed over all altars, it is—even at Rome itself—usually only found over the high altar and the altar of the Blessed Sacrament.

Multiplication of altars is another medieval characteristic. This also is probably a result of the edict of Pope Felix already mentioned. In a vault where more than one martyr was buried an altar might be erected for each. It is in the 6th century that we begin to find traces of the multiplication of altars. In the church of St Gall, Switzerland, in the 9th century there were seventeen. In the modern Latin Church almost every large church contains several altars—dedicated to certain saints, in private side chapels, established for masses for the repose of the founder's soul, &c. Archbishop Wulfred in 816 ordered that beside every altar there should be an inscription recording its dedication. This regulation fell into abeyance after the 12th century, and such inscriptions are very rare. One remains mutilated at Deerhurst (*Archaeologia*, vol. l. p. 60).

Where there is in a cathedral or church more than one altar, the principal one is called a "high altar." Where there is a second high altar, it is generally at the end of the choir or chancel. In monastic churches (*e.g.* formerly at St Albans) it sometimes stands at the end of the nave close to the choir screen.

Beside the altar was a drain (*piscina*) for pouring away the water in which the communion vessels were rinsed. This seems originally to have been under the altar, as it is still in the Eastern Church.

That the primitive communion table was covered with a communion-cloth is highly probable, and is mentioned by Optatus (*c.* A.D. 370), bishop of Milevis. This had developed by the 14th or 15th century into a cerecloth, or waxed cloth, on the table itself; and three linen coverings one above the other, two of about the size of the table and one rather wider than the altar, and long enough to hang down at each end. Five crosses are worked upon it, four in the corners and one in the middle, and there is an embroidered edging.[1] In front was often a hanging panel of embroidered cloth (the frontal; but frontals of wood, ornamented with carving or enamel, &c., are also to be found). These embroidered frontals are changeable, so that the principal colour in the pattern can accord with the liturgical colour of the day. Speaking broadly, red is the colour for feasts of martyrs, white for virgins, violet for penitential seasons, &c.; no less than sixty-three different uses differing in details have been enumerated. A similar panel of needlework (the dossal) is suspended behind the altar.

Portable altars have been used on occasion since the time of Bede. They are small slabs of hard stone, just large enough for the chalice and paten. They are consecrated and marked with the five incised crosses in the same way as the fixed altar, but they may be placed upon a support of any suitable material, whether wood or stone. They are used on a journey in a heretical or heathen country, or in private chapels. In the inventory of the field apparel of Henry, earl of Northumberland, A.D. 1513, is included "A coffer wyth ij liddes to serue for an Awter and ned be" (*Archaeologia*, xxvi. 403).

On the altar are placed a cross and candlesticks—six in number, and seven when a bishop celebrates in his cathedral; and over it is suspended or fixed a tabernacle or receptacle for the reservation of the Sacrament.

III. *Post-Reformation Altars.*—At the Reformation the altars in churches were looked upon as symbols of the unreformed doctrine, especially where the struggle lay between the Catholics and the Calvinists, who on this point were much more radical revolutionaries than the Lutherans. In England the name "altar"[2] was retained in the Communion Office in English, printed in 1549, and in the complete English Prayer-book of the following year, known to students as the First Book of Edward VI. But orders were given soon after that the altars should be destroyed, and replaced by movable wooden tables; while from the revised Prayer-book of 1552 the word "altar" was carefully expunged, "God's board" or "the table" being substituted. The short reign of Mary produced a temporary reaction, but the work of reformation was resumed on the accession of Elizabeth.

The name "altar" has been all along retained in the Coronation Office of the kings of England, where it occurs frequently. It was also recognized in the canons of 1640, but with the reservation that "it was an altar in the sense in which the primitive church called it an altar and in no other." In the same canons the rule for the position of the communion tables, which has been since regularly followed throughout the Church of England, was formulated. In the primitive church the altars seem to have been so placed that, like those of the Hebrews, they could be surrounded on all sides by the worshippers. The chair of the bishop or celebrant was on their east side, and the assistant clergy were ranged on each side of him. But in the middle ages the altars were placed against the east wall of the churches, or else against a *reredos* erected at the east side of the altar, so as to prevent all access to the table from that side; the celebrant was thus brought round to the west side and caused to stand between the people and the altar. On the north and south sides there were often curtains. When tables were substituted for altars in the English churches, these were not merely movable, but at the administration of the Lord's Supper were actually moved into the body of the church, and placed *table-wise*—that is, with the long sides turned to the north and south, and the narrow ends to the east and west,—the officiating clergyman standing at the north side. In the time of Archbishop Laud, however, the present practice of the Church of England was introduced. The communion table, though still of wood and movable, is, as a matter of fact, never moved; it is placed *altar-wise*—that is, with its longer axis running north and south, and close against the east wall. Often there is a reredos behind it; it is also fenced in by rails to preserve it from profanation of various kinds.

In 1841 the ancient church of the Holy Sepulchre at Cambridge was robbed of most of its interest by a calamitous "restoration" carried out under the superintendence and partly at the charge of the Camden Society. On this occasion a stone altar, consisting of a flat slab resting upon three other upright slabs, was presented to the parish, and was set up in the church at the east wall of the chancel. This was brought to the notice of the Court of Arches in 1845, and Sir H. Jenner Fust (*Faulkner* v. *Lichfield and Stearn*) ordered it to be removed, on the ground that a stone structure so weighty that it could not be carried about, and seeming to be a mass of solid masonry, was not a communion-table in the sense recognized by the Church of England.

BIBLIOGRAPHY.—For altars in the ancient East see M. Jastrow, *Religion of Assyria and Babylonia*; Perrot and Chipiez, *Art in Chaldea* (i. 143, 255); Sir J. Gardiner Wilkinson, *A Second Series of the Manners and Customs of the Ancient Egyptians*, ii. 387; Benzinger's and Nowack's works on *Hebräische Archäologie*. For classical altars, much information can be obtained from the notes in J. G. Frazer's *Pausanias*. See also Schömann, *Griechische Alterthümer*, vol. ii.; the volume on "Gottesdienstliche Alterthümer" in Hermann's *Lehrbuch der griechischen Antiquitäten*. On domestic altars and worship see Petersen, *Hausgottesdienst der Griechen* (Cassel, 1851).

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[1] In the Eastern Church four small pieces of cloth marked with the names of the Evangelists are placed on the four corners of the altar, and covered with three cloths, the uppermost (the corporal) being of smaller size.

[2] Except in one place where the term used is "God's board."

On plural dedications consult Maurer, *De aribus graecorum pluribus deis in commune positis* (Darmstadt, 1885). For Christian altars, reference is best made to the articles on the subject in the dictionaries of Christian and liturgical antiquities of Migne, Martigny, Smith and Cheetham, and Pugin, where practically all the available information is collected. See also Ciampinus, *Vetera Monumenta* (Rome, 1747), where numerous illustrations of altars are to be found; Martene, *De antiquis Ecclesiae ritibus*, iii. vi. (Rouen, 1700); Voigt, *Thysiasteriologia sive de altaribus veterum Christianorum* (Hamburg, 1709); and the liturgical works of Bona. Many articles on various sections of the subject have appeared in the journals of archaeological societies; we may mention Nesbitt on the churches of Rome earlier than 1150 (*Archaeologia*, xl. p. 210), Didron, "L'Autel chrétien" (*Annales archéologiques*, iv. p. 238), and a paper by Texier on enamelled altars in the same volume. (R. A. S. M.)

ALTDORF, the capital of the Swiss canton of Uri. It is built at a height of 1516 ft. above sea-level, a little above the right bank of the Reuss, not far above the point where this river is joined on the right by the Schächen torrent. In 1900 the population was 3117, all Romanists and German-speaking. Altdorf is 34 m. from Lucerne by the St Gotthard railway and 22 m. from Goeschenen. Its port on the Lake of Lucerne, Flüelen, is 2 m. distant. There is a stately parish church, while above the little town is the oldest Capuchin convent in Switzerland (1581). Altdorf is best known as the place where, according to the legend, William Tell shot the apple from his son's head. This act by tradition happened on the market-place, where in 1895, at the foot of an old tower (with rude frescoes commemorating the feat), there was set up a fine bronze statue (by Richard Kissling of Zürich) of Tell and his son. In 1899 a theatre was opened close to the town for the sole purpose of performing Schiller's play of *Wilhelm Tell*. The same year a new carriage-road was opened from Altdorf through the Schächen valley and over the Klausen Pass (6404 ft.) to the village of Linththal (30 m.) and so to Glarus. One and a half mile from Altdorf by the Klausen road is the village of Bürglen, where by tradition Tell was born; while he is also said to have lost his life, while saving that of a child, in the Schächen torrent that flows past the village. On the left bank of the Reuss, immediately opposite Altdorf, is Attinghausen, where the ruined castle (which belonged to one of the real founders of the Swiss Confederation) now houses the cantonal museum of antiquities. (W. A. B. C.)

ALTDORFER, ALBRECHT (? 1480–1538), German painter and engraver, was born at Regensburg (Ratisbon), where in 1505 he was enrolled a burgher, and described as "twenty-five years old." Soon afterwards he is known to have been prosperous, and as city architect he erected fortifications and a public slaughter-house. Altdorfer has been called the "Giorgione of the North." His paintings are remarkable for minute and careful finish, and for close study of nature. The most important of them are to be found in the Pinakothek at Munich. A representation of the battle of Arbela (1529), included in that collection, is usually considered his chief work. His engravings on wood and copper are very numerous, and rank next to those of Albrecht Dürer. The most important collection is at the Berlin museum. Albrecht's brother, Erhard Altdorfer, was also a painter and engraver, and a pupil of Lucas Cranach.

ALTEN, SIR CHARLES [Karl] (1764–1840), Hanoverian and British soldier, son of Baron Alten, a member of an old Hanoverian family, entered the service of the elector as a page at the age of twelve. In 1781 he received a commission in the Hanoverian guards, and as a captain took part in the campaigns of 1793–1795 in the Low Countries, distinguishing himself particularly on the Lys in command of light infantry. In 1803 the Hanoverian army was disbanded, and Alten took service with the King's German Legion in British pay. In command of the light infantry of this famous corps he took part with Lord Cathcart in the Hanoverian expedition of 1805 and in the siege of Copenhagen in 1807, and was with Moore in Sweden and Spain, as well as in the disastrous Walcheren expedition. He was soon employed once more in the Peninsula, and at Albuera commanded a brigade. In April 1813 Wellington placed him at the head of the famous "Light Division" (43rd, 52nd, 95th, and Caçadores), in which post he worthily continued the records of Moore and Robert Craufurd at Nivelle, Nive, Orthez and Toulouse. His officers presented him with a sword of honour as a token of their esteem. In 1815 Alten commanded Wellington's 3rd division and was severely wounded at Waterloo. His conduct won for him the rank of Count von Alten. When the King's German Legion ceased to exist, Alten was given the command of the Hanoverians in France, and in 1818 he returned to Hanover, where he became subsequently minister of war and foreign affairs, and rose to be field-marshal, being retained on the British Army list at the same time as Major-General Sir Charles Alten, G. C. B. He died in 1840. A memorial to Alten has been erected at Hanover.

See *Gentleman's Magazine*, 1840; N. L. Beamish, *Hist. of the King's German Legion*, 2 vols. (1832–1837).

ALTENA, a town of Germany, in the Prussian province of Westphalia, on the river Lenne, 38 m. S.S.E. from Dortmund. Pop. (1900) 12,769. It consists of a single street, winding up a deep valley for about 3 m. There are three churches, a museum, high grade and popular schools. Its hardware industries are important, and embrace iron rolling, the manufacture of fine wire, needles, springs and silver ornaments. On the neighbouring Schlossberg is the ancestral castle of the counts of La Marck, ancestors, on the female side, of the Prussian royal house.

ALTENBURG, a town of Germany, capital of the duchy of Saxe-Altenburg, situated near the river Pleisse, 23 m. S. of Leipzig, and at the junction of the Saxon state railways Leipzig-Hof and Altenburg-Zeitz. Pop. (1905) 38,811. The town from its hilly position is irregularly built, but many of its streets are wide, and contain a number of large and beautiful buildings. Its ancient castle is picturesquely situated on a lofty porphyry rock, and is memorable as the place from which, in 1455, Kunz von Kaufungen carried off the young princes Albert and Ernest, the founders of the present royal and ducal families of Saxony. Its beautiful picture gallery, containing portraits of several of the famous princes of the house of Wettin, was almost totally destroyed by fire in January 1905. Altenburg is the seat of the higher courts of the Saxon duchies, and possesses a cathedral and several churches, schools, a library, a gallery of pictures and a school of art, an infirmary and various learned societies. There is also a museum, with natural history, archaeological, and art collections, and among other buildings may be mentioned St Bartholomew's church (1089), the town hall (1562–1564), a lunatic asylum, teachers' seminary and an agricultural academy. There is considerable traffic in grain and cattle brought from the surrounding districts; and twice a year there are large horse fairs. Cigars, woollen goods, gloves, hats and porcelain are among the chief manufactures. There are lignite mines in the vicinity.

ALTENSTEIN, a castle upon a rocky mountain in Saxe-Meiningen, on the south-western slope of the Thüringerwald, not far from Eisenach. It is the summer residence of the dukes of Meiningen, and is surrounded by a noble park, which contains, among other objects of interest, a remarkable underground cavern, 500 ft. long, through which flows a large and rapid stream. Boniface, the apostle of the Germans, lived and preached at Altenstein in 724; and near by is the place where, in 1521, Luther was seized, by the order of the elector Frederick the Wise, to be carried off to the Wartburg. An old beech called "Luther's tree," which tradition connected with the reformer, was blown down in 1841, and a small monument now stands in its place.

ALTERNATION (from Lat. *alternare*, to do by turns), strictly, the process of "alternating," *i.e.* of two things following one another regularly by turns, as night alternates with day. A somewhat different sense is attached to some usages of the derivatives. Thus, in American political representative bodies and in the case of company directors, a substitute is sometimes called an "alternate." An "alternative" is that which is offered as a choice of two things, the acceptance of the one implying the rejection of the other. It is incorrect to speak of more than two alternatives, though Mr Gladstone wrote in 1857 of a fourth (*Oxf. Essays*, 26). When there is only one course open there is said to be no alternative.

ALTHAEA, in classical legend, daughter of Thestius, king of Aetolia, wife of Oeneus, king of Calydon, and mother of Meleager (*q.v.*).

ALTING, JOHANN HEINRICH (1583–1644), German divine, was born at Emden, where his father, Menso Alting (1541–1612), was minister. Johann studied with great success at the universities of Gröningen and Herborn. In 1608 he was appointed tutor of Frederick, afterwards elector-palatine, at Heidelberg, and in 1612 accompanied him to England. Returning in 1613 to Heidelberg, after the marriage of the elector with Princess Elizabeth of England, he was appointed professor of dogmatics, and in 1616 director of the theological department in the *Collegium Sapientiae*. In 1618, along with Abraham Scultetus, he represented the university in the synod of Dort. When Count Tilly took the city of Heidelberg (1622) and handed it over to plunder, Alting found great difficulty in escaping the fury of the soldiers. He first retired to Schorndorf; but, offended by the "semi-Pelagianism" of the Lutherans with whom he was brought in contact, he removed to Holland, where the unfortunate elector and "Winter King" Frederick, in exile after his brief reign in Bohemia, made him tutor to his eldest son. In 1627 Alting was appointed to the chair of theology at Gröningen, where he continued to lecture, with increasing reputation, until his death in 1644. Though an orthodox Calvinist, Alting laid little stress on the sterner side of his creed and, when at Dort he opposed the Remonstrants, he did so mainly on the ground that they were "innovators." Among his works are:—*Notae in Decadem Problematum Jacobi Behm* (Heidelberg, 1618); *Scripta Theologica Heidelbergensia* (Amst., 1662); *Exegesis Augustanae Confessionis* (Amst., 1647).

ALTINUM (mod. *Altino*), an ancient town of Venetia, 12 m. S.E. of Tarvisium (Treviso), on the edge of the lagoons. It was probably only a small fishing village until it became the point of junction of the Via Postumia and the Via Popillia (see AQUILEIA). At the end of the republic it was a *municipium*. Augustus and his successors brought it into further importance as a point on the route between Italy and the north-eastern portions of the empire. After the foundation of the naval station at Ravenna, it became the practice to take ship from there to Altinum, instead of following the Via Popillia round the coast, and thence to continue the journey by land. A new road, the Via Claudia Augusta, was constructed by the emperor Claudius from Altinum to the Danube, a distance of 350 m., apparently by way of the Lake of Constance. The place thus became of considerable strategic and commercial importance, and the comparatively mild climate (considering its northerly situation) led to the erection of villas which Martial (*Epigr.* iv. 25) compares with those of Baiae. It was destroyed by Attila in A.D. 452, and its inhabitants took refuge in the islands of the lagoons, forming settlements from which Venice eventually sprang.

ALTITUDE (Lat. *altitudo*, from *altus*, high), height or eminence, and particularly the height above the ground or above sea-level. In geometry, the altitude of a triangle is the length of the perpendicular from the vertex to the base. In astronomy, the altitude of a heavenly body is the apparent angular elevation of the body above the plane of the horizon (see ASTRONOMY: *Spherical*). ***Apparent altitude*** is the value which is directly observed; ***true altitude*** is deduced by correcting for astronomical refraction and dip of the horizon; ***geocentric altitude*** by correcting for parallax.

ALTMÜHL, a river of Germany, in the kingdom of Bavaria. It is an important left bank tributary of the Danube, rising in the Franconian plateau (Fränkische Terrasse), and after a tortuous course of 116 m., at times flowing through meadows and again in weird romantic gorges, joins the Danube at Kelheim. From its mouth it is navigable up to Dietfurt (18 m.), whence the Ludwigscanal (100 m. long) proceeds to Bamberg on the Regnitz, thus establishing communication between the Danube and the Rhine.

ALTO (Ital. for "high"), a musical term applied to the highest adult male voice or counter-tenor, and to the lower boy's or woman's (contralto) voice.

ALTON, a market-town in the Fareham parliamentary division of Hampshire, England, 46½ m. S.W. of London by the London & South-Western railway. Pop. of urban district (1901) 5479. It has a pleasant undulating site near the headwaters of the river Wey. Of the church of St Lawrence part, including the tower, is Norman; the building was the scene of a fierce conflict between the royalist and parliamentary troops in 1643. There is a museum of natural history; the collection is reminiscent of the famous naturalist Gilbert White, of Selborne in this vicinity. Large markets and fairs are held for corn, hops, cattle and sheep; and the town contains some highly reputed ale breweries, besides paper mills and iron foundries.

ALTON, a city of Madison county, Illinois, U.S.A., in the W. part of the state, on the Mississippi river, about 10 m. above the mouth of the Missouri, and about 25 m. N. of St Louis, Missouri. Pop. (1890) 10,294; (1900) 14,210, of whom 1638 were foreign-born; (1910) 17,528. Alton is served by the Chicago & Alton, the Chicago, Peoria & St Louis, the Cleveland, Cincinnati, Chicago & St Louis, and the Illinois Terminal railways. The river is here spanned by a bridge. The residential portion of the city lies on the river bluffs, some of which rise to a height of 250 ft. above the water level, and the business streets are on the bottom lands of the river. Alton has a public library and a public park. Upper Alton (pop. 2373 in 1900), about 1½ m. N.E. of Alton, is the seat of the Western Military Academy (founded in 1879 as Wyman Institute; chartered in 1892), and of Shurtleff College (Baptist, founded in 1827 at Rock Spring, removed to Upper Alton in 1831, and chartered in 1833), which has a college of liberal arts, a divinity school, an academy and a school of music; and the village of Godfrey, 5½ m. N. of Alton, is the seat of the Monticello Ladies' Seminary, founded by Benjamin Godfrey, opened in 1838, and chartered in 1841. Among the manufactures of Alton are iron and glass ware, miners' tools, shovels, coal-mine cars, flour, and agricultural implements; and there are a large oil refinery and a large lead smelter. The value of the city's factory products increased from $4,250,380 in 1900 to $8,696,814 in 1905, or 104·6 %.

The first settlement on the site of Alton was made in 1807, when a trading post was established by the French. The town was laid out in 1817, was first incorporated in 1821, and in 1827 was made the seat of a state penitentiary, which was later removed to Joliet, the last prisoners being transferred in 1860. Alton was first chartered as a city in 1837. In 1836 the Rev. Elijah P. Lovejoy (1802–1837), a native of Albion, Maine, removed the *Observer*, a religious (Presbyterian) periodical of which he was the editor, from St Louis to Alton. He had attracted considerable attention in St Louis by his criticisms of slavery, but though he believed in emancipation, he was not a radical abolitionist. After coming to Alton his anti-slavery views soon became more radical, and in a few months he was an avowed abolitionist. His views were shared by his brother, Owen Lovejoy (1811–1864), a Congregational minister, who also at that time lived in Alton, and who from 1857 until his death was an able anti-slavery member of Congress. Most of the people of southern Illinois were in sympathy with slavery, and consequently the Lovejoys became very unpopular. The press of the *Observer* was three time destroyed, and on the 7th of November 1837 E. P. Lovejoy was killed while attempting to defend against a mob a fourth press which he had recently obtained and which was stored in a warehouse in Alton. His death caused intense excitement throughout the country, and he was everywhere regarded by abolitionists as a martyr to their cause. In 1897 a monument, a granite column surmounted by a bronze statue of Victory, was erected in his honour by the citizens of Alton and by the state.

See Henry Tanner, *The Martyrdom of Lovejoy* (Chicago, 1881), and "The Alton Tragedy" in S. J. May's *Some Recollections of Our Anti-Slavery Conflict* (Boston, 1869).

ALTONA, a town of Germany, in the Prussian province of Schleswig-Holstein, on the right bank of the Elbe immediately west of Hamburg. Though administratively distinct, the two cities so closely adjoin as virtually to form one whole. Lying higher than Hamburg, Altona enjoys a purer and healthier atmosphere. It has spacious squares and streets, among the latter the Palmaille, a stately avenue ending on a terrace about 100 ft. above the Elbe, whence a fine view is obtained of the river and the lowlands beyond. Of the six Evangelical churches, the Hauptkirche (parish church), with a lofty steeple, is noteworthy. The main thoroughfares are embellished by several striking monuments, notably the memorials of the wars of 1864 and 1870, bronze statues of the emperor William I. and Bismarck and the column of Victory (*Siegessäule*). The museum (1901) is an imposing building in the German Renaissance style and contains, in addition to a valuable library, ethnographical and natural history collections. Its site is that formerly occupied by the terminus of the Schleswig-Holstein railways, but a handsome central station lying somewhat farther to the N., connected with Hamburg by an elevated railway, now accommodates all the traffic and provides through communication with the main Prussian railway systems. There are also fine municipal and judicial buildings, a theatre (under the same management as the Stadttheater in Hamburg), a gymnasium, technical schools, a school of navigation and a hospital. In respect of its local industries Altona has manufactures of tobacco and cigars, of machinery, woollens, cottons and chemicals. There are also extensive breweries, tanneries and soap and oil works. Altona carries on an extensive maritime trade with Great Britain, France and America, but it has by no means succeeded in depriving Hamburg of its commercial superiority—indeed, so dependent is it upon its rival that most of its business is transacted on the Hamburg exchange, while the magnificent warehouses on the Altona river bank are to a large extent occupied by the goods of Hamburg merchants. Since 1888, when Altona joined the imperial Zollverein, approximately half a million sterling has been spent upon harbour improvement works. The exports and imports resemble those of Hamburg. In the ten years 1871–1880, the port was entered on an average annually by 737 vessels of 67,735 tons, in 1881–1890 by 608 vessels of 154,713 tons, and in 1891–1898 by 839 vessels of 253,384 tons.

In 1890 the populous suburbs of Ottensen to the W., where the poet Gottlieb Klopstock lies buried, Bahrenfeld, Othmarschen and Övelgönne were incorporated. Without these suburbs the growth of the town may be seen from the following figures:—(1864, when it ceased to be Danish) 53,039; (1880) 91,049; (1885) 104,717; (1890) together with the four suburbs, 143,249; (1895) 148,944; (1900) 161,508; (1905) 168,301. Altona is the headquarters of the IX. German army corps.

The name Altona is said to be derived from *allzu-nah* ("all too near"), the Hamburgers' designation for an inn which in the middle of the 16th century lay too close to their territory. For a long time this was the only house in the locality. When in 1640 Altona passed to Denmark it was a small fishing village. Its rise to its present position is mainly due to the fostering care of the Danish kings who conferred certain customs privileges and exemptions upon it with a view to making it a formidable rival to Hamburg. In 1713 it was burnt by the Swedes, but rapidly recovered from this disaster, and despite the trials of the Napoleonic wars, gradually increased in prosperity. In 1853, owing to the withdrawal by Denmark of its customs privileges, its trade waned. In 1864 Altona was occupied in the name of the German Confederation, passed to Prussia after the war of 1866, and 1888 together with Hamburg joined the Zollverein, while retaining certain free trade rights over the *Freihafengebiet* which it shares with Hamburg and Wandsbek.

See Wichmann, *Geschichte Altonas* (2 vols., Alt., 1896); Ehrenberg & Stahl, *Altonas topographische Entwickelung* (Alt., 1894).

ALTOONA, a city of Blair county, Pennsylvania, U.S.A., about 117 m. E. by N. of Pittsburg. Pop. (1890) 30,337; (1900) 38,973, of whom 3301 were foreign-born, 1518 being German; (1910) 52,127. It lies in the upper end of Logan Valley at the base of the Alleghany mountains, about 1180 ft. above sea-level, and commands views of some of the most picturesque mountain scenery in the state. A short distance to the W. is the famous Horseshoe Bend of the Pennsylvania railway. Altoona is served by the Pennsylvania railway, and is one of the leading railway cities in the United States. Its freight yard is 7 m. long, and has 221 m. of tracks. Large numbers of eastbound coal trains from the mountains and westbound "empties" returning to the mines stop here; and the cars of these trains are classified here and new trains made up. Locomotives and cars are sent to Altoona to be repaired from all over the Pennsylvania railway system E. of Pittsburg, and cars and locomotives are built here; and in the south Altoona foundries car wheels and general castings for locomotives and cars are made. The several departments of railway work are used to give training in a sort of railway university. Graduates of technical schools are received as special apprentices and are directed in a course of four years through the erecting shops, vice shop, blacksmith shop, boiler shop, roundhouse, test department, machine shop, air-brake shop, iron foundry, car shop, work of firing on the road, office work in the motive power accounting department, and drawing room; the most competent may be admitted through the grades of inspector, in the office of the master mechanic or of the road foreman of engines, assistant master mechanic, assistant engineer of motive power, master mechanic and superintendent of motive power. The Pennsylvania railway, co-operating with the public school authorities, established at Altoona, in 1907, a railway high school, the first institution of the kind in the country. It has a well-equipped drawing room, carpenter shop, forging room, foundry, science laboratories and machinery department, in which expert instruction is given. In 1905 the city's factory products were valued at $14,349,963, and in this year the railway shops gave employment to 83·7 % of all wage-earners employed in manufacturing establishments. The manufacture of silk is the only other important industry in the city. The site of the city (formerly farming land) was purchased in 1849 by the Pennsylvania Railroad Company and was laid out as a town. It was incorporated as a borough in 1854 and was chartered as a city in 1868.

ALTO-RELIEVO (Ital. for "high relief"), the term applied to sculpture that projects from the plane to which it is attached to the extent of more than one-half the outline of the principal figures, which may be nearly or in parts entirely detached from the background. It is thus distinguished from *basso-relievo* (*q.v.*), in which there is a greater or less approximation in effect to the pictorial method, the figures being made to appear as projecting more than half their outline without actually doing so. At the same time it is not only the actual degree of relief which is implied by these two terms, but a resultant difference also of design and treatment necessitated by the contingent differences of light and shadow. (See RELIEF and SCULPTURE.)

ALTÖTTING, a town of Germany, in the kingdom of Bavaria, on the Mörren, not far from its junction with the Inn, and on the Mühldorf-Burghausen railway. Pop. (1900) 4344. It has long been a place of pilgrimage to which Roman Catholics, especially from Austria, Bavaria and Swabia resort in large numbers, on account of a celebrated image of the Virgin Mary in the Holy Chapel, which also contains the hearts of some Bavarian princes in silver caskets. In the church of St Peter and St Paul is the tomb of Tilly.

ALTRANSTÄDT, a village of Germany, in Prussian Saxony near Merseburg (*q.v.*), with (1900) 813 inhabitants. Altranstädt is famous in history for two treaties concluded here: (1) the peace which Augustus II., king of Poland and elector of Saxony, was forced to ratify, on the 24th of September 1706, with Charles XII. of Sweden, whereby the former renounced the throne of Poland in favour of Stanislaus Leszczynski—a treaty which Augustus declared null and void after Charles XII.'s defeat at Poltava (8th of July 1709); (2) the treaty of the 31st of August 1707, by which the emperor Joseph I. guaranteed to Charles XII. religious tolerance and liberty of conscience for the Silesian protestants.

ALTRINCHAM, or ALTRINGHAM (and so pronounced), a market-town in the Altrincham parliamentary division of Cheshire, England, 8 m. S.W. by S. of Manchester, on the London

& North-Western, Manchester, South Junction & Altrincham and Cheshire Lines railways. Pop. of urban district (1901) 16,831. Many residences in the locality are occupied by those whose business lies in Manchester, who are attracted by the healthy climate and the vicinity of Bowdon Downs and Dunham Massey Woods. Market gardening is carried on, large quantities of fruit and flowers being grown for sale in Manchester. Cabinet-making is also practised; and there are sawmills, iron foundries, and manufactures of cotton, yarn and worsted.

Altrincham (Aldringham) was originally included in the barony of Dunham Massey, one of the eight baronies founded by Hugh, earl of Chester, after the Conquest. An undated charter from Hamo de Massey, lord of the barony, in the reign of Edward I., constituted Altrincham a free borough, with a gild merchant, the customs of Macclesfield, the right to elect reeves and bailiffs for the common council and other privileges. In 1290 the same Hamo obtained a grant of a Tuesday market and a three days' fair at the feast of the Assumption of the Virgin; but in 1319, by a charter from Edward II., the date of the fair was changed to the feast of St James the Apostle. A mayor of Altrincham is mentioned by name in 1452, but the office probably existed long before this date; it has now for centuries been a purely nominal appointment, the chief duty consisting in the opening of the annual fairs. The trade in worsted and woollen yarns, which formerly furnished employment to a large section of the population, has now completely declined, partly owing to the introduction of Irish worsted.

See *Victoria County History, Cheshire*; Alfred Ingham, *History of Altrincham and Bowdon* (Altrincham, 1879).

ALTRUISM (Fr. *autrui*, from Lat. *alter*, the other of two), a philosophical term used in ethics for that theory of conduct which regards the good of others as the end of moral action. It was invented by Auguste Comte and adopted by the English positivists as a convenient antithesis to egoism. According to Comte the only practical method of social regeneration is gradually to inculcate the true social feeling which subordinates itself to the welfare of others. The application to sociological problems of the physical theory of organic evolution further developed the altruistic theory. According to Herbert Spencer, the life of the individual in the perfect society is identical with that of the state: in other words, the first object of him who would live well must be to take his part in promoting the well-being of his fellows individually and collectively. Pure egoism and pure altruism are alike impracticable. For on the one hand unless the egoist's happiness is compatible to some extent with that of his fellows, their opposition will almost inevitably vitiate his perfect enjoyment; on the other hand, the altruist whose primary object is the good of others, must derive his own highest happiness—*i.e.* must realize himself most completely—in the fulfilment of this object. In fact, the altruistic idea, in itself and apart from a further definition of the good, is rather a method than an end.

The self-love theory of Hobbes, with its subtle perversions of the motives of ordinary humanity, led to a reaction which culminated in the utilitarianism of Bentham and the two Mills; but their theory, though superior to the extravagant egoism of Hobbes, had this main defect, according to Herbert Spencer, that it conceived the world as an aggregate of units, and was so far individualistic. Sir Leslie Stephen in his *Science of Ethics* insisted that the unit is the social organism, and therefore that the aim of moralists is not the "greatest happiness of the greatest number," but rather the "health of the organism." The socialistic tendencies of subsequent thinkers have emphasized the ethical importance of altruistic action, but it must be remembered always that it is ultimately only a form of action, that it may be commended in all types of ethical theory, and that it is a practical guide only when it is applied in accordance with a definite theory of "the good." Finally, he who devotes himself on principle to furthering the good of others as his highest moral obligation is from the highest point of view realizing, not sacrificing, himself.

See works of Comte, Spencer, Stephen, and text-books of ethics (cf. bibliography at end of article ETHICS).

ALTWASSER, a town of Germany, in the Prussian province of Silesia, 43 m. by rail S.W. from Breslau, and 3 m. N. from Waldenburg. It has factories for glass, porcelain, machinery, cotton-spinning, iron-foundries and coal-mines. Pop. (1900) 12,144.

ALTYN-TAGH, or ASTYN-TAGH, one of the chief constituent ranges of the Kuen-lun (*q.v.*) in Central Asia, separating Tibet from east Turkestan and the Desert of Gobi.

ALUM, in chemistry, a term given to the crystallized double sulphates of the typical formula $M_2SO_4 \cdot M_2^{III} \cdot (SO_4)_3 24H_2O$, where M is the sign of an alkali metal (potassium, sodium, rubidium, caesium), silver or ammonium, and M^{III} denotes one of the trivalent metals, aluminium, chromium or ferric iron. These salts are employed in dyeing and various other industrial processes. They are soluble in water, have an astringent, acid, and sweetish taste, react acid to litmus, and crystallize in regular octahedra. When heated they liquefy; and if the heating be continued, the water of crystallization is driven off, the salt froths and swells, and at last an amorphous powder remains.

Potash alum is the common alum of commerce, although both soda alum and ammonium alum are manufactured. The presence of sulphuric acid in potash alum was known to the alchemists. J. H. Pott and A. S. Marggraf demonstrated that alumina was another constituent. Pott in his *Lithogeognosia* showed that the precipitate obtained when an alkali is poured into a solution of alum is quite different from lime and chalk, with which it had been confounded by G. E. Stahl. Marggraf showed that alumina is one of the constituents of alum, but that this earth possesses peculiar properties, and is one of the ingredients in common clay (*Expériences faites sur la terre de l'alun*, Marggraf's *Opusc.* ii. 111). He also showed that crystals of alum cannot be obtained by dissolving alumina in sulphuric acid and evaporating the solutions, but when a solution of potash or ammonia is dropped into this liquid, it immediately deposits perfect crystals of alum (*Sur la régénération de l'alun*, Marggraf's *Opusc.* ii. 86).

T. O. Bergman also observed that the addition of potash or ammonia made the solution of alumina in sulphuric acid crystallize, but that the same effect was not produced by the addition of soda or of lime (*De confectione aluminus*, Bergman's *Opusc.* i. 225), and that potassium sulphate is frequently found in alum.

After M. H. Klaproth had discovered the presence of potassium in leucite and lepidolite, it occurred to L. N. Vauquel in that it was probably an ingredient likewise in many other minerals. Knowing that alum cannot be obtained in crystals without the addition of potash, he began to suspect that this alkali constituted an essential ingredient in the salt, and in 1797 he published a dissertation demonstrating that alum is a double salt, composed of sulphuric acid, alumina and potash (*Annales de chimie*, xxii. 258). Soon after, J. A. Chaptal published the analysis of four different kinds of alum, namely, Roman alum, Levant alum, British alum and alum manufactured by himself. This analysis led to the same result as that of Vauquelin (*Ann. de chim.* xxii. 280).

The word *alumen*, which we translate *alum*, occurs in Pliny's *Natural History*. In the 15th chapter of his 35th book he gives a detailed description of it. By comparing this with the account of *στυπτηρία* given by Dioscorides in the 123rd chapter of his 5th book, it is obvious that the two are identical. Pliny informs us that alumen was found naturally in the earth. He calls it *salsugoterrae*. Different substances were distinguished by the name of "alumen"; but they were all characterized by a certain degree of astringency, and were all employed in dyeing and medicine, the light-coloured alumen being useful in brilliant dyes, the dark-coloured only in dyeing black or very dark colours. One species was a liquid, which was apt to be adulterated; but when pure it had the property of blackening when added to pomegranate juice. This property seems to characterize a solution of iron sulphate in water; a solution of ordinary (potash) alum would possess no such property. Pliny says that there is another kind of alum which the Greeks call *schistos*. It forms in white threads upon the surface of certain stones. From the name *schistos*, and the mode of formation, there can be little doubt that this species was the salt which forms spontaneously on certain slaty minerals, as alum slate and bituminous shale, and which consists chiefly of the sulphates of iron and aluminium. Possibly in certain places the iron sulphate may have been nearly wanting, and then the salt would be white, and would answer, as Pliny says it did, for dyeing bright colours. Several other species of alumen are described by Pliny, but we are unable to make out to what minerals he alludes.

The alumen of the ancients, then, was not the same with the alum of the moderns. It was most commonly an iron sulphate, sometimes probably an aluminium sulphate, and usually a mixture of the two. But the ancients were unacquainted with our alum. They were acquainted with a crystallized iron sulphate, and distinguished it by the names of *misy*, *sory*, *chalcanthum* (Pliny xxxiv. 12). As alum and green vitriol were applied to a variety of substances in common, and as both are distinguished by a sweetish and astringent taste, writers, even after the discovery of alum, do not seem to have discriminated the two salts accurately from each other. In the writings of the alchemists we find the words *misy*, *sory*, *chalcanthum* applied to alum as well as to iron sulphate; and the name *atramentum sutorium*, which ought to belong, one would suppose, exclusively to green vitriol, applied indifferently to both. Various minerals are employed in the manufacture of alum, the most important being alunite (*q.v.*) or alum-stone, alum schist, bauxite and cryolite.

In order to obtain alum from alunite, it is calcined and then exposed to the action of air for a considerable time. During this exposure it is kept continually moistened with water, so that it ultimately falls to a very fine powder. This powder is then lixiviated with hot water, the liquor decanted, and the alum allowed to crystallize. The alum schists employed in the manufacture of alum are mixtures of iron pyrites, aluminium silicate and various bituminous substances, and are found in upper Bavaria, Bohemia, Belgium and Scotland. These are either roasted or exposed to the weathering action of the air. In the roasting process, sulphuric acid is formed and acts on the clay to form aluminium sulphate, a similar condition of affairs being produced during weathering. The mass is now systematically extracted with water, and a solution of aluminium sulphate of specific gravity 1·16 is prepared. This solution is allowed to stand for some time (in order that any calcium sulphate and basic ferric sulphate may separate), and is then evaporated until ferrous sulphate crystallizes on cooling; it is then drawn off and evaporated until it attains a specific gravity of 1·40. It is now allowed to stand for some time, decanted from any sediment, and finally mixed with the calculated quantity of potassium sulphate (or if ammonium alum is required, with ammonium sulphate), well agitated, and the alum is thrown down as a finely-divided precipitate of alum meal. If much iron should be present in the shale then it is preferable to use potassium chloride in place of potassium sulphate.

In the preparation of alum from clays or from bauxite, the material is gently calcined, then mixed with sulphuric acid and heated gradually to boiling; it is allowed to stand for some time, the clear solution drawn off and mixed with acid potassium sulphate and allowed to crystallize. When cryolite is used for the preparation of alum, it is mixed with calcium carbonate and heated. By this means, sodium aluminate is formed; it is then extracted with water and precipitated either by sodium bicarbonate or by passing a current of carbon dioxide through the solution. The precipitate is then dissolved in sulphuric acid, the requisite amount of potassium sulphate added and the solution allowed to crystallize.

Potash alum, $K_2SO_4{\cdot}Al_2(SO_4)_3{\cdot}24H_2O$, crystallizes in regular octahedra and is very soluble in water. The solution reddens litmus and is an astringent. When heated to nearly a red heat it gives a porous friable mass which is known as "burnt alum." It fuses at 92° C. in its own water of crystallization. "Neutral alum" is obtained by the addition of as much sodium carbonate to a solution of alum as will begin to cause the separation of alumina; it is much used in mordanting. Alum finds application as a mordant, in the preparation of lakes for sizing hand-made paper and in the clarifying of turbid liquids.

Sodium alum, $Na_2SO_4{\cdot}Al_2(SO_4)_3{\cdot}24H_2O$, occurs in nature as the mineral mendozite. It is very soluble in water, and is extremely difficult to purify. In the preparation of this salt, it is preferable to mix the component solutions in the cold, and to evaporate them at a temperature not exceeding 60° C. 100 parts of water dissolve 110 parts of sodium alum at 0° C. (W. A. Tilden, *Jour. Chem. Soc.*, 1884, 45, p. 409), and 51 parts at 16° C. (E. Augé, *Comptes rendus*, 1890, 110, p. 1130).

Chrome alum, $K_2SO_4{\cdot}Cr_2(SO_4)_3{\cdot}24H_2O$, appears chiefly as a by-product in the manufacture of alizarin, and as a product of the reaction in bichromate batteries.

The solubility of the various alums in water varies greatly, sodium alum being readily soluble in water, whilst caesium and rubidium alums are only sparingly soluble. The various solubilities are shown in the following table:—

Ammonium Alum.		Caesium Alum.		Potash Alum.		Rubidium Alum.	
t°C.	100 parts water dissolve.	t°C.	100 parts water dissolve.	t°C.	100 parts water dissolve.	t°C.	100 parts water dissolve.
0	2·62	0	0·19	0	3·9	0	0·71
10	4·5	10	0·29	10	9·52	10	1·09
50	15·9	50	1·235	50	44·11	50	4·98
80	35·2	80	5·29	80	134·47	80	21·60
100	70·83			100	357·48		
Poggiale *Ann. Chim. phys.* [3] 8, p. 467.		C. Setterberg *Ann.* 1882, 211, p. 104.		Poggiale		C. Setterberg	

ALUMINIUM (symbol *Al*; atomic weight 27·0), a metallic chemical element. Although never met with in the free state, aluminium is very widely distributed in combination, principally as silicates. The word is derived from the Lat. *alumen* (see ALUM), and is probably akin to the Gr. ἅλς (the root of *salt*, *halogen*, &c.). In 1722 F. Hoffmann announced the base of alum to be an individual substance; L. B. Guyton de Morveau suggested that this base should be called *alumine*, after *Sel alumineux*, the French name for alum; and about 1820 the word was changed into *alumina*. In 1760 the French chemist, T. Baron de Henouville, unsuccessfully attempted "to reduce the base of alum" to a metal, and shortly afterwards various other investigators essayed the problem in vain. In 1808 Sir Humphry Davy, fresh from the electrolytic isolation of potassium and sodium, attempted to decompose alumina by heating it with potash in a platinum crucible and submitting the mixture to a current of electricity; in 1809, with a more powerful battery, he raised iron wire to a red heat in contact with alumina, and obtained distinct evidence of the production of an iron-aluminium alloy. Naming the new metal in anticipation of its actual birth, he called it *alumium*; but for the sake of analogy he was soon persuaded to change the word to *aluminum*, in which form, alternately with *aluminium*, it occurs in chemical literature for some thirty years.

Preparation.

In the year 1824, endeavouring to prepare it by chemical means, H. C. Oersted heated its chloride with potassium amalgam, and failed in his object simply by reason of the mercury, so that when F. Wöhler repeated the experiment at Göttingen in 1827, employing potassium alone as the reducing agent, he obtained it in the metallic state for the first time. Contaminated as it was with potassium and with platinum from the crucible, the metal formed a grey powder and was far from pure; but in 1845 he improved his process and succeeded in producing metallic globules wherewith he examined its chief properties, and prepared several compounds hitherto unknown. Early in 1854, H. St Claire Deville, accidentally and in ignorance of Wöhler's later results, imitated the 1845 experiment. At once observing the reduction of the chloride, he realized the importance of his discovery and immediately began to study the commercial production of the metal. His attention was at first divided between two processes—the chemical method of reducing the chloride with potassium, and an electrolytic method of decomposing it with a carbon anode and a platinum cathode, which was simultaneously imagined by himself and R. Bunsen. Both schemes appeared practically impossible; potassium cost about £17 per lb, gave a very small yield and was dangerous to manipulate, while on the other hand, the only source of electric current then available was the primary battery, and zinc as a store of industrial energy was utterly out of the question. Deville accordingly returned to pure chemistry and invented a practicable method of preparing sodium which, having a lower atomic weight than potassium, reduced a larger proportion. He next devised a plan for manufacturing pure alumina from the natural ores, and finally elaborated a process and plant which held the field for almost thirty years. Only the discovery of dynamo-electric machines and their application to metallurgical processes rendered it possible for E. H. and A. H. Cowles to remove the industry from the hands of chemists, till the time when P. T. L. Héroult and C. M. Hall, by devising the electrolytic method now in use, inaugurated the present era of industrial electrolysis.

Ores.

The chief natural compounds of aluminium are four in number: oxide, hydroxide (hydrated oxide), silicate and fluoride. *Corundum*, the only important native oxide (Al_2O_3), occurs in large deposits in southern India and the United States. Although it contains a higher percentage of metal (52·9 %) than any other natural compound, it is not at present employed as an ore, not only because it is so hard as to be crushed with difficulty, but also because its very hardness makes it valuable as an abrasive. *Cryolite* ($AlF_3 \cdot 5NaF$) is a double fluoride of aluminium and sodium, which is scarcely known except on the west coast of Greenland. Formerly it was used for the preparation of the metal, but the inaccessibility of its source, and the fact that it is not sufficiently pure to be employed without some preliminary treatment, caused it to be abandoned in favour of other salts. When required in the Héroult-Hall process as a solvent, it is sometimes made artificially. Aluminium silicate is the chemical body of which all clays are nominally composed. *Kaolin* or *China clay* is essentially a pure disilicate ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$), occurring in large beds almost throughout the world, and containing in its anhydrous state 24·4 % of the metal, which, however, in common clays is more or less replaced by calcium, magnesium, and the alkalis, the proportion of silica sometimes reaching 70 %. Kaolin thus seems to be the best ore, and it would undoubtedly be used were it not for the fatal objection that no satisfactory process has yet been discovered for preparing pure alumina from any mineral silicate. If, according to the present method of winning the metal, a bath containing silica as well as alumina is submitted to electrolysis, both oxides are dissociated, and as silicon is a very undesirable impurity, an alumina contaminated with silica is not suited for reduction. *Bauxite* is a hydrated oxide of aluminium of the ideal composition, $Al_2O_3 \cdot 2H_2O$. It is a somewhat widely distributed mineral, being met with in Styria, Austria, Hesse, French Guiana, India and Italy; but the most important beds are in the south of France, the north of Ireland, and in Alabama, Georgia and Arkansas in North America. The chief Irish deposits are in the neighbourhood of Glenravel, Co. Antrim, and have the advantage of being near the coast, so that the alumina can be transported by water-carriage. After being dried at 100° C., Antrim bauxite contains from 33 to 60 % of alumina, from 2 to 30% of ferric oxide, and from 7 to 24 % of silica, the balance being titanic acid and water of combination. The American bauxites contain from 38 to 67 % of alumina, from 1 to 23 % of ferric oxide, and from 1 to 32 % of silica. The French bauxites are of fairly constant composition, containing usually from 58 to 70 % of alumina, 3 to 15 % of foreign matter, and 27 % made up of silica, iron oxide and water in proportions that vary with the colour and the situation of the beds.

Before the application of electricity, only two compounds were found suitable for reduction to the metallic state. Alumina itself is so refractory that it cannot be melted save by the oxy-hydrogen blowpipe or the electric arc, and except in the molten state it is not susceptible of decomposition by any chemical reagent. Deville first selected the chloride as his raw material, but observing it to be volatile and extremely deliquescent, he soon substituted in its place a double chloride of aluminium and sodium. Early in 1855 John Percy suggested that cryolite should be more convenient, as it was a natural mineral and might not require purification, and at the end of March in that year, Faraday exhibited before the Royal Institution samples of the metal reduced from its fluoride by Dick and Smith. H. Rose also carried out experiments on the decomposition of cryolite, and expressed an opinion that it was the best of all compounds for reduction; but, finding the yield of metal to be low, receiving a report of the difficulties experienced in mining the ore, and fearing to cripple his new industry by basing it upon the employment of a mineral of such uncertain supply, Deville decided to keep to his chlorides. With the advent of the dynamo, the position of affairs was wholly changed. The first successful idea of using electricity depended on the enormous heating powers of the arc. The infusibility of alumina was no longer prohibitive, for the molten oxide is easily reduced by carbon. Nevertheless, it was found impracticable to smelt alumina electrically except in presence of copper, so that the Cowles furnace yielded, not the pure metal, but an alloy. So long as the metal was principally regarded as a necessary ingredient of aluminium-bronze, the Cowles process was popular, but when the advantages of aluminium itself became more apparent, there arose a fresh demand for some chief method of obtaining it unalloyed. It was soon discovered that the faculty of inducing dissociation possessed by the current might now be utilized with some hope of pecuniary success, but as electrolytic currents are of lower voltage than those required in electric furnaces, molten alumina again became impossible. Many metals, of which copper, silver and nickel are types, can be readily won or purified by the electrolysis of aqueous solutions, and theoretically it may be feasible to treat aluminium in an identical manner. In practice, however, it cannot be thrown down electrolytically with a dissimilar anode so as to win the metal, and certain difficulties are still met with in the analogous operation of plating by means of a similar anode. Of the simple compounds, only the fluoride is amenable to electrolysis in the fused state, since the chloride begins to volatilize below its melting-point, and the latter is only 5° below its boiling-point. Cryolite is not a safe body to electrolyse, because the minimum voltage needed to break up the aluminium fluoride is 4·0, whereas the sodium fluoride requires only 4·7 volts; if, therefore, the current rises in tension, the alkali is reduced, and the final product consists of an alloy with sodium. The corresponding double chloride is a far better material; first, because it melts at about 180° C., and does not volatilize below a red heat, and second, because the voltage of aluminium chloride is 2·3 and that of sodium chloride 4·3, so that there is a much wider margin of safety to cover irregularities in the electric pressure. It has been found, however, that molten cryolite and the analogous double fluoride represented by the formula $Al_2F_6 \cdot 2NaF$ are very efficient solvents of alumina, and that these solutions can be easily electrolysed at about 800° C. by means of a current that completely decomposes the oxide but leaves the haloid salts unaffected. Molten cryolite dissolves roughly 30 % of its weight of pure alumina, so that when ready for treatment the solution contains about the same proportion of what may be termed "available" aluminium as does the fused double chloride of aluminium and sodium. The advantages lie with the oxide because of its easier preparation. Alumina dissolves readily enough in aqueous hydrochloric acid to yield a solution of the chloride, but neither this solution, nor that containing sodium chloride, can be evaporated to dryness without decomposition. To obtain the anhydrous single or double chloride, alumina must be ignited with carbon in a current of chlorine, and to exclude iron from the finished metal, either the alumina must be pure or the chloride be submitted to purification. This preparation of a chlorine compound suited for electrolysis becomes more costly and more troublesome than that of the oxide, and in addition four times as much raw material must be handled.

At different times propositions have been made to win the metal from its sulphide. This compound possesses a heat of formation so much lower that electrically it needs but a voltage of 0·9 to decompose it, and it is easily soluble in the fused sulphides of the alkali metals. It can also be reduced metallurgically by the action of molten iron. Various considerations, however, tend to show that there cannot be so much advantage in employing it as would appear at first sight. As it is easier to reduce than any other compound, so it is more difficult to produce. Therefore while less energy is absorbed in its final reduction, more is needed in its initial preparation, and it is questionable whether the economy possible in the second stage would not be neutralized by the greater cost of the first stage in the whole operation of winning the metal from bauxite with the sulphide as the intermediary.

Chemical reduction.

The Deville process as gradually elaborated between 1855 and 1859 exhibited three distinct phases:—Production of metallic sodium, formation of the pure double chloride of sodium and aluminium, and preparation of the metal by the interaction of the two former substances. To produce the alkali metal, a calcined mixture of sodium carbonate, coal and chalk was strongly ignited in flat retorts made of boiler-plate; the sodium distilled over into condensers and was preserved under heavy petroleum. In order to prepare pure alumina, bauxite and sodium carbonate were heated in a furnace until the reaction was complete; the product was then extracted with water to dissolve the sodium aluminate, the solution treated with carbon dioxide, and the precipitate removed and dried. This purified oxide, mixed with sodium chloride and coal tar, was carbonized at a red heat, and ignited in a current of dry chlorine as long as vapours of the double chloride were given off, these being condensed in suitable chambers. For the production of the final aluminium, 100 parts of the chloride and 45 parts of cryolite to serve as a flux were powdered together and mixed with 35 parts of sodium cut into small pieces. The whole was thrown in several portions on to the hearth of a furnace previously heated to low redness and was stirred at intervals for three hours. At length when the furnace was tapped a white slag was drawn off from the top, and the liquid metal beneath was received into a ladle and poured into cast-iron moulds. The process was worked out by Deville in his laboratory at the *École Normale* in Paris. Early in 1855 he conducted large-scale experiments at Javel in a factory lent him for the purpose, where he produced sufficient to show at the French Exhibition of 1855. In the spring of 1856 a complete plant was erected at La Glacière, a suburb of Paris, but becoming a nuisance to the neighbours, it was removed to Nanterre in the following year. Later it was again transferred to Salindres, where the manufacture was continued by Messrs. Péchiney till the advent of the present electrolytic process rendered it no longer profitable.

When Deville quitted the Javel works, two brothers C. and A. Tissier, formerly his assistants, who had devised an improved sodium furnace and had acquired a thorough knowledge of their leader's experiments, also left, and erected a factory at Amfreville, near Rouen, to work the cryolite process. It consisted simply in reducing cryolite with metallic sodium exactly as in Deville's chloride method, and it was claimed to possess various mythical advantages over its rival. Two grave disadvantages were soon obvious—the limited supply of ore, and, what was even more serious, the large proportion of silicon in the reduced metal. The Amfreville works existed some eight or ten years, but achieved no permanent prosperity. In 1858 or 1859 a small factory, the first in England, was built by F. W. Gerhard at Battersea, who also employed cryolite, made his own sodium, and was able to sell the product at 3s. 9d. per oz. This enterprise only lasted about four years. Between 1860 and 1874 Messrs Bell Brothers manufactured the metal at Washington, near Newcastle, under Deville's supervision, producing nearly 2 cwt. per year. They took part in the International Exhibition of 1862, quoting a price of 40s. per lb troy.

In 1881 J. Webster patented an improved process for making alumina, and the following year he organized the Aluminium Crown Metal Co. of Hollywood to exploit it in conjunction with Deville's method of reduction. Potash-alum and pitch were calcined together, and the mass was treated with hydrochloric acid; charcoal and water to form a paste were next added, and the whole was dried and ignited in a current of air and steam. The residue, consisting of alumina and potassium sulphate, was leached with water to separate the insoluble matter which was dried as usual. All the by-products, potassium sulphate, sulphur and aluminate of iron, were capable of recovery, and were claimed to reduce the cost of the oxide materially. From this alumina the double chloride was prepared in essentially the same manner as practised at Salindres, but sundry economies accrued in the process, owing to the larger scale of working and to the adoption of W. Weldon's method of regenerating the spent chlorine liquors. In 1886 H. Y. Castner's sodium patents appeared, and The Aluminium Co. of Oldbury was promoted to combine the advantages of Webster's alumina and Castner's sodium. Castner had long been interested in aluminium, and was desirous of lowering its price. Seeing that sodium was the only possible reducing agent, he set himself to cheapen its cost, and deliberately rejecting sodium carbonate for the more expensive sodium hydroxide (caustic soda), and replacing carbon by a mixture of iron and carbon—the so-called carbide of iron—he invented the highly scientific method of winning the alkali metal which has remained in existence almost to the present day. In 1872 sodium prepared by Deville's process cost about 4s. per lb, the greater part of the expense being due to the constant failure of the retorts; in 1887 Castner's sodium cost less than 1s. per lb, for his cast-iron pots survived 125 distillations.

In the same year L. Grabau patented a method of reducing the simple fluoride of aluminium with sodium, and his process was operated at Trotha in Germany. It was distinguished by the unusual purity of the metal obtained, some of his samples containing 99·5 to 99·8 %. In 1888 the Alliance Aluminium Co., organized to work certain patents for winning the metal from cryolite by means of sodium, erected plant in London, Hebburn and Wallsend, and by 1889 were selling the metal at 11s. to 15s. per lb. The Aluminium Company's price in 1888 was 20s. per lb and the output about 250 lb per day. In 1889 the price was 16s., but by 1891 the electricians commenced to offer metal at 4s. per lb, and aluminium reduced with sodium became a thing of the past.

Electrical reduction.

About 1879 dynamos began to be introduced into metallurgical practice, and from that date onwards numerous schemes for utilizing this cheaper source of energy were brought before the public. The first electrical method worthy of notice is that patented by E. H. and A. H. Cowles in 1885, which was worked both at Lockport, New York, U.S.A., and at Milton, Staffordshire. The furnace consisted of a flat, rectangular, firebrick box, packed with a layer of finely-powdered charcoal 2 in. thick. Through stuffing-boxes at the ends passed the two electrodes, made after the fashion of arc-light carbons, and capable of being approached together according to the requirements of the operation. The central space of the furnace was filled with a mixture of corundum, coarsely-powdered charcoal and copper; and an iron lid lined with firebrick was luted in its place to exclude air. The charge was reduced by means of a 50-volt current from a 300-kilowatt dynamo, which was passed through the furnace for 1½ hours till decomposition was complete. About 100 lb of bronze, containing from 15 to 20 lb of aluminium, were obtained from each run, the yield of the alloy being reported at about 1 lb per 18 e.h.p.-hours. The composition of the alloys thus produced could not be predetermined with exactitude; each batch was therefore analysed, a number of them were bulked together or mixed with copper in the necessary proportion, and melted in crucibles to give merchantable bronzes containing between 1¼ and 10% of aluminium. Although the copper took no part in the reaction, its employment was found indispensable, as otherwise the aluminium partly volatilized, and partly combined with the carbon to form a carbide. It was also necessary to give the fine charcoal a thin coating of calcium oxide by soaking it in lime-water, for the temperature was so high that unless it was thus protected it was gradually converted into graphite, losing its insulating power and diffusing the current through the lining and walls of the furnace. That this process did not depend upon electrolysis, but was simply an instance of electrical smelting or the decomposition of an oxide by means of carbon at the temperature of the electric arc, is shown by the fact that the Cowles furnace would work with an alternating current.

In 1883 R. Grätzel patented a useless electrolytic process with fused cryolite or the double chloride as the raw material, and in 1886 Dr E. Kleiner propounded a cryolite method which was worked for a time by the Aluminium Syndicate at Tyldesley near Manchester, but was abandoned in 1890. In 1887 A. Minet took out patents for electrolysing a mixture of sodium chloride with aluminium fluoride, or with natural or artificial cryolite. The operation was continuous, the metal being regularly run off from the bottom of the bath, while fresh alumina and flouride were added as required. The process exhibited several disadvantages, the electrolyte had to be kept constant in composition lest either fluorine vapours should be evolved or sodium thrown down, and the raw materials had accordingly to be prepared in a pure state. After prolonged experiments in a factory owned by Messrs Bernard Frères at St Michel in Savoy, Minet's process was given up, and at the close of the 19th century the Héroult-Hall method was alone being employed in the manufacture of aluminium throughout the world.

The original Deville process for obtaining pure alumina from bauxite was greatly simplified in 1889 by K. T. Bayer, whose improved process is exploited at Larne in Ireland and at Gardanne in France. New works on the same process have recently been erected near Marseilles. Crude bauxite is ground, lightly calcined to destroy organic matter, and agitated under a pressure of 70 or 80 lb per sq. in. with a solution of sodium hydroxide having the specific gravity 1·45. After two or three hours the liquid is diluted till its density falls to 1.23, when it is passed through filter-presses to remove the insoluble ferric oxide and silica. The solution of sodium aluminate, containing aluminium oxide and sodium oxide in the molecular proportion of 6 to 1, is next agitated for thirty-six hours with a small quantity of hydrated alumina previously obtained, which causes the liquor to decompose, and some 70% of the aluminium hydroxide to be thrown down. The filtrate, now containing roughly two molecules of alumina to one of soda, is concentrated to the original gravity of 1·45, and employed instead of fresh caustic for the attack of more bauxite; the precipitate is then collected, washed till free from soda, dried and ignited at about 1000° C. to convert it into a crystalline oxide which is less hygroscopic than the former amorphous variety.

The process of manufacture which now remains to be described was patented during 1886 and 1887 in the name of C. M. Hall in America, in that of P. T. L. Héroult in England and France. It would be idle to discuss to whom the credit of first imagining the method rightfully belongs, for probably this is only one of the many occasions when new ideas have been born in several brains at the same time. By 1888 Hall was at work on a commercial scale at Pittsburg, reducing German alumina; in 1891 the plant was removed to New Kensington for economy in fuel, and was gradually enlarged to 1500 h.p.; in 1894 a factory driven by water was erected at Niagara Falls, and subsequently works were established at Shawenegan in Canada and at Massena in the United States. In 1890 also the Hall process operated by steam power was installed at Patricroft, Lancashire, where the plant had a capacity of 300 lb per day, but by 1894 the turbines of the Swiss and French works ruined the enterprise. About 1897 the Bernard factory at St Michel passed into the hands of Messrs Péchiney, the machinery soon being increased, and there, under the control of a firm that has been concerned in the industry almost from its inception, aluminium is being manufactured by the Hall process on a large scale. In July 1888 the *Société Métallurgique Suisse* erected plant driven by a 500 h.p. turbine to carry out Héroult's alloy process, and at the end of that year the *Allgemeine Elektricitäts Gesellschaft* united with the Swiss firm in organizing the *Aluminium Industrie Actien Gesellschaft* of Neuhasen, which has factories in Switzerland, Germany and Austria. The *Société Electrométallurgique Française*, started under the direction of Héroult in 1888 for the production of aluminium in France, began operations on a small scale at Froges in Isère; but soon after large works were erected in Savoy at La Praz, near Modane, and in 1905 another large factory was started in Savoy at St Michel. In 1895 the British Aluminium Company was founded to mine bauxite and manufacture alumina in Ireland, to prepare the necessary electrodes at Greenock, to reduce the aluminium by the aid of water-power at the Falls of Foyers, and to refine and work up the metal into marketable shapes at the old Milton factory of the Cowles Syndicate, remodelled to suit modern requirements. In 1905 this company began works for the utilization of another water-power at Loch Leven.

In 1907 a new company, The Aluminium Corporation, was started in England to carry out the production of the metal by the Héroult process, and new factories were constructed near Conway in North Wales and at Wallsend-on-Tyne, quite close to where, twenty years before, the Alliance Aluminium Co. had their works.

The Héroult cell consists of a square iron or steel box lined with carbon rammed and baked into a solid mass; at the bottom is a cast-iron plate connected with the negative pole of the dynamo, but the actual working cathode is undoubtedly the layer of already reduced and molten metal that lies in the bath. The anode is formed of a bundle of carbon rods suspended from overhead so as to be capable of vertical adjustment. The cell is filled up with cryolite, and the current is turned on till this is melted; then the pure powdered alumina is fed in continuously as long as the operation proceeds. The current is supplied at a tension of 3 to 5 volts per cell, passing through 10 or 12 in series; and it performs two distinct functions:—(1) it overcomes the chemical affinity of the aluminium oxide, (2) it overcomes the resistance of the electrolyte, heating the liquid at the same time. As a part of the voltage is consumed in the latter duty, only the residue can be converted into chemical work, and as the theoretical voltage of the aluminium fluoride in the cryolite is 4·0, provided the bath is kept properly supplied with alumina, the fluorides are not attacked. It follows, therefore, except for mechanical losses, that one charge of cryolite lasts indefinitely, that the sodium and other impurities in it are not liable to contaminate the product, and that only the alumina itself need be carefully purified. The operation is essentially a dissociation of alumina into aluminium, which collects at the cathode, and into oxygen, which combines with the anodes to form carbon monoxide, the latter escaping and being burnt to carbon dioxide outside. Theoretically 36 parts by weight of carbon are oxidized in the production of 54 parts of aluminium; practically the anodes waste at the same rate at which metal is deposited. The current density is about 700 ampères per sq. ft. of cathode surface, and the number of rods in the anode is such that each delivers 6 or 7 ampères per sq. in. of cross-sectional area. The working temperature lies between 750° and 850° C., and the actual yield is 1 lb of metal per 12 e.h.p. hours. The bath is heated internally with the current rather than by means of external fuel, because this arrangement permits the vessel itself to be kept comparatively cool; if it were fired from without, it would be hotter than the electrolyte, and no material suitable for the construction of the cell is competent to withstand the attack of nascent aluminium at high temperatures. Aluminium is so light that it is a matter requiring some ingenuity to select a convenient solvent through which it shall sink quickly, for if it does not sink, it short-circuits the electrolyte. The molten metal has a specific gravity of 2·54, that of molten cryolite saturated with alumina is 2·35, and that of the fluoride Al_2F_6 2NaF saturated with alumina 1·97. The latter therefore appears the better material, and was originally preferred by Hall; cryolite, however, dissolves more alumina, and has been finally adopted by both inventors.

Properties.

Aluminium is a white metal with a characteristic tint which most nearly resembles that of tin; when impure, or after prolonged exposure to air, it has a slight violet shade. Its atomic weight is 27 (26·77, H=1, according to J. Thomsen). It is trivalent. The specific gravity of cast metal is 2·583, and of rolled 2·688 at 4° C. It melts at 626° C. (freezing-point 654·5°, Heycock and Neville). It is the third most malleable and sixth most ductile metal, yielding sheets 0·000025 in. in thickness, and wires 0·004 in. in diameter. When quite pure it is somewhat harder than tin, and its hardness is considerably increased by rolling. It is not magnetic. It stands near the positive end of the list of elements arranged in electromotive series, being exceeded only by the alkalis and metals of the alkaline earths; it therefore combines eagerly, under suitable conditions, with oxygen and chlorine. Its coefficient of linear expansion by heat is 0·0000222 (Richards) or 0·0000231 (Roberts-Austen) per 1° C. Its mean specific heat between 0° and 100° is 0·227, and its latent heat of fusion 100 calories (Richards). Only silver, copper and gold surpass it as conductors of heat, its value being 31·33 (Ag=100, Roberts-Austen). Its electrical conductivity, determined on 99·6 % metal, is 60·5 % that of copper for equal volumes, or double that of copper for equal weights, and when chemically pure it exhibits a somewhat higher relative efficiency. The average strength of 98 % metal is approximately shown by the following table:—

	Elastic Limit, tons per sq. in.	Ultimate Strength, tons per sq. in.	Reduction of Area %
Cast . . .	3	7	15
Sheet . . .	5	11	35
Bars . . .	6	12	40
Wire . . .	7-13	13-29	60

Weight for weight, therefore, aluminium is only exceeded in tensile strength by the best cast steel, and its own alloy, aluminium bronze. An absolutely clean surface becomes tarnished in damp air, an almost invisible coating of oxide being produced, just as happens with zinc; but this film is very permanent and prevents further attack. Exposure to air and rain also causes slight corrosion, but to nothing like the same extent as occurs with iron, copper or brass. Commercial electrolytic aluminium of the best quality contains as the average of a large number of tests, 0·48 % of silicon and 0·46 % of iron, the residue being essentially aluminium itself. The metal in mass is not affected by hot or cold water, the foil is very slowly oxidized, while the amalgam decomposes rapidly. Sulphuretted hydrogen having no action upon it, articles made of it are not blackened in foggy weather or in rooms where crude coal gas is burnt. To inorganic acids, except hydrochloric, it is highly resistant, ranking well with tin in this respect; but alkalis dissolve it quickly. Organic acids such as vinegar, common salt, the natural ingredients of food, and the various extraneous substances used as food preservatives, alone or mixed together, dissolve traces of it if boiled for any length of time in a chemically-clean vessel; but when aluminium utensils are submitted to the ordinary routine of the kitchen, being used to heat or cook milk, coffee, vegetables, meat and even fruit, and are also cleaned frequently in the usual fashion, no appreciable quantity of metal passes into the food. Moreover, did it do so, the action upon the human system would be infinitely less harmful than similar doses of copper or of lead.

The highly electro-positive character of aluminium is most important. At elevated temperatures the metal decomposes nearly all other metallic oxides, wherefore it is most serviceable as a metallurgical reagent. In the casting of iron, steel and brass, the addition of a trifling proportion (0·005 %) removes oxide and renders the molten metal more fluid, causing the finished products to be more homogeneous, free from blow-holes and solid all through. On the other hand, its electro-positive nature necessitates some care in its utilization. If it be exposed to damp, to sea-water or to corrosive influences of any kind in contact with another metal, or if it be mixed with another metal so as to form an alloy which is not a true chemical compound, the other metal being highly negative to it, powerful galvanic action will be set up and the structure will quickly deteriorate. This explains the failure of boats built of commercially pure aluminium which have been put together with iron or copper rivets, and the decay of other boats built of a light alloy, in which the alloying metal (copper) has been injudiciously chosen. It also explains why aluminium is so difficult to join with low-temperature solders, for these mostly contain a large proportion of lead. This disadvantage, however, is often overestimated since in most cases other means of uniting two pieces are available.

Alloys.

The metal produces an enormous number of useful alloys, some of which, containing only 1 or 2 % of other metals, combine the lightness of aluminium itself with far greater hardness and strength. Some with 90 to 99 % of other metals exhibit the general properties of those metals conspicuously improved. Among the heavy alloys, the aluminium bronzes (Cu, 90-97·5 %; Al, 10-2·5 %) occupy the most important position, showing mean tensile strengths increasing from 20 to 41 tons per sq. in. as the percentage of aluminium rises, and all strongly resisting corrosion in air or sea-water. The light copper alloys, in which the proportions just given are practically reversed, are of considerably less utility, for although they are fairly strong, they lack power to resist galvanic action. This subject is far from being exhausted, and it is not improbable that the alloy-producing capacity of aluminium may eventually prove its most valuable characteristic. In the meantime, ternary light alloys appear the most satisfactory, and tungsten and copper, or tungsten and nickel, seem to be the best substances to add.

Uses.

The uses of aluminium are too numerous to mention. Probably the widest field is still in the purification of iron and steel. To the general public it appeals most strongly as a material for constructing cooking utensils. It is not brittle like porcelain and cast iron, not poisonous like lead-glazed earthenware and untinned copper, needs no enamel to chip off, does not rust and wear out like cheap tin-plate, and weighs but a fraction of other substances. It is largely replacing brass and copper in all departments of industry—especially where dead weight has to be moved about, and lightness is synonymous with economy—for instance, in bed-plates for torpedo-boat engines, internal fittings for ships instead of wood, complete boats for portage, motor-car parts and boiling-pans for confectionery and in chemical works. The British Admiralty employ it to save weight in the Navy, and the war-offices of the European powers equip their soldiers with it wherever possible. As a substitute for Solenhofen stone it is used in a modified form of lithography, which can be performed on rotary printing-machines at a high speed. With the increasing price of copper, it is coming into vogue as an electrical conductor for uncovered mains; it is found that an aluminium wire 0·126 in. in diameter will carry as much current as a copper wire 0·100 in. in diameter, while the former weighs about 79 lb and the latter 162 lb per mile. Assuming the materials to be of equal tensile strength per unit of area—hard-drawn copper is stronger, but has a lower conductivity—the adoption of aluminium thus leads to a reduction of 52 % in the weight, a gain of 60 % in the strength, and an increase of 26 % in the diameter of the conductor. Bare aluminium strip has recently been tried for winding-coils in electrical machines, the oxide of the metal acting as insulators between the layers. When the price of aluminium is less than double the price of copper aluminium is cheaper than copper per unit of electric current conveyed; but when insulation is necessary, the smaller size of the copper wire renders it more economical. Aluminium conductors have been employed on heavy work in many places, and for telegraphy and telephony they are in frequent demand and give perfect satisfaction. Difficulties were at first encountered in making the necessary joints, but these have been overcome by practice and experience.

Two points connected with this metal are of sufficient moment to demand a few words by way of conclusion. Its extraordinary lightness forms its chief claim to general adoption, yet is apt to cause mistakes when its price is mentioned. It is the weight of a mass of metal which governs its financial value; its industrial value, in the vast majority of cases, depends on the volume of that mass. Provided it be rigid, the bed-plate of an engine is no better for weighing 30 cwt. than for weighing 10 cwt. A saucepan is required to have a certain diameter and a certain depth in order that it may hold a certain bulk of liquid: its weight is merely an encumbrance. Copper being 3⅓ times as heavy as aluminium, whenever the latter costs less than 3⅓ times as much as copper it is actually cheaper. It must be remembered, too, that electrolytic aluminium only became known during the last decade of the 19th century. Samples dating from the old sodium days are still in existence, and when they exhibit unpleasant properties the defect is often ascribed to the metal instead of to the process by which it was won. Much has yet to be learnt about the practical qualities of the electrolytic product, and although every day's experience serves to place the metal in a firmer industrial position, a final verdict can only be passed after the lapse of time. The individual and collective influence of the several impurities which occur in the product of the Héroult cell is still to seek, and the importance of this inquiry will be seen when we consider that if cast iron, wrought iron and steel, the three totally distinct metals included in the generic name of "iron"—which are only distinguished one from another chemically by minute differences in the proportion of certain non-metallic ingredients—had only been in use for a comparatively few years, attempts might occasionally be made to forge cast iron, or to employ wrought iron in the manufacture of edge-tools. (E. J. R.)

Compounds of Aluminium.

Aluminium oxide or *alumina*, Al_2O_3, occurs in nature as the mineral corundum (*q.v.*), notable for its hardness and abrasive power (see EMERY), and in well-crystallized forms it constitutes, when coloured by various metallic oxides, the gem-stones, sapphire, oriental topaz, oriental amethyst and oriental emerald. Alumina is obtained as a white amorphous powder by heating aluminium hydroxide. This powder, provided that it has not been too strongly ignited, is soluble in strong acids; by ignition it becomes denser and nearly as hard as corundum; it fuses in the oxyhydrogen flame or electric arc, and on cooling it assumes a crystalline form closely resembling the mineral species. Crystallized alumina is also obtained by heating the fluoride with boron trioxide; by fusing aluminium phosphate with sodium sulphate; by heating alumina to a dull redness in hydrochloric acid gas under pressure; and by heating alumina with lead oxide to a bright red heat. These reactions are of special interest, for they culminate in the production of artificial ruby and sapphire (see GEMS, ARTIFICIAL).

Aluminium Hydrates.—Several hydrated forms of aluminium oxide are known. Of these hydrargillite or gibbsite, $Al(OH)_3$, diaspore, $AlO(OH)$, and bauxite, $Al_2O(OH)_4$, occur in the mineral kingdom. Aluminium hydrate, $Al(OH)_3$, is obtained as a gelatinous white precipitate, soluble in potassium or sodium hydrate, but insoluble in ammonium chloride, by adding ammonia to a cold solution of an aluminium salt; from boiling solutions the precipitate is opaque. By drying at ordinary temperatures, the hydrate $Al(OH)_3 \cdot H_2O$ is obtained; at 300° this yields $AlO(OH)$, which on ignition gives alumina, Al_2O_3. Precipitated aluminium hydrate finds considerable application in dyeing. Soluble modifications were obtained by Walter Crum (*Journ. Chem. Soc.*, 1854, vi. 216), and Thomas Graham (*Phil. Trans.*, 1861, p. 163); the first named decomposing aluminium acetate (from lead acetate and aluminium sulphate) with boiling water, the latter dialysing a solution of the basic chloride (obtained by dissolving the hydroxide in a solution of the normal chloride). Both these soluble hydrates are readily coagulated by traces of a salt, acid or alkali; Crum's hydrate does not combine with dye-stuffs, neither is it soluble in excess of acid, while Graham's compound readily forms lakes, and readily dissolves when coagulated in acids.

In addition to behaving as a basic oxide, aluminium oxide (or hydrate) behaves as an acid oxide towards the strong bases with the formation of *aluminates*. Potassium aluminate, $K_2Al_2O_4$, is obtained in solution by dissolving aluminium hydrate in caustic potash; it is also obtained, as crystals containing three molecules of water, by fusing alumina with potash, exhausting with water, and crystallizing the solution *in vacuo*. Sodium aluminate is obtained in the manufacture of alumina; it is used as a mordant in dyeing, and has other commercial applications. Other aluminates (in particular, of iron and magnesium), are of frequent occurrence in the mineral kingdom, *e.g.* spinel, gahnite, &c.

Salts of Aluminium.—Aluminium forms one series of salts, derived from the trioxide, Al_2O_3. These exhibit, in certain cases, marked crystallographical and other analogies with the corresponding salts of chromium and ferric iron.

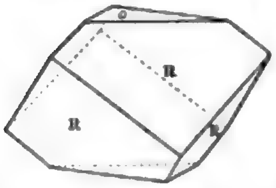
Aluminium fluoride, AlF_3, obtained by dissolving the metal in hydrofluoric acid, and subliming the residue in a current of hydrogen, forms transparent, very obtuse rhombohedra, which are insoluble in water. It forms a series of double fluorides, the most important of which is cryolite (*q.v.*); this mineral has been applied to the commercial preparation of the metal (see above). Aluminium chloride, $AlCl_3$, was first prepared by Oersted, who heated a mixture of carbon and alumina in a current of chlorine, a method subsequently improved by Wöhler, Bunsen, Deville and others. A purer product is obtained by heating aluminium turnings in a current of dry chlorine, when the chloride distils over. So obtained, it is a white crystalline solid, which slowly sublimes just below its melting point (194°). Its vapour density at temperatures above 750° corresponds to the formula $AlCl_3$; below this point the molecules are associated. It is very hygroscopic, absorbing water with the evolution of hydrochloric acid. It combines with ammonia to form $AlCl_3 \cdot 3NH_3$; and forms double compounds with phosphorus pentachloride, phosphorus oxychloride, selenium and tellurium chlorides, as well as with many metallic chlorides; sodium aluminium chloride, $AlCl_3 \cdot NaCl$, is used in the production of the metal. As a synthetical agent in organic chemistry, aluminium chloride has rendered possible more reactions than any other substance; here we can only mention the classic syntheses of benzene homologues. Aluminium bromide, $AlBr_3$, is prepared in the same manner as the chloride. It forms colourless crystals, melting at 90°, and boiling at 265°-270°. Aluminium iodide, AlI_3, results from the interaction of iodine and aluminium. It forms colourless crystals, melting at 185°, and boiling at 360°. Aluminium sulphide, Al_2S_3, results from the direct union of the metal with sulphur, or when carbon disulphide vapour is passed over strongly heated alumina. It forms a yellow fusible mass, which is decomposed by water into alumina and sulphuretted hydrogen. Aluminium sulphate $Al(SO_4)_3$, occurs in the mineral kingdom as keramohalite, $Al_2(SO_4)_3 \cdot 18H_2O$, found near volcanoes and in alum-shale; aluminite or websterite is a basic salt, $Al_2(SO_4)(OH)_4 \cdot 7H_2O$. Aluminium sulphate, known commercially as "concentrated alum" or "sulphate of alumina," is manufactured from kaolin or china clay, which, after roasting (in order to oxidize any iron present), is heated with sulphuric acid, the clear solution run off, and evaporated. "Alum cake" is an impure product. Aluminium sulphate crystallizes as $Al_2(SO_4)_3 \cdot 18H_2O$ in tablets belonging to the monoclinic system. It has a sweet astringent taste, very soluble in water, but scarcely soluble in alcohol. On heating, the crystals lose water, swell up, and give the anhydrous sulphate, which, on further heating, gives alumina. It forms double salts with the sulphates of the metals of the alkalis, known as the alums (see ALUM).

Aluminium nitride (AlN) is obtained as small yellow crystals when aluminium is strongly heated in nitrogen. The nitrate, $Al(NO_3)_3$, is obtained as deliquescent crystals (with $8H_2O$)

by evaporating a solution of the hydroxide in nitric acid. Aluminium phosphates may be prepared by precipitating a soluble aluminium salt with sodium phosphate. Wavellite $Al_6(PO_4)_2(OH)_{12}\cdot 9H_2O$, is a naturally occurring basic phosphate, while the gem-stone turquoise (*q.v.*) is $Al(PO_4)(OH)_3\cdot H_2O$, coloured by traces of copper. Aluminium silicates are widely diffused in the mineral kingdom, being present in the commonest rock-forming minerals (felspars, &c.), and in the gem-stones, topaz, beryl, garnet, &c. It also constitutes with sodium silicate the mineral lapis-lazuli and the pigment ultramarine (*q.v.*). Forming the basis of all clays, aluminium silicates play a prominent part in the manufacture of pottery and porcelain.

Bibliography.—The metallurgy and uses of aluminium are treated in detail in P. Moissonnier, *L'Aluminium* (Paris, 1903); in J. W. Richards, *Aluminium* (1896); and in A. Minet, *Production of Aluminium*, Eng. trans. by L. Waldo (1905); reference may also be made to treatises on general metallurgy, *e.g.* C. Schnabel, *Handbook of Metallurgy*, vol. ii. (1907). For the chemistry see Roscoe and Schlorlemmer, *Treatise on Inorganic Chemistry*, vol. ii. (1908); H. Moissan, *Traité de chimie minérale*; Abegg, *Handbuch der anorganischen Chemie*; and O. Dammer, *Handbuch der anorganischen Chemie*. Aluminium alloys have been studied in detail by Guillet.

ALUNITE, or Alumstone, a mineral first observed in the 15th century at Tolfa, near Rome, where it is mined for the manufacture of alum. Extensive deposits are also worked in Tuscany and Hungary, and at Bulladelah in New South Wales. By repeatedly roasting and lixiviating the mineral, alum is obtained in solution, and this is crystallized out by evaporation. Alunite occurs as seams in trachytic and allied volcanic rocks, having been formed by the action of sulphureous vapours on these rocks. The white, finely granular masses somewhat resemble limestone in appearance, and the more compact kinds from Hungary are so hard and tough that they are used for millstones. Distinct crystals of alunite are rarely met with in cavities in the massive material; these are rhombohedra with interfacial angles of 90° 50′, so that they resemble cubes in appearance. Minute glistening crystals have also been found loose in cavities in altered rhyolite. The hardness is 4 and the specific gravity 2·6. The mineral is a hydrated basic aluminium and potassium sulphate, $KAl_3(SO_4)_2(OH)_6$. It is insoluble in water, but soluble in sulphuric acid. First called aluminilite by J. C. Delamétherie in 1797, this name was contracted by F. S. Beudant in 1824 to alunite. (L. J. S.)



ALUR (Lur, Luri, Lurem), a Negro people of the Nile valley, living on the north-west coast of Albert Nyanza. They are akin to the Acholi (*q.v.*), speaking practically the same language.

ALURE (O. Fr., from *aller*, to walk), an architectural term for an alley, passage, the water-way or flat gutter behind a parapet, the galleries of a clerestory, sometimes even the aisle itself of a church. The term is sometimes written *valure* or *valoring*.

ALVA, or Alba, **FERNANDO ALVAREZ DE TOLEDO**, Duke of, (1508–1583), Spanish soldier, descended from one of the most illustrious families in Spain, was born in 1508. His grandfather, Ferdinand of Toledo, educated him in military science and politics; and he was engaged with distinction at the battle of Pavia while still a youth. Selected for a military command by Charles V., he took part in the siege of Tunis (1535), and successfully defended Perpignan against the dauphin of France. He was present at the battle of Mühlberg (1547), and the victory gained there over John of Saxony was due mainly to his exertions. He took part in the subsequent siege of Wittenberg, and presided at the court-martial which tried the elector and condemned him to death. In 1552 Alva was intrusted with the command of the army intended to invade France, and was engaged for several months in an unsuccessful siege of Metz. In consequence of the success of the French arms in Piedmont, he was made commander-in-chief of all the emperor's forces in Italy, and at the same time invested with unlimited power. Success did not, however, attend his first attempts, and after several unfortunate attacks he was obliged to retire into winter quarters. After the abdication of Charles he was continued in the command by Philip II., who, however, restrained him from extreme measures. Alva had subdued the whole Campagna and was at the gates of Rome, when he was compelled by Philip's orders to negotiate a peace. One of its terms was that the duke of Alva should in person ask forgiveness of the haughty pontiff whom he had conquered. Proud as the duke was by nature, and accustomed to treat with persons of the highest dignity, he confessed his voice failed him at the interview and his presence of mind forsook him. Not long after this (1559) he was sent at the head of a splendid embassy to Paris to espouse, in the name of his master, Elizabeth, daughter of Henry, king of France. In 1567, Philip, who was a bigoted Catholic, sent Alva into the Netherlands at the head of an army of 10,000 men, with unlimited powers for the extirpation of heretics. When he arrived he soon showed how much he merited the confidence which his master reposed in him, and instantly erected a tribunal which soon became known to its victims as the "Court of Blood," to try all persons who had been engaged in the late commotions which the civil and religious tyranny of Philip had excited. He imprisoned the counts Egmont and Horn, the two popular leaders of the Protestants, brought them to an unjust trial and condemned them to death. In a short time he totally annihilated every privilege of the people, and with unrelenting cruelty put multitudes of them to death. The executioner was employed in removing all those friends of freedom whom the sword had spared. In most of the considerable towns Alva built citadels. In the city of Antwerp he erected a statue of himself, which was a monument no less of his vanity than of his tyranny: he was figured trampling on the necks of two smaller statues, representing the two estates of the Low Countries. His attempt to raise money by imposing the Spanish *alcabala*, a tax of 5% on all sales, aroused the opposition of the Catholic Netherlands themselves. The exiles from the Low Countries, encouraged by the general resistance to his government, fitted out a fleet of privateers, and after strengthening themselves by successful depredations, ventured upon the bold exploit of seizing the town of Brielle. Thus Alva by his cruelty became the unwitting instrument of the future independence of the seven Dutch provinces. The fleet of the exiles, having met the Spanish fleet, totally defeated it, and reduced North Holland and Mons. Many cities hastened to throw off the yoke; while the states-general, assembling at Dordrecht, openly declared against Alva's government, and marshalled under the banners of the prince of Orange. Alva's preparations to oppose the gathering storm were made with his usual vigour, and he succeeded in recovering Mons, Mechlin and Zutphen, under the conduct of his son Frederick. With the exception of Zealand and Holland, he regained all the provinces; and at last his son stormed Naarden, and massacring its inhabitants, proceeded to invest the city of Haarlem, which, after standing an obstinate siege, was taken and pillaged. Their next attack was upon Alkmaar; but the spirit of desperate resistance was raised to such a height in the breasts of the Hollanders that the Spanish veterans were repulsed with great loss and Frederick constrained reluctantly to retire. Alva's feeble state of health and continued disasters induced him to solicit his recall from the government of the Low Countries; a measure which, in all probability, was not displeasing to Philip, who was now resolved to make trial of a milder administration. In December 1573 the much-oppressed country was relieved from the presence of the duke of Alva, who, returning home accompanied by his son, made the infamous boast that during the course of six years, besides the multitudes destroyed in battle and massacred after victory, he had consigned 18,000 persons to the executioner.

On his return he was treated for some time with great distinction by Philip. A tardy and imperfect justice, however, overtook him, when he was banished from court and confined in the castle of Uzeda for complicity in certain disgraceful conduct of his son. Here he had remained two years, when the success of Don Antonio in assuming the crown of Portugal determined Philip to turn his eyes towards Alva as the person in whose fidelity and abilities he could most confide. A secretary was instantly despatched to Alva to ascertain whether his health was sufficiently vigorous to enable him to undertake the command of an army. The aged chief returned an answer full of loyal zeal, and was immediately appointed to the supreme command in Portugal. It is a striking fact, however, that the liberation and elevation of Alva were not followed by forgiveness. In 1581 Alva entered Portugal, defeated Antonio, drove him from the kingdom, and soon reduced the whole under the subjection of Philip. Entering Lisbon he seized an immense treasure, and suffered his soldiers, with their accustomed violence and rapacity, to sack the suburbs and vicinity. It is reported that Alva, being requested to give an account of the money expended on that occasion, sternly replied, "If the king asks me for an account, I will make him a statement of kingdoms preserved or conquered, of signal victories, of successful sieges and of sixty years' service." Philip deemed it proper to make no further inquiries. Alva, however, did not enjoy the honours and rewards of his last expedition, for he died in January 1583 at the age of 74.

AUTHORITIES.—See the *Life*, by Rustant (Madrid, 1751). His correspondence during his Flemish government has been published by M. Gachard (Brussels, 1850). See also *Coleccion de documentos ineditos para la historia de España*, vols. iv., vii., viii., xiv., xxxii. and xxxv. (Madrid); and Motley's *Rise of the Dutch Republic* (1856).

ALVA, a police burgh of Clackmannanshire, Scotland, 3¼ m. N. of Alloa, terminus of a branch line of the North British railway. Pop. (1891) 5225; (1901) 4624. It is situated at the foot of three front peaks of the Ochils—West Hill (1682 ft.), Middle Hill (1436 ft.) and Wood Hill (1723 ft.). There are spinning-mills, and manufactures of tweeds, tartans and other woollen goods. Silver, lead and other metals have been found in the hills, but not in paying quantities. The glen to the east of the town, in which are abandoned workings, is called the Silver Glen. Alva House is the seat of the Johnstones, a family which has been intimately connected with the district since the latter half of the 18th century.

ALVARADO, PEDRO DE (1495–1541), one of the Spanish leaders in the discovery and conquest of America, was born at Badajoz about 1495. He held a command in the expedition sent from Cuba against Yucatan in the spring of 1518, and returned in a few months, bearing reports of the wealth and splendour of Montezuma's empire. In February 1519 he accompanied Hernando Cortes in the expedition for the conquest of Mexico, being appointed to the command of one of the eleven vessels of the fleet. He acted as Cortes's principal officer, and on the first occupation of the city of Mexico was left there in charge. When the Spaniards had temporarily to retire before the Mexican uprising, Alvarado led the rear-guard (1st of July 1520), and the *Salto de Alvarado*—a long leap with the use of his spear, by which he saved his life—became famous. He was engaged (1523–24) in the conquest of Guatemala, of which he was subsequently appointed governor by Charles V. In 1534 he attempted to bring the province of Quito under his power, but had to content himself with the exaction of a pecuniary indemnity for the expenses of the expedition. During a visit to Spain, three years later, he had the governorship of Honduras conferred upon him in addition to that of Guatemala. He died in Guatemala in 1541.

ALVAREZ, FRANCISCO (*c.* 1465–1541 ?), Portuguese missionary and explorer, was born at Coimbra. He was a chaplain-priest and almoner to Dom Manuel, king of Portugal, and was sent in 1515 as secretary to Duarte Galvão and Rodrigo da Lima on an embassy to the negūs of Abyssinia (Lebna Dengel Dawit (David) II.). The expedition having been delayed by the way, it was not until 1520 that he reached Abyssinia, where he remained six years, returning to Lisbon in 1526–1527. In 1533 he was sent to Rome on an embassy to Pope Clement VII. The precise date of his death, like that of his birth, is unknown, but it must have been later than 1540, in which year he published at Lisbon under the king's patronage an account of his travels in one volume folio, entitled *Verdadera Informaçam das terras do Preste Joam.* This curious work was translated into Italian (G. B. Ramusio, *Navagationi*, vol. i., Venice, 1550); into Spanish (*Historia de las Cosas de Etiopia*, by Fray Thomas de Padilla, Antwerp, 1557); into French (*Historiale Description de l'Ethiopie*, Christ. Plantin, Antwerp, 1558); into German (*Wahrhaftiger Bericht von . . . Ethiopien*, Eisleben, 1566); into English (Sam. Purchas, *Pilgrimes*, part ii., London, 1625). The information it contains must, however, be received with caution, as the author is prone to exaggerate, and does not confine himself to what came within his own observation.

ALVAREZ, DON JOSÉ (1768–1827), Spanish sculptor, was born at Priego, in the province of Cordova, in 1768. His full name was José Alvarez de Pereira y Cubero. Bred to his father's trade of a stone-mason, he devoted all his spare time to drawing and modelling. His education in art was due partly to the teaching of the French sculptor Verdiguier at Cordova, and partly to lessons at Madrid, where he attended the lectures of the academy of San Fernando. In 1799 he obtained from Charles IV. a pension of 12,000 reals to enable him to visit Paris and Rome. In the former city he executed in 1804 a statue of Ganymede, which placed him at once in the front rank of the sculptors of his time, and which is now in the sculpture gallery of the Prado. Shortly afterwards his pension was more than doubled, and he left Paris for Rome, where he remained till within a year of his death. He had married in Paris Elizabeth Bougel, by whom he had a son in 1805. This son, known as Don José Alvarez y Bougel, also distinguished himself as a sculptor and a painter, but he died at Burgos before he had reached the age of twenty-five, a little more than two years after his father's death in Madrid in 1827. One of the most successful works of the elder Alvarez was a group representing Antilochus and Memnon, which was commissioned in marble (1818) by Ferdinand VII., and secured for the artist the appointment of court-sculptor. It is now in the museum of Madrid. He also modelled a few portrait busts (Ferdinand VII., Rossini, the duchess of Alba), which are remarkable for their vigour and fidelity.

ALVAREZ, DON MANUEL (1727–1797), Spanish sculptor, was born at Salamanca. He followed classical models so closely that he was styled by his countrymen *El Griego*, "The Greek." His works, which are very numerous, are chiefly to be found at Madrid.

ALVARY, MAX (1858–1898), German singer, was born at Düsseldorf. Gifted with a fine tenor voice and handsome presence he speedily made a reputation in Germany in the leading rôles in Wagnerian opera, and from 1885 onwards appeared also in America and England. He was at his best in 1892, when his performances as Tristan and Siegfried at Covent Garden aroused great enthusiasm.

ALVEARY (from the Lat. *alvearium*), a beehive; used, like *apiarium* in the same sense, figuratively for a collection of hard-working people, or a scholarly work (*e.g.* dictionary) involving bee-like industry. By analogy the term is used for the hollow of the ear, where the wax collects.

ALVENSLEBEN, CONSTANTIN VON (1809–1892), Prussian general, was born on the 26th of August 1809 at Eichenbarleben in Prussian Saxony, and entered the Prussian guards from the cadet corps in 1827. He became first lieutenant in 1842, captain in 1849, and major on the Great General Staff in 1853, whence after seven years he went to the Ministry of War. He was soon afterwards promoted colonel, and commanded a regiment of Guard infantry up to 1864, when he became a major-general. In this rank he commanded a brigade of guards in the war of 1866. At the action of Soor (Bürkersdorf) on the 28th of June he distinguished himself very greatly, and at Königgrätz, where he led the advanced guard of the Guard corps, his energy and initiative were still more conspicuous. Soon afterwards he succeeded to the command of his division, General Hiller v. Gärtringen having fallen in the battle; he was promoted lieutenant-general, and retained this command after the conclusion of peace, receiving in addition the order *pour le mérite* for his services. In 1870, on the outbreak of war with France, von Alvensleben succeeded Prince Frederick Charles in command of the III army corps which formed part of the II German

Army commanded by the prince. Under their new general, the Brandenburg regiments forming the III corps proved themselves collectively the best in the whole German army, with the possible exception of the Prussian guards, and, if Prince Frederick Charles is entitled to the chief credit in training the III corps, Alvensleben had contributed in almost equal degree to the efficiency of the Guard infantry, while his actual leadership of the III corps in the battles of 1870 and 1871 showed him afresh as a fighting general of the very first rank. The battle of Spicheren, on the 6th of August, was initiated and practically directed throughout by him, and in the confusion which followed this victory, for which the superior commanders were not prepared, Alvensleben showed his energy and determination by resuming the advance on his own responsibility. This led to the great battles of the 14th, 16th and 18th of August around Metz, and again the III corps was destined, under its resolute leader, to win the chief credit. Crossing the Moselle the instant that he received permission from his army commander to do so, Alvensleben struck the flank of Bazaine's whole army (August 16th) in movement westward from Metz. The III corps attacked at once, and for many hours bore the whole brunt of the battle at Vionville. By the most resolute leading, and at the cost of very heavy losses, Alvensleben held the whole French army at bay while other corps of the I and II German Armies gradually closed up. In the battle of Gravelotte, on the 18th, the corps took little part. Its work was done, and it remained with the II Army before Metz until the surrender of Bazaine's army. Prince Frederick Charles then moved south-west to co-operate with the grand-duke of Mecklenburg on the Loire. At the battle of Beaune-la-Rolande, the corps, with its comrades of Vionville, the X corps under General v. Voigts-Rhetz, won new laurels, and it participated in the advance on Le Mans and the battle at that place on the 12th of January 1871. At the close of the war Alvensleben received the oak-leaves of the order *pour le mérite*, the first class of the Iron Cross and a grant of 100,000 thalers. He became full general of infantry in 1873 and retired immediately afterwards. In 1889 the emperor William II. ordered that the 52nd infantry regiment (one of the distinguished regiments of Vionville) should thereafter bear Alvensleben's name, and in 1892, on the anniversary of the battle of Le Mans, the old general received the order of the Black Eagle. He died on the 28th of March 1892 at Berlin.

His brother, Gustav von Alvensleben (1803–1881), Prussian general of infantry, was born at Eichenbarleben on the 30th of September 1803, entered the Guard infantry in 1821, and took part as a general staff officer in the suppression of the Baden insurrection of 1849. He became a major-general in 1858, aide-de-camp to the king in 1861, and lieutenant-general in 1863, and in the campaign of 1866 performed valuable military and political services. He was promoted general of infantry in 1868. In the war of 1870 he commanded the IV army corps, which took a conspicuous part in the action of Beaumont and afterwards served in the siege of Paris. He received the Iron Cross, the order *pour le mérite*, and a money grant, as a reward for his services, and retired in 1872. He died at Gernrode in the Harz on the 30th of June 1881.

Another brother, Albrecht, Count von Alvensleben (1794–1858), was a distinguished Prussian statesman.

ALVEOLATE (from Lat. *alveolus*), honeycombed, a word used technically in biology, &c., to mean pitted like a honeycomb.

ALVERSTONE, RICHARD EVERARD WEBSTER, 1st Baron (1842–), lord chief justice of England, was born on the 22nd of December 1842, being the second son of Thomas Webster, Q.C. He was educated at King's College and Charterhouse schools, and Trinity College, Cambridge; was called to the bar in 1868, and became Q.C. only ten years afterwards. His practice was chiefly in commercial, railway and patent cases until (June 1885) he was appointed attorney-general in the Conservative Government in the exceptional circumstances of never having been solicitor-general, and not at the time occupying a seat in parliament. He was elected for Launceston in the following month, and in November exchanged this seat for the Isle of Wight, which he continued to represent until his elevation to the House of Lords. Except under the brief Gladstone administration of 1886, and the Gladstone-Rosebery cabinet of 1892–1895, Sir Richard Webster was attorney-general from 1885 to 1900. In 1890 he was leading counsel for *The Times* in the Parnell inquiry; in 1893 he represented Great Britain in the Bering Sea arbitration; in 1898 he discharged the same function in the matter of the boundary between British Guiana and Venezuela; and in 1903 was one of the members of the Alaska Boundary Commission. He was well known as an athlete in his earlier years, having represented his university as a runner, and his interest in cricket and foot-racing was kept up in later life. In the House of Commons, and outside it, he was throughout his political career prominently associated with church work; and his speeches were distinguished for gravity and earnestness. In 1900 he succeeded Sir Nathaniel Lindley as Master of the Rolls, being raised to the peerage as Baron Alverstone, and in October of the same year he was elevated to the office of lord chief justice upon the death of Lord Russell of Killowen.

ALWAR, or Ulwar, a native state of India in the Rajputana agency. It is bounded on the E. by the state of Bharatpur and the British district of Gurgaon, on the N. by Gurgaon district and the state of Patiala, on the W. by the states of Nabha and Jaipur, and on the S. by the state of Jaipur. Its configuration is irregular, the greatest length from north to south being about 80 m., and breadth from east to west about 60 m., with a total area of 3141 sq. m. The eastern portion of the state is open and highly cultivated; the western is diversified by hills and peaks, which form a continuation of the Aravalli range, from 12 to 20 m. in breadth. These hills run in rocky and precipitous parallel ridges, in some places upwards of 2200 ft. in height. The Sabhi river flows through the north-western part of the state, the only other stream of importance being the Ruparel, which rises in the Alwar hills, and flows through the state into the Bharatpur territory. The population in 1901 was 828,487, showing an increase of 8% during the decade. When compared with a heavy decrease elsewhere throughout Rajputana, this increase may be attributed to the successful administration of famine relief, under British officials. The revenue is £185,000. The maharaja Jai Singh, who succeeded in 1892 at the age of ten, was educated at the Mayo college, where he excelled both in sports and in knowledge of English. He came of age in 1903, when he was invested by the viceroy with full ruling powers. Alwar was the first native state to accept a currency struck at the Calcutta mint, of the same weight and assay as the imperial rupee, with the head of the British sovereign on the obverse. Imperial service troops are maintained, consisting of both cavalry and infantry, with transport. The state is traversed by the Delhi branch of the Rajputana railway. A settlement of the land revenue has been carried out by an English civilian.

The state was founded by Pratap Singh (1740–1791), a Rajput of ancient lineage, and increased by his adopted son Bakhtawar Singh. The latter joined the British against the Mahrattas, and in 1803, after the battle of Laswari (Nov. 1), signed a treaty of offensive and defensive alliance with the British government. In 1811, owing to his armed intervention in Jaipur, a fresh engagement was made, prohibiting him from political intercourse with other states without British consent. In 1857 the raja Binni Singh sent a force of Mussulmans and Rajputs to relieve the British garrison in Agra; the Mussulmans, however, deserted, and the rest were defeated by the mutineers.

The City of Alwar has a railway station on the Rajputana line, 98 m. from Delhi; pop. (1901) 56,771, showing a steady increase. It stands in a valley overhung by a fortress 1000 ft. above. It is surrounded by a rampart and moat, with five gates, and contains fine palaces, temples and tombs. The water-supply is brought from a lake 9 m. distant. It has a high school, affiliated to the Allahabad university; and a school for the sons of nobles, founded to commemorate the Diamond Jubilee of Queen Victoria. The Lady Dufferin hospital is under the charge of an English lady doctor, with two female assistants.

ALYATTES, king of Lydia (609–560 B.C.), the real founder of the Lydian empire, was the son of Sadyattes, of the house of the Mermnadae. For several years he continued the war against Miletus begun by his father, but was obliged to turn his attention to the Medes and Babylonians. On the 28th of May 585, during a battle on the Halys between him and Cyaxares, king of Media, an eclipse of the sun took place; hostilities were suspended, peace concluded, and the Halys fixed as the boundary between the two kingdoms. Alyattes drove the Cimmerii (see SCYTHIA) from Asia, subdued the Carians, and took several Ionian cities (Smyrna, Colophon). He was succeeded by his son Croesus. His tomb still exists on the plateau between lake Gygaea and the river Hermus to the north of Sardis—a large mound of earth with a substructure of huge stones. It was excavated by Spiegelthal in 1854, who found that it covered a large vault of finely-cut marble blocks approached by a flat-roofed passage of the same stone from the south. The sarcophagus and its contents had been removed by early plunderers of the tomb, all that was left being some broken alabaster vases, pottery and charcoal. On the summit of the mound were large *phalli* of stone.

See A. von Ölfers, "Über die lydischen Königsgräber bei Sardes," *Abh. Berl. Ak.*, 1858.

ALYPIUS, a Greek writer on music whose works, with those of six others, were collected and published with a commentary and explanatory notes (*Antiquae Musicae Auctores Septem*, Amstel., 1652), by Mark Meibomius (1630–1711). He is said to have written before Euclid and Ptolemy; and Cassiodorus arranges his *Introduction to Music* between those of Nicomachus and Gaudentius. The work consists solely of a list of symbols of the various scales and modes, and is probably only a fragment.

ALYPIUS OF ANTIOCH, a geographer of the 4th century, who was sent by the emperor Julian into Britain as first prefect, and was afterwards commissioned to rebuild the temple of Jerusalem. Among the letters of Julian are two (29 and 30) addressed to Alypius; one inviting him to Rome, the other thanking him for a geographical treatise, which no longer exists.

See also Ammianus Marcellinus xxiii. 1, § 2.

ALYTES, the midwife toad, first discovered by P. Demours in 1741, on the border of a small pond in the Jardin des Plantes, in the very act of parturition which has rendered it famous, and described as *Petit crapaud mâle accoucheur de sa femelle*. *Alytes obstetricans* is of special interest as the first known example of paternal solicitude in Batrachians, and although many no less wonderful cases of nursing instinct have since been revealed to us, it remains the only one among European forms.

Alytes obstetricans is a small toad-like Batrachian, two inches in length, of dull greyish coloration, plump form with warty skin and large eyes with vertical pupils. Although toad-like it is not really related to the toads proper, but belongs to the family *Discoglossidae*, characterized by a circular, adherent tongue, teeth in the upper jaw and on the palate, short but distinct ribs on the anterior vertebrae, and convex-concave vertebrae. It inhabits France, Belgium, Switzerland, Western Germany (eastwards to the Weser), Spain and Portugal. A second species, *A. cisternasii*, occurs in Spain and Portugal.

Alytes is nocturnal and slow in its movements. It is thoroughly terrestrial, selecting for its retreat in the daytime holes made by small mammals, or interstices between stones. Towards evening it reveals its presence by a clear whistling note, which has often been compared to the sound of a little bell, or to a chime when produced by numerous individuals. The breeding season lasts throughout spring and summer, and the female is able to spawn two, three or even four times in the year. Pairing and oviposition take place on land; the male seizes the female round the waist. The eggs are large and yellow, and produced in two rosary-like strings, as if strung together by elastic filaments continuous with the gelatinous capsules. After impregnation, the male twists them round his legs and returns to his usual retreat, going about at night in order to feed himself and to keep up the moisture of the eggs, even resorting to a short immersion in the water during exceptionally dry nights. The development of the embryo within the egg takes about three weeks. When the time for eclosion has come, the male enters the water with his burden; the larvae, in the full tadpole condition, measuring 14 to 17 millimetres, bite their way through their tough envelope, which is not abandoned by the father until all the young are liberated, and complete in the ordinary way their metamorphosis. The tadpoles grow to a large size considering that of the adult, the body equalling in size a sparrow's or even a small pigeon's egg, and they often remain more than a year in that condition.

See A. de l'Isle, "Mémoire sur les mœurs et l'accouchement de l'Alytes obstetricans," *Ann. Sci. Nat.* (6) iii. 1876; G. A. Boulenger, *Tailless Batrachians of Europe* (Ray Society, 1897). (G. A. B.)

ALZEY, a town of Germany, in the grand duchy of Hesse-Darmstadt, 18 m. S. of Mainz by rail. Pop. (1900) 6893. There are a Roman Catholic and two Protestant churches, several high-grade schools and a teachers' seminary. Alzey has industries of dyeing and weaving, breweries, and does a considerable trade in wine. It is immortalized in the *Nibelungenlied* in the person of "Volkêr von Alzeie," the warrior who in the last part of the epic plays a part second only to that of Hagen, and who "was called the minstrel (*spilman*) because he could fiddle." It became an imperial city in 1277. In 1620 it was sacked by the Spaniards and in 1689 burnt by the French. Annexed to France during the Napoleonic wars, it passed in 1815 to the grand-duchy of Hesse-Darmstadt.

ALZOG, JOHANN BAPTIST (1808–1878), German theologian, was born at Ohlau, in Silesia, on the 29th of June 1808. He studied at Breslau and Bonn and was ordained priest at Cologne in 1834. In the following year he accepted the chairs of exegesis and church history at the seminary of Posen. He removed in 1844 to Hildesheim, where he had been appointed rector of the seminary. He became professor of church history at the university of Freiburg in the Breisgau in 1853 and held that post till his death on the 1st of March 1878. Together with Döllinger, Alzog was instrumental in convoking the famous Munich assembly of Catholic scholars in 1863. He also took part, with Bishops Hefele and Haseberg, in the preparatory work of the Vatican Council and voted in favour of the doctrine of papal infallibility but against the opportuneness of its promulgation. Alzog's fame rests mainly on his *Handbuch der Universal-Kirchengeschichte* (Mainz, 1841, often reprinted under various titles; Eng. trans. by Pabisch and Byrne, *A Manual of Church History*, 4 vols. Cincinnati, 1874). Based upon the foundations laid by Möhler, this manual was generally accepted as the best exposition of Catholic views, in opposition to the Protestant manual by C. A. Hase, and was translated into several languages. Besides a host of minor writings on ecclesiastical subjects, and an active collaboration in the great *Kirchenlexicon* of Wetzer and Welte, Alzog was also the author of *Grundriss der Patrologie* (Freiburg, 1866, 4th ed. 1888), a scholarly work, though now superseded by that of O. Bardenhewer.

A full list of Alzog's writings is given in H. Hurter's *Nomenclator literarius recentioris theologiae catholicae*, vol. iii. For an account of his life see the funeral oration by F. X. Kraus, entitled: *Gedächtnissrede auf Johannes Alzog* (Freiburg, 1879).

AMADÍS DE GAULA. This famous romance of chivalry survives only in a Castilian text, but it is claimed by Portugal as well as by Spain. The date of its composition, the name of its author, and the language in which it was originally written are not yet settled. It is not even certain when the romance was first printed, for though the oldest known edition (a unique copy of which is in the British Museum) appeared at Saragossa in 1508, it is highly probable that *Amadís* was in print before this date: an edition is reported to have been issued at Seville in 1496. As it exists in Spanish, *Amadís de Gaula* consists of four books, the last of which is generally believed to be by the *regidor* of Medina del Campo, Garci Rodriguez de Montalvo (whose name is given as Garci Ordoñez de Montalvo in all editions of *Amadís* later than that of 1508, and as Garci Gutiérrez de Montalvo in some editions of the *Sergas de Esplandián*). Montalvo alleges that the first three books were arranged and corrected by him from "the ancient originals," and a reference in the prologue to the siege of Granada points to the conclusion that the Spanish recast was made shortly after 1492; it is possible, however, that the prologue alone was written after 1492, and that the text itself is older. The number of these "ancient originals" is not stated, nor is there any mention of the language in which they were composed; Montalvo's silence on the latter point might be taken to imply that they were in Castilian, but any such inference would be hazardous. Three books of *Amadís de Gaula* are mentioned by Pero Ferrús who was living in 1379, and there is evidence that the romance was current in Castile more than a quarter of a century earlier; but again there is no information as to the language in which they were written. Gomes Eannes de Azurara, in his *Chronica de Conde D. Pedro de Menezes* (*c.* 1450), states that *Amadís de Gaula* was written by Vasco de Lobeira in the time of king Ferdinand of Portugal who died in 1383: as Vasco de Lobeira was knighted in 1385, it would follow that he wrote the elaborate romance in his earliest youth. This conclusion is untenable, and the suggestion that the author was Pedro de Lobeira (who flourished in the 15th century) involves a glaring anachronism. A further step was taken by the historian João de Barros, who maintained in an unpublished work dating between 1540 and 1550 that Vasco de Lobeira wrote *Amadís de Gaula* in Portuguese, and that his text was translated into Castilian; this is unsupported assertion. Towards the end of the 16th century Miguel Leite Ferreira, son of the Portuguese poet, Antonio Ferreira, declared that the original manuscript of *Amadís de Gaula* was then in the Aveiro archives, and an *Amadís de Gaula* in Portuguese, which is alleged to have existed in the conde de Vimeiro's library as late as 1586, had vanished before 1726. In the absence of corroboration, these dubious details must be received with extreme reserve. A stronger argument in favour of the Portuguese case is drawn from the existing Spanish text. In book I, chapters 40 and 42, it is recorded that the Infante Alphonso of Portugal suggested a radical change in the narrative of Briolanja's relations with Amadís. This prince has been identified as the Infante Alphonso who died in 1312, or as Alphonso IV. who ascended the Portuguese throne in 1325. Were either of these identifications established, the date of composition might be referred with certainty to the beginning of the 14th century or the end of the 13th. But both identifications are conjectural. Nevertheless the passage in the Spanish text undeniably lends some support to the Portuguese claim, and recent critics have inclined to the belief that *Amadís de Gaula* was written by João de Lobeira, a Galician knight who frequented the Portuguese court between 1258 and 1285, and to whom are ascribed two fragments of a poem in the Colocci-Brancuti *Cansoniere* (Nos. 240 and 240^b), which reappears with some unimportant variants in *Amadís de Gaula* (book II, chapter 11). The coincidence may be held to account in some measure for the traditional association of a Lobeira with the authorship of *Amadís de Gaula*; but, though curious, it warrants no definite conclusion being drawn from it. Against the Portuguese claim it is argued that the *Villancico* corresponding to João de Lobeiro's poem is an interpolation in the Spanish text, that Portuguese prose was in a rudimentary stage of development at the period when—*ex hypothesi*—the romance was composed, and that the book was very popular in Spain almost a century before it is even mentioned in Portugal. Lastly, there is the incontrovertible fact that *Amidís de Gaula* exists in Castilian, while it remains to be proved that it ever existed in Portuguese. As to its substance, it is beyond dispute that much of the text derives from the French romances of the Round Table; but the evidence does not enable us to say (1) whether it was pieced together from various French romances; (2) whether it was more or less literally translated from a lost French original; or (3) whether the first Peninsular adapter or translator was a Castilian or a Portuguese. On these points judgment must be suspended. There can, however, be no hesitation in accepting Cervantes' verdict on *Amadís de Gaula* as the "best of all the books of this kind that have ever been written." It is the prose epic of feudalism, and its romantic spirit, its high ideals, its fantastic gallantry, its ingenious adventures, its mechanism of symbolic wonders, and its flowing style have entranced readers of such various types as Francis I. and Charles V., Ariosto and Montaigne.

BIBLIOGRAPHY.—Carolina Michaëlis de Vasconcellos and Gottfried Baist in the *Grundriss der romanischen Philologie* (Strassburg, 1897), ii. Band, 2. Abteilung, pp. 216-226 and 440-442; Ludwig Braunfels, *Kritischer Versuch über den Roman Amadis von Gallien* (Leipzig, 1876); Theophilo Braga, *Historia das novelas portuguesas de cavalleria* (Porto, 1873), *Curso de litteratura e arte portuguesa* (Lisboa, 1881), and *Questões de litteratura e arte portuguesa* (Lisboa, 1885); Marcelino Menéndez y Pelayo, *Origenes de la novela* (Madrid, 1905); Eugène Baret, *De l'Amadis de Gaule et de son influence sur les mœurs et la littérature au XVIe et au XVIIe siècle* (Paris, 1873). (J. F.-K.)

AMADOU, a soft tough substance used as tinder, derived from *Polyporus fomentarius*, a fungus belonging to the group Basidiomycetes and somewhat resembling a mushroom in manner of growth. It grows upon old trees, especially the oak, ash, fir and cherry. The fungus is cut into slices and then steeped in a solution of nitre. Amadou is prepared on the continent of Europe, chiefly in Germany, but the fungus is a native of Britain. *Polyporus igniarius* and other species are also used, but yield an inferior product.

AMAKUSA, an island belonging to Japan, 26½ m. long and 13½ in extreme width, situated about 32° 20′ N., and 130° E. long., on the west of the province of Higo (island of Kiushiu), from which it is separated by the Yatsushiro-kai. It has no high mountains, but its surface being very hilly—four of the peaks rise to a height over 1500 ft.—the natives resort to the terrace system of cultivation with remarkable success. A number of the heads of the Christians executed in connexion with the Shimabara rebellion in the first half of the 17th century were buried in this island. Amakusa produces a little coal and fine kaolin, which was largely used in former times by the potters of Hirado and Satsuma.

AMAL, the name of the noblest family among the Ostrogoths, and that from which nearly all their kings were chosen.

AMALARIC (d. 531), king of the Visigoths, son of Alaric II., was a child when his father fell in battle against Clovis, king of the Franks (507). He was carried for safety into Spain, which country and Provence were thenceforth ruled by his maternal grandfather, Theodoric the Ostrogoth, acting through his vicegerent, an Ostrogothic nobleman named Theudis. In 522 the young Amalaric was proclaimed king, and four years later, on Theodoric's death, he assumed full royal power in Spain and a part of Languedoc, relinquishing Provence to his cousin Athalaric. He married Clotilda, daughter of Clovis; but his disputes with her, he being an Arian and she a Catholic, brought on him the penalty of a Frankish invasion, in which he lost his life in 531.

AMALASUNTHA or AMALASUENTHA, queen of the Ostrogoths (d. 535), daughter of Theodoric, king of the Ostrogoths, was married in 515 to Eutharic, an Ostrogoth of the old Amal line, who had previously been living in Spain. Her husband died, apparently in the early years of her marriage, leaving her with two children, Athalaric and Matasuentha. On the death of her father in 526, she succeeded him, acting as regent for her son, but being herself deeply imbued with the old Roman culture, she gave to that son's education a more refined and literary turn than suited the ideas of her Gothic subjects. Conscious of her unpopularity she banished, and afterwards put to death, three Gothic nobles whom she suspected of intriguing against her rule, and at the same time opened negotiations with the emperor Justinian with the view of removing herself and the Gothic treasure to Constantinople. Her son's death in 534 made but little change in the posture of affairs. Amalasuntha, now queen, with a view of strengthening her position, made her cousin Theodahad partner of her throne (not, as sometimes stated, her husband, for his wife was still living). The choice was unfortunate. Theodahad, notwithstanding a varnish of literary culture, was a coward and a scoundrel. He fostered the disaffection of the Goths, and either by his orders or with his permission, Amalasuntha was imprisoned on an island in the Tuscan lake of Bolsena, where in the spring of 535 she was murdered in her bath.

The letters of Cassiodorus, chief minister and literary adviser of Amalasuntha, and the histories of Procopius and Jordanes, give us our chief information as to the character of Amalasuntha.

AMALEKITES, an ancient tribe, or collection of tribes, in the south and south-east of Palestine, often mentioned in the Old Testament as foes of the Israelites. They were regarded as a branch of the Edomites (Gen. xxxvi. 12, see EDOM), and appear to have numbered among their divisions the Kenites. When the Israelites were journeying from Egypt to the land of Canaan, the Amalekites are said to have taken advantage of their weak condition to harry the stragglers in the rear, and as a judgment for their hostility it was ordained that their memory should be blotted out from under heaven (Deut. xxv. 17-19). An allusion to this appears in the account of Israel's defeat on the occasion of the attempt to force a passage from Kadesh through Hormah, evidently into Palestine (Num. xiv. 43-45, cp. Deut. i. 44-46). The statements are obscure, and elsewhere Hormah is the scene of a victory over the Canaanites by Israel (Num. xxi. 1-3), or by the tribes Judah and Simeon (Judg. i. 17). The question is further complicated by the account of Joshua's overthrow of Amalek apparently in the Sinaitic peninsula. The event was commemorated by the erection of the altar "Yahweh-nissi" ("Yahweh my banner" or "memorial"), and rendered even more memorable by the utterance, "Yahweh hath sworn: Yahweh will have war with Amalek from generation to generation" (Ex. xvii. 8-16, on its present position, see EXODUS [BOOK]). The same sentiment recurs in Yahweh's command to Saul to destroy Amalek utterly for its hostility to Israel (1 Sam. xv.), and in David's retaliatory expedition when he distributed among his friends the spoil of the "enemies of Yahweh" (xxx. 26). Saul himself, according to one tradition, was slain by an Amalekite (2 Sam. i., contrast 1 Sam. xxxi.). A similar spirit appears among the prophecies ascribed to Balaam: "Amalek, first (or chief) of nations, his latter end [will be] destruction" (Num. xxiv. 20).

The district of Amalek lay to the south of Judah (cp. 1 Chron. iv. 42 seq.), probably between Kadesh and Hormah (cp. Gen. xiv. 7; 1 Sam. xv. 7, xxvii. 8), and the interchange of the ethnic with "Canaanites" and "Amorites" suggests that the Amalekites are merely one of Israel's traditional enemies of the older period. Hence we find them taking part with Ammonites and Midianites (Judg. iii. 13, vi. 3), and their king Agag, slain by Samuel as a sacrificial offering (1 Sam. xv. 9), was a byword for old-time might and power (Num. xxiv. 7). Even in one of the Psalms (lxxxiii. 7) Amalek is mentioned among the enemies of Israel—just as Greek writers of the 6th century of this era applied the old term Scythians to the Goths (Nöldeke),—and the traditional hostility between Saul and Amalek is reflected still later in the book of Esther where Haman the Agagite is pitted against Mordecai the Benjamite.

Twice Amalek seems to be mentioned as occupying central Palestine (Judg. v. 14, xii. 15), but the passages are textually uncertain. The name is celebrated in Arabian tradition, but the statements regarding them are confused and conflicting, and for historical purposes are practically worthless, as has been proved by Th. Nöldeke (*Ueber die Amalekiter*, Göttingen, 1864). On the biblical data, see also E. Meyer, *Die Israeliten* (*Index*, *s.v.*).

(S. A. C.)

AMALFI, a town and archiepiscopal see of Campania, Italy, in the province of Salerno, from the town of which name it is distant 12 m. W.S.W. by road, on the N. coast of the Gulf of Salerno. Pop. (1901) 6681. It lies at the mouth of a deep ravine, in a sheltered situation, at the foot of Monte Cerreto (4314 ft.), in the centre of splendid coast scenery, and is in consequence much visited by foreigners. The cathedral of S. Andrea is a structure in the Lombard-Norman style, of the 11th century; the façade in black and white stone was well restored in 1891; the bronze doors were executed at Constantinople before 1066. The campanile dates from 1276. The interior is also fine, and contains ancient columns and sarcophagi. The conspicuous Capuchin monastery on the W. with fine cloisters (partly destroyed by a landslip in 1899) is now used as an hotel. Amalfi is first mentioned in the 6th century, and soon acquired importance as a naval power; in the 9th century it shared with Venice and Gaeta the Italian trade with the East, and in 848 its fleet went to the assistance of Pope Leo IV. against the Saracens. It was then an independent republic with a population of some 70,000, but in 1131 it was reduced by King Roger of Sicily. In 1135 and 1137 it was taken by the Pisans, and rapidly declined in importance, though its maritime code, known as the *Tavole Amalfitane*, was recognized in the Mediterranean until 1570. In 1343 a large part of the town was destroyed by an inundation, and its harbour is now of little importance. Its industries too, have largely disappeared, and the paper manufacture has lost ground since 1861.

AMALGAM, the name applied to alloys which contain mercury. It is said by Andreas Libavius to be a corruption of μάλαγμα; in the alchemists the form *algamala* is also found. Many amalgams are formed by the direct contact of a metal with mercury, sometimes with absorption, sometimes with evolution, of heat. Other methods are to place the metal and mercury together in dilute acid, to add mercury to the solution of a metallic salt, to place a metal in a solution of mercuric nitrate, or to electrolyse a metallic salt using mercury as the negative electrode. Some amalgams are liquids, especially when containing a large proportion of mercury; others assume a crystalline form. In some cases definite compounds have been isolated from amalgams which may be regarded as mixtures of one or more of such compounds with mercury in excess. In general these compounds are decomposable by heat, but some of them, such as those of gold, silver, copper and the alkali metals, even when heated above the boiling point of mercury retain mercury and leave residues of definite composition. Tin amalgam is used for "silvering" mirrors, gold and silver amalgam in gilding and silvering, cadmium and copper amalgam in dentistry, and an amalgam of zinc and tin for the rubbers of electrical machines; the zinc plates of electric batteries are amalgamated in order to reduce polarization.

AMALRIC, the name of two kings of Jerusalem.

AMALRIC I., king from 1162 to 1174, was the son of Fulk of Jerusalem, and the brother of Baldwin III. He was twice married: by his first wife, Agnes of Edessa, he had issue a son and a daughter, Baldwin IV. and Sibylla, while his second wife, Maria Comnena, bore him a daughter Isabella, who ultimately carried the crown of Jerusalem to her fourth husband, Amalric of Lusignan (Amalric II.). The reign of Amalric I. was occupied by the Egyptian problem. It became a question between Amalric and Nureddin, which of the two should control the discordant viziers, who vied with one another for the control of the decadent caliphs of Egypt. The acquisition of Egypt had been an object of the Franks since the days of Baldwin I. (and indeed of Godfrey himself, who had promised to cede Jerusalem to the patriarch Dagobert as soon as he should himself acquire Cairo). The capture of Ascalon by Baldwin III. in 1153 made this object more feasible; and we find the Hospitallers preparing sketch-maps of the routes best suited for an invasion of Egypt, in the style of a modern war office. On the other hand, it was natural for Nureddin to attempt to secure Egypt, both because it was the terminus of the trading route which ran from Damascus and because the acquisition of Egypt would enable him to surround the Latin kingdom. For some five years a contest was waged between Amalric and Shirguh (Shirkuh), the lieutenant of Nureddin, for the possession of Egypt. Thrice (1164, 1167, 1168) Amalric penetrated into Egypt: but the contest ended in the establishment of Saladin, the nephew of Shirguh, as vizier—a position which, on the death of the puppet caliph in 1171, was turned into that of sovereign. The extinction of the Latin kingdom might now seem imminent; and envoys were sent to the West with anxious appeals for assistance in 1169, 1171 and 1173. But though in 1170 Saladin attacked the kingdom, and captured Aila on the Red Sea, the danger was not so great as it seemed. Nureddin was jealous of his over-mighty subject, and his jealousy bound Saladin's hands. This was the position of affairs when Amalric died, in 1174; but, as Nureddin died in the same year, the position was soon altered and Saladin began the final attack on the kingdom. Amalric I., the second of the native kings of Jerusalem, had the qualities of his brother Baldwin III. (*q.v.*). He was something of a scholar, and it was he who set William of Tyre to work. He was perhaps still more of a lawyer: his delight was in knotty points of the law, and he knew the *Assises* better than any of his subjects. The Church had some doubts of him, and he laid his hands on the Church. William of Tyre was once astonished to find him questioning, on a bed of sickness, the resurrection of the body; and his taxation of clerical goods gave umbrage to the clergy generally. But he maintained the state of his kingdom with the resources which he owed to the Church; and he is the last in the fine list of the early kings of Jerusalem.

William of Tyre is our original authority: see xix. 2-3 for his sketch of Amalric. Röhricht narrates the reign of Amalric I., *Geschichte des Königreichs Jerusalem*, c. xvii.-xviii.

Amalric II., king from 1197 to 1205, was the brother of Guy of Lusignan. He had been constable of Jerusalem, but in 1194, on the death of his brother, he became king of Cyprus, as Amalric I. He married Isabella, the daughter of Amalric I. by his second marriage, and became king of Jerusalem in right of his wife in 1197. In 1198 he was able to procure a five years' truce with the Mahommedans, owing to the struggle between Saladin's brothers and his sons for the inheritance of his territories. The truce was disturbed by raids on both sides, but in 1204 it was renewed for six years. Amalric died in 1205, just after his son and just before his wife. The kingdom of Cyprus passed to Hugh, his son by an earlier marriage, while that of Jerusalem passed to Maria, the daughter of Isabella by her previous marriage with Conrad of Montferrat. (E. Br.)

AMALRIC (Fr. Amaury) **OF BENA** (d. *c.* 1204–1207), French theologian, was born in the latter part of the 12th century at Bena, a village in the diocese of Chartres. He taught philosophy and theology at the university of Paris and enjoyed a great reputation as a subtle dialectician; his lectures developing the philosophy of Aristotle attracted a large circle of hearers. In 1204 his doctrines were condemned by the university, and, on a personal appeal to Pope Innocent III., the sentence was ratified, Amalric being ordered to return to Paris and recant his errors. His death was caused, it is said, by grief at the humiliation to which he had been subjected. In 1209 ten of his followers were burnt before the gates of Paris, and Amalric's own body was exhumed and burnt and the ashes given to the winds. The doctrines of his followers, known as the Amalricians, were formally condemned by the fourth Lateran Council in 1215. Amalric appears to have derived his philosophical system from Erigena (*q.v.*), whose principles he developed in a one-sided and strongly pantheistic form. Three propositions only can with certainty be attributed to him: (1) that God is all; (2) that every Christian is bound to believe that he is a member of the body of Christ, and that this belief is necessary for salvation: (3) that he who remains in love of God can commit no sin. These three propositions were further developed by his followers, who maintained that God revealed Himself in a threefold revelation, the first in Abraham, marking the epoch of the Father; the second in Christ, who began the epoch of the Son; and the third in Amalric and his disciples, who inaugurated the era of the Holy Ghost. Under the pretext that a true believer could commit no sin, the Amalricians indulged in every excess, and the sect does not appear to have long survived the death of its founder.

See W. Preger, *Geschichte der deutschen Mystik im Mittelalter* (Leipzig, 1874, i. 167-173); Hauréau, *Hist. de la phil. scol.* (Paris, 1872); C. Schmidt, *Hist. de l'Église d'Occident pendant le moyen âge* (Paris, 1885); Hefele, *Conciliengesch.* (2nd ed., Freiburg, 1886).

AMALTEO, the name of an Italian family belonging to Oderzo, Treviso, several members of which were distinguished in literature. The best known are three brothers, Geronimo (1507–1574), Giambattista (1525–1573) and Cornelio (1530–1603), whose Latin poems were published in one collection under the title *Trium Fratrum Amaltheorum Carmina* (Venice, 1627; Amst., 1689). The eldest brother, Geronimo, was a celebrated physician; the second, Giambattista, accompanied a Venetian embassy to England in 1554, and was secretary to Pius IV. at the council of Trent; the third, Cornelio, was a physician and secretary to the republic of Ragusa.

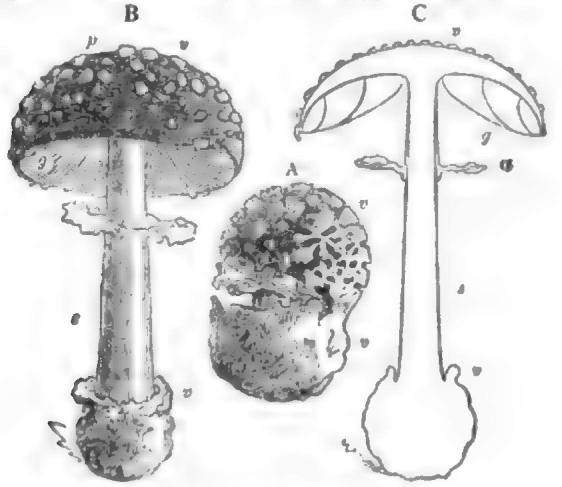
AMALTEO, POMPONIO (1505–1584), Italian painter of the Venetian school, was born at San Vito in Friuli. He was a pupil and son-in-law of Pordenone, whose style he closely imitated. His works consist chiefly of frescoes and altar-pieces and many of them (*e.g.* in the church of Santa Maria de' Battisti, at San Vito) have suffered greatly from the ravages of time.

AMALTHEIA, in Greek mythology, the foster-mother of Zeus. She is sometimes represented as the goat which suckled the infant-god in a cave in Crete, sometimes as a nymph of uncertain parentage (daughter of Oceanus, Haemonius, Olen, Melisseus), who brought him up on the milk of a goat. This goat having broken off one of its horns, Amaltheia filled it with flowers and fruits and presented it to Zeus, who placed it together with the goat amongst the stars. According to another story, Zeus himself broke off the horn and gave it to Amaltheia, promising that it would supply whatever she desired in abundance. Amaltheia gave it to Achelous (her reputed brother), who exchanged it for his own horn which had been broken off in his contest with Heracles for the possession of Deianeira. According to ancient mythology, the owners of the horn were many and various. Speaking generally, it was regarded as the symbol of inexhaustible riches and plenty, and became the attribute of various divinities (Hades, Gaea, Demeter, Cybele, Hermes), and of rivers (the Nile) as fertilizers of the land. The term "horn of Amaltheia" is applied to a fertile district, and an estate belonging to Titus Pomponius Atticus was called Amaltheum. Cretan coins represent the infant Zeus being suckled by the goat; other Greek coins exhibit him suspended from its teats or carried in the arms of a nymph (Ovid, *Fasti*, v. 115; *Metam.* ix. 87).

AMANA, a township in Iowa county, Iowa, U.S.A., 19 m. S.W. (by rail) of Cedar Rapids. Pop. (1890) 1687; (1900) 1748. It is served by the Chicago, Milwaukee & St Paul, and the Chicago, Rock Island & Pacific railways. The township is the home of a German religious communistic society, the Amana Society, formerly the True Inspiration Society (so called from its belief in the present inspiration of the truly godly and perfectly pious), whose members live in various villages near the Iowa river. These villages are named Amana, West Amana, South Amana, East Amana, Middle Amana, High Amana and Homestead. The houses are of brick or unpainted wood. The society has in all 26,000 acres of land, of which about 10,000 acres are covered with forests. The principal occupation of the members is farming, although they also have woollen mills (their woollens being of superior quality), a cotton print factory, flour mills, saw mills and dye shops. Each family has its own dwelling-place and a small garden; each member of a family has an annual allowance of credit at the common store and a room in the dwelling-house; and each group of families has a large garden, a common kitchen and a common dining-hall where men and women eat at separate tables. Between the ages of five and fourteen education is compulsory for the entire year. In the schools nature study and manual training are prominent; German is used throughout and English is taught in upper classes only. No man is permitted to marry until twenty-four years of age, and no woman until twenty. The society's views and practices are nearly related to the teachings of Schwenkfeld and Boehme. Baptism is not practised; the Lord's Supper is celebrated only once in two years; foot-washing is held as a sacrament. At an annual spiritual examination of the members, there are mutual criticisms and public confessions of sin. The Inspirationists are opposed to war and to taking of oaths. The Society became attached to the Separatist leader, Eberhard Ludwig Gruber (d. 1728) in Wetterau in 1714; in 1842–1844 about 000 members, led by Christian Metz, the "divine instrument" of the Society, emigrated from Germany to the United States and settled in a colony called Ebenezer, in Erie county, near Buffalo, N.Y.; in 1855 the colony began to remove to its present home, which it named from the mountain mentioned in the Song of Solomon, iv. 8, the Hebrew word meaning "remain true" (or, more probably, "fixed"), and in 1859 it was incorporated under the name of the Amana Society. Metz died in 1864 and was succeeded by Barbara Landmann, since whose death in 1884 the community has lacked an inspired leader. Amana was the strongest in numbers of the few sectarian communities in America which outlived the 19th century. A few new members have joined the community from Switzerland and Germany in recent years. In 1905 the community won a suit brought against it for its dissolution on the ground that, having been incorporated solely as a benevolent and religious body, it was illegally carrying on a general business.

See W. R. Perkins and B. L. Wick, *History of the Amana Society or Community of True Inspiration*, Historical Monograph, No. 1, in State University of Iowa publications (Iowa City, 1891); R. T. Ely, "Amana: A Study of Religious Communism," in *Harper's Magazine* for October 1902; and Bertha M. H. Shambaugh, *Amana, the Community of True Inspiration* (Iowa City, 1908).

AMANITA. The amanitas include some of the most showy representatives of the *Agaricineae* or mushroom order of fungi (*q.v.*). In the first stages of growth, they are completely enveloped by an outer covering called the veil. As the plant develops the veil is ruptured; the lower portion forms a sheath or volva round the base of the stem, while the upper portion persists as white patches or scales or warts on the surface of the cap. The stem usually bears an upper ring of tissue, the remains of an inner veil, that stretched from the stem to the edge of the cap and broke away from the cap as the latter expanded. The presence of the volva, and the clear white gills and spores, distinguish this genus from all other agarics. They are beautiful objects in the autumn woods; *Amanita muscaria*, the fly fungus, formerly known as *Agaricus muscarius*, being especially remarkable by its bright red cap covered with white warts. Others are pure white or of varying shades of yellow or green. There are sixteen British species of *Amanita*; they grow on the ground in or near woods. Several of the species are very poisonous.



Amanita muscaria.

A, the young plant.
B, the mature plant.
C, longitudinal section of mature plant.
p, the *pileus*.
g, the gills.
a, the *annulus*, or remnant of *velum partiale*.
v, remains of *volva* or *velum universale*.
s, the stalk.

AMANUENSIS (a Latin word, derived from the phrase *servus a manu*, slave of the hand, a secretary), one who writes, from dictation or otherwise, on behalf of another.

AMAPALA, the only port on the Pacific coast of Honduras, on the northern shore of Tigre island, in the Bay of Fonseca (*q.v.*); in 13° 3′ N., and 87° 9′ W. Pop. (1905) about 4000. Amapala was founded in 1838, and its port was opened and declared free in 1868. The roadstead is perfectly sheltered and so deep that the largest vessels can lie within a few yards of the shore. It is the natural outlet for the commerce of some of the richest parts of Honduras, Nicaragua and Salvador; and during the 19th century it exported large quantities of gold, silver and other ores, although its progress was retarded by the delay in constructing a transcontinental railway from Puerto Cortes. Its depots on the mainland, both about 30 m. distant, are La Brea, for the line to Puerto Cortes, and San Lorenzo, for Tegucigalpa. Silver is still exported, in addition to hides, timber, coffee and indigo, and there are valuable fisheries.

AMARANTH, or AMARANT (from the Gr. *ἀμάραντος*, unwithering), a name chiefly used in poetry, and applied to certain plants which, from not soon fading, typified immortality. Thus Milton (*Paradise Lost*, iii. 353):—

> "Immortal amarant, a flower which once
> In paradise, fast by the tree of life,
> Began to bloom; but soon for man's offence
> To heaven removed, where first it grew, there grows,
> And flowers aloft, shading the fount of life,
> And where the river of bliss through midst of heaven
> Rolls o'er elysian flowers her amber stream:
> With these that never fade the spirits elect
> Bind their resplendent locks."

It should be noted that the proper spelling of the word is amarant; the more common spelling seems to have come from a hazy notion that the final syllable is the Greek word *ἄνθος*, "flower," which enters into a vast number of botanical names.

The plant genus *Amarantus* (natural order Amarantaceae) contains several well-known garden plants, such as love-lies-bleeding (*A. caudatus*), a native of India, a vigorous hardy annual, with dark purplish flowers crowded in handsome drooping spikes. Another species *A. hypochondriacus*, is prince's feather, another Indian annual, with deeply-veined lance-shaped leaves, purple on the under face, and deep crimson flowers densely packed on erect spikes. "Globe amaranth" belongs to an allied genus, *Gomphrena*, and is also a native of India. It is an annual about 18 in. high, with solitary round heads of flowers; the heads are violet from the colour of the bracts which surround the small flowers.

In ancient Greece the amaranth (also called *χρυσάνθεμον* and *ἑλίχρυσος*) was sacred to Ephesian Artemis. It was supposed to have special healing properties, and as a symbol of immortality was used to decorate images of the gods and tombs. In legend, Amarynthus (a form of Amarantus) was a hunter of Artemis and king of Euboea; in a village of Amarynthus, of which he was the eponymous hero, there was a famous temple of Artemis Amarynthia or Amarysia (Strabo x. 448; Pausan. i. 31, p. 5).

See Lenz, *Botanik der alt. Griech. und Röm.* (1859); J. Murr, *Die Pflanzenwelt in der griech. Mythol.* (1890).

AMARAPURA ("the city of the gods"), formerly the capital of the Burmese kingdom, now a suburb of Mandalay, Burma, with a population in 1901 of 9103. The town was founded in 1783 to form a new capital about 6 m. to the north-east of Ava. It increased rapidly in size and population, and in 1810 was estimated to contain 170,000 inhabitants; but in that year the town was destroyed by fire, and this disaster, together with the removal of the native court to Ava in 1823, caused a decline in the prosperity of the place. In 1827 its population was estimated at only 30,000. It suffered severe calamity from an earthquake, which in 1839 destroyed the greater part of the city. It was finally abandoned in 1860, when king Mindon occupied Mandalay, 5 or 6 m. farther north. Amarapura was laid out on much the same plan as Ava. The ruins of the city wall, now overgrown with jungle, show it to have been a square with a side of about three-quarters of a mile in length. At each corner stood a solid brick pagoda about 100 ft. high. The most remarkable edifice was a celebrated temple, adorned with 250 lofty pillars of gilt wood, and containing a colossal bronze statue of Buddha. The remains of the former palace of the Burmese monarchs still survive in the centre of the town. During the time of its prosperity Amarapura was defended by a rampart and a large square citadel, with a broad moat, the walls being 7000 ft. long and 20 ft. high, with a bastion at each corner. The Burmans know it now as Myohaung, "the old city." It has a station on the Rangoon-Mandalay railway, and is the junction for the line to Maymyo and the Kunlong ferry and for the Sagaing-Myitkyina railway. The group of villages called Amarapura by Europeans is known to the Burmans as Taung-myo, "the southern city," as distinguished from Mandalay, the Myauk-myo, or "northern city," 3 m. distant.

AMARAR, a tribe of African "Arabs" inhabiting the mountainous country on the west side of the Red Sea from Suakin northwards towards Kosseir. Between them and the Nile are the Ababda and Bisharin tribes and to their south dwell the Hadendoa. The country of the Amarar is called the Etbai. Their headquarters are in the Ariab district. The tribe is divided into four great families: (1) Weled Gwilei, (2) Weled Aliab, (3) Weled Kurbab Wagadab, and (4) the Amarar proper of the Ariab district. They claim to be of Koreish blood and to be the descendants of an invading Arab army. Possibly some small bands of Koreish Arabs may have made an inroad and converted some of the Amarar to Islam. Further than this there is little to substantiate their claim.

See *Anglo-Egyptian Sudan*, edited by Count Gleichen (London, 1905); Sir F. R. Wingate, *Mahdism and the Egyptian Sudan* (London, 1891); A. H. Keane, *Ethnology of Egyptian Sudan* (London, 1884).

AMARA SINHA (*c.* A.D. 375), Sanskrit grammarian and poet, of whose personal history hardly anything is known. He is said to have been "one of the nine gems that adorned the throne of Vikramaditya," and according to the evidence of Hsüan Tsang, this is the Chandragupta Vikramaditya that flourished about A.D. 375. Amara seems to have been a Buddhist; and an early tradition asserts that his works, with one exception, were destroyed during the persecution carried on by the orthodox Brahmins in the 5th century. The exception is the celebrated *Amara-Kosha* (Treasury of Amara), a vocabulary of Sanskrit roots, in three books, and hence sometimes called *Trikanda* or the "Tripartite." It contains 10,000 words, and is arranged, like other works of its class, in metre, to aid the memory. The first chapter of the *Kosha* was printed at Rome in Tamil character in 1798. An edition of the entire work, with English notes and an index by H. T. Colebrooke, appeared at Serampore in 1808. The Sanskrit text was printed at Calcutta in 1831. A French translation by A. L. A. Loiseleur-Deslongchamps as published at Paris in 1839.

AMARI, MICHELE (1806–1889), Italian orientalist and patriot, was born at Palermo. From his earliest youth he imbibed liberal principles from his relatives, especially from his grandfather, and although at the age of fourteen he was appointed clerk in the Bourbon civil service, he joined the Carbonari like many other young Sicilians and actively sympathized with the revolution of 1820. The movement, which was separatist in its tendencies, was quickly suppressed, but the conspiracies continued, and Amari's father, implicated in that of 1822, was arrested and condemned to death together with many others; but his sentence was commuted to imprisonment, and in 1834 he was liberated. Michele Amari still held his clerkship, but he regarded the Neapolitan government with increasing hatred, and he led a life of active physical exercise to train himself for the day of revolution. He devoted much of his time to the study of English and of history; his first literary essay was a translation of Sir Walter Scott's *Marmion* (1832), and in 1839 he published a work on the Sicilian Vespers, entitled *Un Periodo delle storie Siciliane del XIII. secolo*, filled with political allusions reflecting unfavourably on the government. The book had an immediate success and went through many editions, but it brought the author under the suspicion of the authorities, and in 1842 he escaped from a boat just as he was about to be arrested. He settled in Paris, where he came in contact with a number of literary men, such as Michelet and Thierry, as well as with the Italian exiles. Having no private means he had to earn a precarious livelihood by literature. He was much struck with certain French translations of Arabic works on Sicily, which awoke in him a desire to read the authors in the original. With the assistance of Prof. Reinaud and Baron de Slane he soon acquired great proficiency in Arabic, and his translations and editions of oriental texts, as well as his historical essays, made him a reputation. In 1844 he began his great work *La Storia dei Musulmani in Sicilia*, but the revolution of 1848 plunged him into politics once more. His pamphlet, *Quelques Observations sur le droit public de la Sicile*, advocating the revival of the 1812 constitution for the island, met with great success, and on arriving at Palermo, whence the Bourbon government had been expelled, he was chosen member of the war committee and appointed professor of public law at the university. At the general elections Amari was returned for Palermo and became minister of finance in the Stabile cabinet. On its fall he was sent to Paris and London to try to obtain help for the struggling island; having failed in his mission he returned to Sicily in 1849, hoping to fight. But the Neapolitan troops had re-occupied the island, the Liberals were in disagreement among themselves, and Amari with several other notables with difficulty escaped to Malta. Characteristic of his scholarly nature is the fact that he delayed his flight to take the impress of an important Arabic inscription. He returned to Paris, sad and dejected at the collapse of the movement, and devoted himself once more to his Arabic studies. He published a work on the chronology of the Koran, for which he received a prize from the Académie des Inscriptions, edited the *Solwan el Mota* by Ibn Zafer (a curious collection of philosophical thoughts) and Ibn Haukal's *Description of Palermo*, and in 1854 the first volume of his history of the Mahommedans in Sicily appeared. He received a meagre stipend for cataloguing the Arabic MSS. in the Bibliothèque Nationale, and he contributed many articles to the reviews. Although a firm friend of Mazzini, he discouraged the latter's premature conspiracies. In 1859, after the expulsion of the central Italian despots, Amari was appointed professor of Arabic at Pisa and afterwards at Florence. But when Garibaldi and his thousand had conquered Sicily, Amari returned to his native island, and was given an appointment in the government. Although intensely Sicilian in sentiment, he became one of the staunchest advocates of the union of Sicily with Italy, and was subsequently made senator of the kingdom at Cavour's instance. He was minister of education in the Farini and Minghetti cabinets, but on the fall of the latter in 1864, he resumed his professorship at Florence and spent the rest of his life in study. His circle of acquaintances, both in Italy and abroad, was very large, and his sound scholarship was appreciated in all countries. He died in 1889, loaded with honours. The last volume of his *Storia dei Musulmani* appeared in 1873, and in addition to the above-mentioned works he published many others on oriental and historical subjects. His work on the Sicilian Vespers was re-written as *La Guerra del Vespro* (9th ed., Milan, 1886). He was the pioneer of Arabic studies in modern Italy, and he still remains the standard authority on the Mussulman domination in Sicily, though his judgment on religious questions is sometimes warped by a violently anti-clerical bias.

See A. D'Ancona, *Carteggio di Michele Amari coll' elogio di lui* (Turin, 1896); and Oreste Tommasini's essay in his *Scritti di storia e critica* (Rome, 1891). (L. V.*)

AMARYLLIS (the name of a girl in classical pastoral poetry), in botany, a genus of the natural order Amaryllidaceae, containing the belladonna lily (*Amaryllis Belladonna*), a native of South Africa, which was introduced into cultivation at the beginning of the 18th century. This is a half-hardy bulbous plant, producing in the spring a number of strap-shaped, dull green leaves, 1–1½ ft. long, arranged in two rows, and in autumn a solid stem, bearing at the top a cluster of 6–12 funnel-shaped flowers, of a rose colour and very fragrant. Several forms are known in cultivation. Most of the so-called Amaryllis of gardens belong to the allied genus *Hippeastrum* (*q.v.*).

AMASIA (anc. *Amasia*), the chief town of a sanjak in the Sivas vilayet of Asia Minor and an important trade centre on the Samsun-Sivas road, beautifully situated on the Yeshil Irmak (*Iris*). Pop. 30,000; Moslems about 20,000, of whom a large proportion are Kizilbash (Shia); Christians (mostly Armenians), 10,000. It was one of the chief towns of the kingdom of Trebizond and of the Seljuks, one of whose sultans, Kaikobad I., enriched it with fine buildings and restored the castle, which was thus enabled to stand a seven months' siege by Timur. It was also much favoured by the early Osmanli sultans, one of whom, Selim I., was born there. Bayezid II. built a fine mosque. The place was modernized about a generation ago by Zia Pasha, the poet, when governor, and is now an unusually well built Turkish town with good bazaar and khans and a fine clock-tower. The

Americans and the Jesuits have missionary schools for the Armenian population. Amasia has extensive orchards and fruit gardens still, as in Ibn Batuta's time, irrigated by water wheels turned by the current of the river; and there are steam flour-mills. Wheat, flour and silk are exported.

Ancient *Amasia* has left little trace of itself except on the castle rock, on the left of the river, where the acropolis walls and a number of splendid rock-cut tombs, described by Strabo as those of the kings of Pontus, can be seen. The cliff is cut away all round these immense sepulchres so that they stand free. The finest, known from its polished surfaces as the "Mirror Tomb," is about 2 m. from the modern city. Amasia rose into historical importance after the time of Alexander as the cradle of the power of Pontus; but the last king to reign there was the father of Mithradates Eupator "The Great." The latter, however, made it the base of his operations against the Romans in 89, 72 and 67 B.C. Pompey made it a free city in 65, after Mithradates' fall. It was the birthplace of Strabo. (D. G. H.)

AMASIS, or Amosis (the Greek forms of the Egyptian name *Ahmase*, *Ahmosi*, "the moon is born," often written *Aahmes* or *Ahmes* in modern works), the name of two kings of ancient Egypt.

Amasis I., the founder of the XVIIIth dynasty, is famous for his successful wars against the Hyksos princes who still ruled in the north-east of the Delta (see Egypt: *History*, sect. 1.)

Amasis II. was the last great ruler of Egypt before the Persian conquest, 570–526 B.C. Most of our information about him is derived from Herodotus (ii. 161 et seq.) and can only be imperfectly controlled by monumental evidence. According to the Greek historian he was of mean origin. A revolt of the native soldiers gave him his opportunity. These troops, returning home from a disastrous expedition to Cyrene, suspected that they had been betrayed in order that Apries, the reigning king, might rule more absolutely by means of his mercenaries, and their friends in Egypt fully sympathized with them. Amasis, sent to meet them and quell the revolt, was proclaimed king by the rebels, and Apries, who had now to rely entirely on his mercenaries, was defeated and taken prisoner in the ensuing conflict at Momemphis; the usurper treated the captive prince with great lenity, but was eventually persuaded to give him up to the people, by whom he was strangled and buried in his ancestral tomb at Sais. An inscription confirms the fact of the struggle between the native and the foreign soldiery, and proves that Apries was killed and honourably buried in the 3rd year of Amasis. Although Amasis thus appears first as champion of the disparaged native, he had the good sense to cultivate the friendship of the Greek world, and brought Egypt into closer touch with it than ever before. Herodotus relates that under his prudent administration Egypt reached the highest pitch of prosperity; he adorned the temples of Lower Egypt especially with splendid monolithic shrines and other monuments (his activity here is proved by remains still existing). To the Greeks Amasis assigned the commercial colony of Naucratis on the Canopic branch of the Nile, and when the temple of Delphi was burnt he contributed 1000 talents to the rebuilding. He also married a Greek princess named Ladice, the daughter of Battus, king of Cyrene, and he made alliances with Polycrates of Samos and Croesus of Lydia. His kingdom consisted probably of Egypt only, as far as the First Cataract, but to this he added Cyprus, and his influence was great in Cyrene. At the beginning of his long reign, before the death of Apries, he appears to have sustained an attack by Nebuchadrezzar (568 B.C.). Cyrus left Egypt unmolested; but the last years of Amasis were disturbed by the threatened invasion of Cambyses and by the rupture of the alliance with Polycrates of Samos. The blow fell upon his son Psammetichus III., whom the Persian deprived of his kingdom after a reign of only six months.

See Naucratis; also W. M. Flinders Petrie, *History*, vol. iii.; Breasted, *History* and *Historical Documents*, vol. iv. p. 509; Maspero, *Les Empires*. (F. Ll. G.)

AMATEUR (Lat. *amator*, lover), a person who takes part in any art, craft, game or sport for the sake of the pleasure afforded by the occupation itself and not for pecuniary gain. Being thus a person for whom the pursuit in question is a recreation and not a business, and who therefore presumably devotes to it a portion only of his leisure and not his working hours, the average amateur possesses less skill than the average professional, whose livelihood and reputation depend on his proficiency, and who therefore concentrates all his energies on the task of attaining the greatest possible mastery in his chosen career. In the arts, such as music, painting and the drama, the best amateurs are outdistanced as executants not merely by the best professionals but by professionals far below the highest rank; and although the inferiority of the amateur is not perhaps so pronounced or so universal in the case of games and outdoor sports, the records of such pastimes as horse-racing, boxing, rowing, billiards, tennis and golf prove that here also the same contrast is generally to be found. Hence it has come about that the term "amateur," and more especially the adjectival derivative "amateurish," has acquired a secondary meaning, usually employed somewhat contemptuously, signifying inefficiency, unskilfulness, superficial knowledge or training.

The immense increase in popularity of athletic contests and games of all kinds in modern times, and especially the keen competition for "records" and championships, often of an international character, have made it a matter of importance to arrive at a clear and formal definition of the amateur as distinguished from the professional. The simple, straightforward definition of the amateur given above has been proved to be easily evaded. Many leading cricketers, for example, preserve their amateur status who, although they are not paid wages for each match they play like their professional colleagues, are provided with an annual income by their county or club under the guise of salary for performing the duties of "secretary" or some other office, leaving them free to play the game six days a week. Similarly, "gentlemen riders" are often presented with a cash payment described as a bet, or under some other pretext. Nor is the dividing-line between "out-of-pocket expenses" allowed to the amateur and the remuneration payable to the professional always strictly drawn. The various associations controlling the different branches of sport have therefore devised working regulations to be observed so far as their jurisdiction extends. Thus the Amateur Athletic Association of Great Britain defines an amateur as "one who has never competed for a money prize or staked bet, or with or against a professional for any prize, or who has never taught, pursued or assisted in the practice of athletic exercises as a means of obtaining a livelihood." The rules of the Amateur Rowing Association are stricter, denying amateur status to anyone who has ever steered or rowed in a race with a professional for any prize, or who is or has been by trade or employment for wages a mechanic, artisan or labourer, or engaged in any menial duty, besides insisting upon the usual restrictions in regard to taking money and competing with professionals. In association football the rules are much more lax, for although amateurs are clearly distinguished from professionals, an amateur may even become a regular member, though unsalaried, of a professional team without losing his amateur status. The Rugby game was, up to 1895, entirely controlled by the Rugby Football Union, which, by the strictness of its laws, effectually prevented the growth of professionalism, but there had been much dissatisfaction in the provinces with the Union's decision against reimbursing day-working players for "broken time," *i.e.* for that part of their wages which they lost by playing on working days, and this resulted in the formation (1895) of the Northern Union, which permits remuneration for "broken time," but allows no person who works for his living to play football unless regularly employed at his particular trade.

In America the amateur question is less complicated than in Great Britain; but the intensely business-like character of American ideas of sport has encouraged the modern spirit of professionalism. All important sports in America, except baseball, football, cricket, golf and rowing, are, however, under the control of the Amateur Athletic Union of the United States, the rules of which, so far as they relate to professionalism, are as follows. No person shall be eligible to compete in any athletic meeting, game or entertainment, given or sanctioned by this Union, who has (1) received or competed for compensation or reward in any form for the display, exercise or example of his skill or knowledge of any athletic exercise, or for rendering personal service of any kind to any athletic organization, or for becoming or continuing a member of any athletic organization; or (2) has entered any competition under a name other than his own, or from a club of which he was not at that time a member in good standing; or (3) has knowingly entered any competition open to any professional or professionals, or has knowingly competed with any professional for any prize or token; or (4) has issued or allowed to be issued in his behalf any challenge to compete against any professional or for money; or (5) has pawned, bartered or sold any prize won in athletic competition. It will be seen that by rule 3 the American Union enacts a standard for all athletes not much different from that of the British Amateur Rowing Association. The rules for the sports not within the Union's jurisdiction are practically the same, except that in baseball, cricket and golf amateurs may compete with professionals, though not for cash prizes. In the case of open golf competitions professional prize-winners receive cash, while amateurs are given plate to the value of their prizes as in Great Britain. There are practically no professional football players in America.

On both sides of the Atlantic the question of the employment of professional coaches has occasioned much discussion. In America it has been accepted as legal. In England the same is almost universally true, but there are certain exceptions, such as the decision of the Henley Regatta Committee, that no crew entering may be coached by a professional within two months of the race-day. Whether such a regulation be wise or the reverse is a question that depends upon the spirit in which games are regarded. Nobody wants to disparage proficiency; but if a game is conducted on business methods, the "game" element tends to be minimized, and if its object is pecuniary it ceases to be "sport" in the old sense, and the old idea of the "amateur" who indulges in it for love of the mere enjoyment tends to disappear.

AMATHUS, an ancient city of Cyprus, on the S. coast, about 24 m. W. of Larnaka and 6 m. E. of Limassol, among sandy hills and sand-dunes, which perhaps explain its name in Greek (ἄμαθος, sand). The earliest remains hitherto found on the site are tombs of the early Iron Age period of Graeco-Phoenician influences (1000–600 B.C.). Amathus is identified by some (E. Oberhummer, *Die Insel Cypern*, i., 1902, pp. 13-14; but see CITIUM) with *Kartihadasti* (Phoenician "New-Town") in the Cypriote tribute-list of Esarhaddon of Assyria (668 B.C.). It certainly maintained strong Phoenician sympathies, for it was its refusal to join the phil-Hellene league of Onesilas of Salamis which provoked the revolt of Cyprus from Persia in 500–494 B.C. (Herod. v. 105), when Amathus was besieged unsuccessfully and avenged itself by the capture and execution of Onesilas. The phil-Hellene Evagoras of Salamis was similarly opposed by Amathus about 385-380 B.C. in conjunction with Citium and Soli (Diod. Sic. xiv. 98); and even after Alexander the city resisted annexation, and was bound over to give hostages to Seleucus (Diod. Sic. xix. 62). Its political importance now ended, but its temple of Adonis and Aphrodite (*Venus Amathusia*) remained famous in Roman time.

The wealth of Amathus was derived partly from its corn (Strabo 340, quoting Hipponax, *fl.* 540 B.C.), partly from its copper mines (Ovid, *Met.* x. 220, 531), of which traces can be seen inland (G. Mariti, i. 187; L. Ross, *Inselreise*, iv. 195; W. H. Engel, *Kypros*, i. 111 ff.). Ovid also mentions its sheep (*Met.* x. 227); the epithet *Amathusia* in Roman poetry often means little more than "Cypriote," attesting however the fame of the city.

Amathus still flourished and produced a distinguished patriarch of Alexandria (Johannes Eleëmon), as late as 606–616, and a ruined Byzantine church marks the site; but it was already almost deserted when Richard Cœur de Lion won Cyprus by a victory there over Isaac Comnenus in 1191. The rich necropolis, already partly plundered then, has yielded valuable works of art to New York (L. P. di Cesnola, *Cyprus*, 1878 *passim*) and to the British Museum (*Excavations in Cyprus*, 1894 (1899) *passim*); but the city has vanished, except fragments of wall and of a great stone cistern on the acropolis. A similar vessel was transported to the Louvre in 1867. Two small sanctuaries, with terra-cotta votive offerings of Graeco-Phoenician age, lie not far off, but the great shrine of Adonis and Aphrodite has not been identified (M. Ohnefalsch-Richter, *Kypros*, i. ch.1). (J. L. M.)

AMATI, the name of a family of Italian violin-makers, who flourished at Cremona from about 1550 to 1692. According to Fétis, Andrea and Nicolo Amati, two brothers, were the first Italians who made violins. They were succeeded by Antonio and Geronimo, sons of Nicolo. Another Nicolo, son of Geronimo, was born on the 3rd of September 1596 and died on the 12th of August 1684. He was the most eminent of the family. He improved the model adopted by the rest of the Amatis and produced instruments capable of yielding greater power of tone. His pattern was usually small, but he also made the so-called "Grand Amatis." Of his pupils the most famous were Andrea Enamieri and Antonio Stradivari.

AMATITLÁN, or SAN JUAN DE AMATITLÁN, the capital of a department bearing the same name in Guatemala, on Lake Amatitlán, 15 m. S.W. of Guatemala city by the transcontinental railway from Puerto Barrios to San José. Pop. (1905) about 10,000. The town consists almost entirely of one-storeyed adobe huts inhabited by mulattoes and Indians, whose chief industry is the production of cochineal. In 1840 only a small Indian village marked its site, and its subsequent growth was due to the sugar plantations established by a Jesuit settlement. The wells of the town are strongly impregnated with salt and alum, and in the vicinity there are several hot springs. Lake Amatitlán, 9 m. long and 3 m. broad, lies on the northern side of the great Guatemalan Cordillera. Above it rises the four-cratered volcano of Pacaya (8390 ft.), which was in eruption in 1870. The outlet of the lake is a swift river 65 m. long, which cuts a way through the Cordillera, and enters the Pacific at Istapa, after forming at San Pedro a fine waterfall more than 200 ft. high.

AMAUROSIS (Gr. for "blinding,"), a term for "deprivation of sight," limited chiefly to those forms of defect or loss of vision which are caused by diseases not directly involving the eye.

AMAZON, the great river of South America. Before the conquest of South America, the *Rio de las Amazonas* had no general name; for, according to a common custom, each savage tribe gave a name only to the section of the river which it occupied—such as Paranáguazú, Guyerma, Solimões and others. In the year 1500, Vicente Yañez Pinzon, in command of a Spanish expedition, discovered and ascended the Amazon to a point about 50 m. from the sea. He called it the *Rio Santa Maria de la Mar Dulce*, which soon became abbreviated to *Mar Dulce*, and for some years, after 1502, it was known as the *Rio Grande*. The principal companions of Pinzon, in giving evidence in 1515, mention it as *El Ryo Marañon*. There is much controversy about the origin of the word *Marañon*. Peter Martyr in a letter to Lope Hurtado de Mendoza in 1513 is the first to state that it is of native origin. Ten years after the death of Pinzon, his friend Oviedo calls it the Marañon. Many writers believe that this was its Indian name. We are disposed to agree with the Brazilian historian Constancio that *Marañon* is derived from the Spanish word *maraña*, a tangle, a snarl, which well represents the bewildering difficulties which the earlier explorers met in navigating not only the entrance to the Amazon, but the whole island-bordered, river-cut and indented coast of the now Brazilian province of Maranhão.

The first descent of the mighty artery from the Andes to the sea was made by Orellana in 1541, and the name Amazonas arises from the battle which he had with a tribe of Tapuya savages where the women of the tribe fought alongside the men, as was the custom among all of the Tapuyas. Orellana, no doubt, derived the name *Amazonas* from the ancient Amazons (*q.v.*) of Asia and Africa described by Herodotus and Diodorus.

The first ascent of the river was made in 1638 by Pedro Texiera, a Portuguese, who reversed the route of Orellana and reached Quito by way of the Rio Napo. He returned in 1639 with the Jesuit fathers Acuña and Artieda, delegated by the viceroy of Peru to accompany him.

The river Amazon has a drainage area of 2,722,000 sq. m., if the Tocantins be included in its basin. It drains four-tenths of South America, and it gathers its waters from 5° N. to 20° S. latitude. Its most remote sources are found on the inter-Andean plateau, but a short distance from the Pacific Ocean; and, after a course of about 4000 m. through the interior of Peru and across Brazil, it enters the Atlantic Ocean on the equator. It is generally accepted by geographers that the Marañon, or Upper Amazon, rises in the little lake, Lauricocha, in 10° 30′ S. latitude, and 100 m. N.N.E. of Lima. They appear to have followed the account given by Padre Fritz which has since been found incorrect. According to Antonio Raimondi, it is the Rio de Nupe branch of the small stream which issues from the lake that has the longer course and the greater volume of water. The Nupe rises in the Cordillera de Huayhuath and is the true source of the Marañon. There is a difference among geographers as to where the Marañon ends and the Amazon begins, or whether both names apply to the same river. The Pongo de Manseriche, at the base of the Andes and the head of useful navigation, seems to be the natural terminus of the Marañon; and an examination of the hydrographic conditions of the great valley makes the convenience and accuracy of this apparent. Raimondi terminates the Marañon at the mouth of the Ucayali, Reclus the same, both following the missionary fathers of the colonial period. C. M. de la Condamine uses "Amazon" and "Marañon" indiscriminately and considers them one and the same. Smyth and Lowe give the mouth of the Javary as the eastern limit, as does d'Orbigny. Wolf, apparently uncertain, carries the "Marañon or Amazon" to the Peruvian frontier of Brazil at Tabatinga. Other travellers and explorers contribute to the confusion. This probably arises from the rivalry of the Spaniards and Portuguese. The former accepted the name Marañon in Peru, and as the missionaries penetrated the valley they extended the name until they reached the mouth of the Ucayali; while, as the Portuguese ascended the Amazon, they carried this name to the extent of their explorations. Beginning with the lower river we propose to notice, first, the great affluents which go to swell the volume of the main stream.

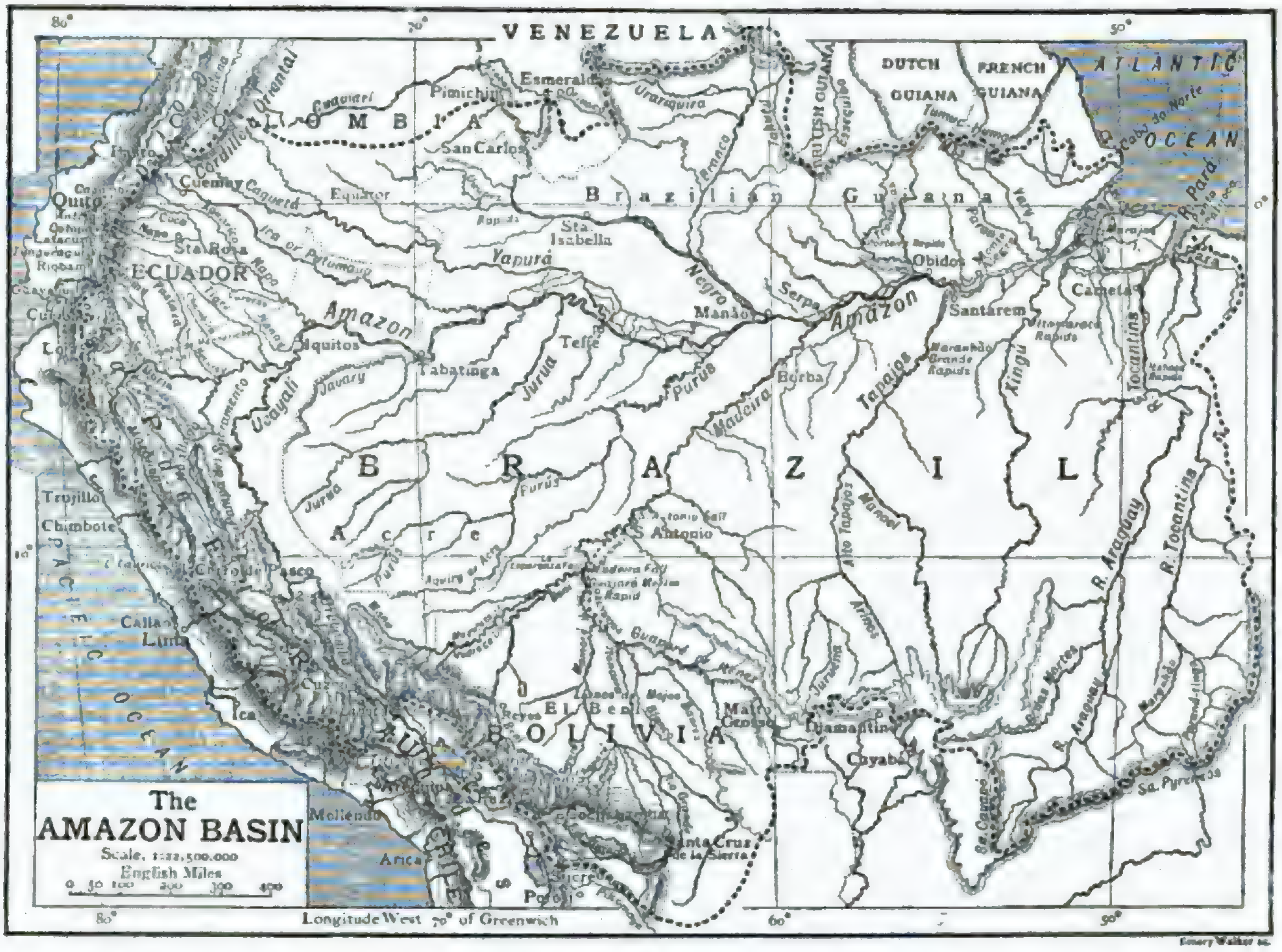
Tributaries.

The TOCANTINS is not really a branch of the Amazon, although usually so considered. It is the central fluvial artery of Brazil, running from south to north for a distance of about 1500 m. It rises in the mountainous district known as the Pyreneos; but its more ambitious western affluent, the Araguay, has its extreme southern headwaters on the slopes of the Serra Cayapó, and flows a distance of 1080 m. before its junction with the parent stream, which it appears almost to equal in volume. Besides its main tributary, the Rio das Mortes, it has twenty smaller branches, offering many miles of canoe navigation. In finding its way to the lowlands, it breaks frequently into falls and rapids, or winds violently through rocky gorges, until, at a point about 100 m. above its junction with the Tocantins, it saws its way across a rocky dyke for 12 m. in roaring cataracts. The tributaries of the Tocantins, called the Maranhão and Paraná-tinga, collect an immense volume of water from the highlands which surround them, especially on the south and south-east. Between the latter and the confluence with the Araguay, the Tocantins is occasionally obstructed by rocky barriers which cross it almost at a right angle. Through these, the river carves its channel, broken into cataracts and rapids, or *cachoeiras*, as they are called throughout Brazil. Its lowest one, the Itaboca cataract, is about 130 m. above its estuarine port of Cametá, for which distance the river is navigable; but above that it is useless as a commercial avenue, except for laborious and very costly transportation. The flat, broad valleys, composed of sand and clay, of both the Tocantins and its Araguay branch are overlooked by steep bluffs. They are the margins of the great sandstone plateaus, from 1000 to 2000 ft. elevation above sea-level, through which the rivers have eroded their deep beds. Around the estuary of the Tocantins the great plateau has disappeared, to give place to a part of the forest-covered, half submerged alluvial plain, which extends far to the north-east and west. The Pará river, generally called one of the mouths of the Amazon, is only the lower reach of the Tocantins. If any portion of the waters of the Amazon runs round the southern side of the large island of Marajo into the river Pará, it is only through tortuous, natural canals, which are in no sense outflow channels of the Amazon.

The XINGÚ, the next large river west of the Tocantins, is a true tributary of the Amazon. It was but little known until it was explored in 1884–1887 by Karl von den Steinen from Cuyabá. Travelling east, 240 m., he found the river Tamitatoaba, 180 ft. wide, flowing from a lake 25 m. in diameter. He descended this torrential stream to the river Romero, 1300 ft. wide, entering from the west, which receives the river Colisú. These three streams form the Xingú, or Paraná-xingú, which, from 73 m. lower down, bounds along a succession of rapids for 400 m. A little above the head of navigation, 105 m. from its mouth, the river makes a bend to the east to find its way across a rocky barrier. Here is the great cataract of Itamaracá, which rushes down an inclined plane for 3 m. and then gives a final leap, called the fall of Itamaracá. Near its mouth, the Xingú expands into an immense lake, and its waters then mingle with those of the Amazon through a labyrinth of *caños* (natural canals), winding in countless directions through a wooded archipelago.

The TAPAJOS, running through a humid, hot and unhealthy valley, pours into the Amazon 500 m. above Pará and is about 1200 m. long. It rises on the lofty Brazilian plateau near Diamantino in 14° 25′ S. lat. Near this place a number of streams unite to form the river Arinos, which at latitude 10° 25′ joins the Juruena to form the Alto Tapajos, so called as low down as the Rio Manoel, entering from the east. Thence to Santarem the stream is known as the Tapajos. The lower Arinos, the Alto Tapajos and the Tapajos to the last rapid, the Maranhão Grande, is a continuous series of formidable cataracts and rapids; but from the Maranhão Grande to its mouth, about 188 m., the river can be navigated by large vessels. For its last 100 m. it is from 4 to 9 m. wide and much of it very deep. The valley of the Tapajos is bordered on both sides by bluffs. They are from 300 to 400 ft. high along the lower river; but, a few miles above Santarem, they retire from the eastern side and only approach the Amazon flood-plain some miles below Santarem.

The MADEIRA has its junction with the Amazon 870 m. by river above Pará, and almost rivals it in the volume of its waters. It rises more than 50 ft. during the rainy season, and the largest ocean steamers may ascend it to the Fall of San Antonio, 663 m. above its mouth; but in the dry months, from June to November, it is only navigable for the same distance for craft drawing from 5 to 6 ft. of water. According to the treaty of San Ildefonso, the Madeira begins at the confluence of the Guaporé with the Mamoré. Both of these streams have their headwaters almost in contact with those of the river Paraguay. The idea of a connecting canal is based on ignorance of local conditions. San Antonio is the first of a formidable series of cataracts and rapids, nineteen in number, which, for a river distance of 263 m., obstruct the upper course of the Madeira until the last rapid called Guajará Merim (or Small Pebble), is reached, a little below the union of the Guaporé with the Mamoré. The junction of the great river Beni with the Madeira is at the Madeira Fall, a vast and grand display of reefs, whirlpools and boiling torrents. Between Guajará-Merim and this fall, inclusive, the Madeira receives the drainage of the north-eastern slopes of the Andes, from Santa Cruz de la Sierra to Cuzco, the whole of the south-western slope of Brazilian Matto Grosso, and the northern one of the Chiquitos sierras, an area about


The AMAZON BASIN
Scale, 1:22,500,000
English Miles
0 50 100 200 300 400
Longitude West 70° of Greenwich
80°
70°
60°
50°
VENEZUELA
COLOMBIA
DUTCH GUIANA
FRENCH GUIANA
ATLANTIC OCEAN
Brazilian Guiana
ECUADOR
BRAZIL
BOLIVIA
PACIFIC OCEAN
Amazon
Yapurá
Negro
Madeira
Purus
Jurua
Ucayali
Tapajos
Xingu
Tocantins
R. Araguay
Quito
Iquitos
Tabatinga
Teffe
Manáos
Obidos
Santarem
Cametá
Pará
Trujillo
Chimbote
Callao
Lima
Ica
Mollendo
Arica
Potosi
Sucre
Cochabamba
Santa Cruz de la Sierra
Matto Grosso
Diamantina
Cuyabá
S. Antonio
Reyes
El Beni
Acre
Emery Walker sc.

equal to that of France and Spain. The waters find their way to the falls of the Madeira by many great rivers, the principal of which, if we enumerate them from east to west, are the Guaporé or Itenez, the Baures and Blanco, the Itonama or San Miguel, the Mamoré, Beni, and Mayutata or Madre de Dios, all of which are reinforced by numerous secondary but powerful affluents. The Guaporé presents many difficulties to continuous navigation; the Baures and Itonama offer hundreds of miles of navigable waters through beautiful plains; the Mamoré has been sounded by the writer in the driest month of the year for a distance of 500 m. above Guajará-Merim, who found never less than from 10 to 30 ft. of water, with a current of from 1 to 3 m. an hour. Its Rio Grande branch, explored under the writer's instructions, was found navigable for craft drawing 3 ft. of water to within 30 m. of Santa Cruz de la Sierra—a level sandy plain intervening. The Grande is a river of enormous length, rising in a great valley of the Andes between the important cities of Sucre and Cochabamba, and having its upper waters in close touch with those of the Pilcomayo branch of the river Paraguay. It makes a long curve through the mountains, and, after a course of about 800 m., joins the Mamoré near 15° S. lat. The Chaparé, Securé and Chimoré, tributaries of the Mamoré, are navigable for launches up to the base of the mountains, to within 130 m. of Cochabamba. The Beni has a 12-ft. fall 18 m. above its mouth called "La Esperanza"; beyond this, it is navigable for 217 m. to the port of Reyes for launches in the dry season and larger craft in the wet one. The extreme source of the Beni is the little river La Paz, which rises in the inter-Andean region, a few miles south-east of Lake Titicaca, and flows as a rivulet through the Bolivian city of La Paz. From this point to Reyes the river is a torrent. The principal affluent of the Beni, and one which exceeds it in volume, enters it 120 m. above its mouth, and is known to the Indians along its banks as the Mayutata, but the Peruvians call it the Madre de Dios. Its ramifications drain the slopes of the Andes between 12° and 15° of latitude. It is navigable in the wet season to within 180 m. of Cuzco. Its upper waters are separated by only a short transitable canoe portage of 7 m. in a straight line from those of the Ucayali. The portage on the eastern side terminates at the Cashpajali river 22 m. above its junction with the Manu. For the first 13 m. it is navigable all the year for craft drawing 18 in. of water, but the remaining 9 m. present many obstacles to navigation. At the Manu junction the elevation above sea-level is 1070 ft., the river width 300 ft., depth 8 ft., current $1\frac{1}{2}$ m. per hour. The general direction of the Manu is south-east for 158 m. as far as the Pilcopata river, where under the name of Madre de Dios it continues with a flow of 22,000 cubic metres per minute. Here its elevation is 718 ft. above the sea and its width 500 ft. During the above course of 158 m. the Manu receives 135 large and small affluents. Although the inclination of its bed is not great, the obstacles to free navigation are abundant, and consist of enormous trees and masses of tree-trunks which have filled the river during the period of freshets.

From the time it receives the Manu, the Madre de Dios carries its immense volume of waters 485 m. to the Beni over the extremely easy slope of a vast and fertile plain. Its banks are low, its bottom pebbly. A greater part of its course is filled with large and small islands some 63 in number. Its average width is about 1500 ft. Below the mouth of the Tambopata, the flow is estimated at 191,250 cubic metres per minute. The average current is $2\frac{1}{2}$ m. per hour. There are two important rapids and one cataract on the lower 300 m. of the river.

The Mayutata receives three principal tributaries from the south—the Tambopata, Inambari and Pilcopata.

The Peruvian government has sought to open a trade route between the Rio Ucayali and the rich rubber districts of the

Mayutata. All of the upper branches of the river Madeira find their way to the falls across the open, almost level Mojos and Beni plains, 35,000 sq. m. of which are yearly flooded to an average depth of about 3 ft. for a period of from three to four months. They rival if they do not exceed in fertility the valley of the Nile, and are the healthiest and most inviting agricultural and grazing region of the basin of the Amazon.

The PURÚS, a very sluggish river, enters the Amazon west of the Madeira, which it parallels as far south as the falls of the latter stream. It runs through a continuous forest at the bottom of the great depression lying between the Madeira river, which skirts the edge of the Brazilian sandstone plateau, and the Ucayali which hugs the base of the Andes. One of its marked features is the five parallel *furos*[1] which from the north-west at almost regular intervals the Amazon sends to the Purús; the most south-westerly one being about 150 m. above the mouth of the latter river. They cut a great area of very low-lying country into five islands. Farther down the Purús to the right three smaller *furos* also connect it with the Amazon. Chandless found its elevation above sea-level to be only 107 ft. 500 m. from its mouth. It is one of the most crooked streams in the world, and its length in a straight line is less than half that by its curves. It is practically only a drainage ditch for the half-submerged, lake-flooded district it traverses. Its width is very uniform for 1000 m. up, and for 800 m. its depth is never less than 45 ft. It is navigable by steamers for 1648 m. as far as the little stream, the Curumahá, but only by light-draft craft. Chandless ascended it 1866 m. At 1792 m. it forks into two small streams. Occasionally a cliff touches the river, but in general the lands are subject to yearly inundations throughout its course, the river rising at times above 50 ft., the numerous lakes to the right and left serving as reservoirs. Its main tributary, the Aquiry or Acre, enters from the right about 1104 m. from the Amazon. Its sources are near those of the Mayutata. It is navigable for a period of about five months of the year, when the Purús valley is inundated; and, for the remaining seven months, only canoes can ascend it sufficiently high to communicate overland with the settlements in the great india-rubber districts of the Mayutata and lower Beni; thus these regions are forced to seek a canoe outlet for their rich products by the very dangerous, costly and laborious route of the falls of the Madeira.

The JURUÁ is the next great southern affluent of the Amazon west of the Purús, sharing with this the bottom of the immense inland Amazon depression, and having all the characteristics of the Purús as regards curvature, sluggishness and general features of the low, half-flooded forest country it traverses. It rises among the Ucayali highlands, and is navigable and unobstructed for a distance of 1133 m. above its junction with the Amazon.

The JAVARY, the boundary line between Brazil and Peru, is another Amazon tributary of importance. It is supposed to be navigable by canoe for 900 m. above its mouth to its sources among the Ucayali highlands, but only 260 have been found suitable for steam navigation. The Brazilian Boundary Commission ascended it in 1866 to the junction of the Shino with its Jaquirana branch. The country it traverses in its extremely sinuous course is very level, similar in character to that of the Juruá, and is a fostered wilderness occupied by a few savage hordes.

The UCAYALI, which rises only about 70 m. north of Lake Titicaca, is the most interesting branch of the Amazon next to the Madeira. The Ucayali was first called the San Miguel, then the Ucayali, Ucayare, Poro, Apu-Poro, Cocama and Rio de Cuzco. Peru has fitted out many costly and ably-conducted expeditions to explore it. One of them (1867) claimed to have reached within 240 m. of Lima, and the little steamer "Napo" forced its way up the violent currents for 77 m. above the junction with the Pachitea river as far as the river Tambo, 770 m. from the confluence of the Ucayali with the Amazon. The "Napo" then succeeded in ascending the Urubamba branch of the Ucayali 35 m. above its union with the Tambo, to a point 200 m. north of Cuzco. The remainder of the Urubamba, as shown by Bosquet in 1806 and Castelnau in 1846, is interrupted by cascades, reefs and numberless other obstacles to navigation. Señor Torres, who explored the Alto Ucayali for the Peruvian government, gives it a length of 186 m., counting from the mouth of the Pachitea to the junction of the Tambo and Urubamba. Its width varies from 1300 to 4000 ft., due to the great number of islands. The current runs from 3 to 4 m. an hour, and a channel from 60 to 150 ft. wide can always be found with a minimum depth of 5 ft. There are five bad passes, due to the accumulation of trees and rafts of timber. Sometimes enormous rocks have fallen from the mountains and spread over the river-bed causing huge whirlpools. "No greater difficulties present themselves to navigation by 10-knot steamers drawing 4 ft. of water."

The TAMBO, which rises in the Vilcanota knot of mountains south of Cuzco, is a torrential stream valueless for commercial purposes. The banks of the Ucayali for 500 m. up are low, and in the rainy season extensively inundated.

The HUALLAGA (also known as the Guallaga and Rio de los Motilones), which joins the Amazon to the west of the Ucayali, rises high among the mountains, in about 10° 40′ S. lat., on the northern slopes of the celebrated Cerro de Pasco. For nearly its entire length it is an impetuous torrent running through a succession of gorges. It has forty-two rapids, its last obstruction being the Pongo de Aguirre, so called from the traitor Aguirre who passed there. To this point, 140 m. from the Amazon, the Huallaga can be ascended by large river steamers. Between the Huallaga and the Ucayali lies the famous "Pampa del Sacramento," a level region of stoneless alluvial lands covered with thick, dark forests, first entered by the missionaries in 1726. It is about 300 m. long, from north to south, and varies in width from 40 to 100 m. Many streams, navigable for canoes, penetrate this region from the Ucayali and the Huallaga. It is still occupied by savage tribes.

The river MARAÑON rises about 100 m. to the north-east of Lima. It flows through a deeply-eroded Andean valley in a north-west direction, along the eastern base of the Cordillera of the Andes, as far as 5° 36′ S. lat.; then it makes a great bend to the north-east, and with irresistible power cuts through the inland Andes, until at the Pongo de Manseriche[2] it victoriously breaks away from the mountains to flow onwards through the plains under the name of the Amazon. Barred by reefs, and full of rapids and impetuous currents, it cannot become a commercial avenue. At the point where it makes its great bend the river Chinchipe pours into it from southern Ecuador. Just below this the mountains close in on either side of the Marañon, forming narrows or *pongos* for a length of 35 m., where, besides numerous whirlpools, there are no less than thirty-five formidable rapids, the series concluding with three cataracts just before reaching the river Imasa or Chunchunga, near the mouth of which La Condamine embarked in the 18th century to descend the Amazon. Here the general level of the country begins to decrease in elevation, with only a few mountain spurs, which from time to time push as far as the river and form *pongos* of minor importance and less dangerous to descend. Finally, after passing the narrows of Guaracayo, the *cerros* gradually disappear, and for a distance of about 20 m. the river is full of islands, and there is nothing visible from its low banks but an immense forest-covered plain. But the last barrier has yet to be passed, the Pongo de Manseriche, 3 m. long, just below the mouth of the Rio Santiago, and between it and the old abandoned missionary station of Borja, in 38° 30′ S. lat. and 77° 30′ 40″ W. long. According to Captain Carbajal, who descended it in the little steamer "Napo" in 1868, it is a vast rent in the Andes about 2000 ft. deep, narrowing in places to a width of only 100 ft., the precipices "seeming to close in at the top." Through this dark cañon the Marañon leaps along, at times, at the rate of 12 m. an hour.[1] The Pongo de Manseriche was first discovered by the Adelantado Joan de Salinas. He fitted out an expedition at Loxa in Ecuador, descended the Rio Santiago to the Marañon, passed through the perilous Pongo in 1557 and invaded the country of the Maynas Indians. Later, the missionaries of Cuenca and Quito established many missions in the *Pais de los Maynas*, and made extensive use of the Pongo de Manseriche as an avenue of communication with their several convents on the Andean plateau. According to their accounts, the huge rent in the Andes, the Pongo, is about five or six m. long, and in places not more than 80 ft. wide, and is a frightful series of torrents and whirlpools interspersed with rocks. There is an ancient tradition of the savages of the vicinity that one of their gods descending the Marañon and another ascending the Amazon to communicate with him, they opened the pass called the Pongo de Manseriche. From the northern slope of its basin the Amazon receives many tributaries, but their combined volume of water is not nearly so great as that contributed to the parent stream by its affluents from the south. That part of Brazil lying between the Amazon and French, Dutch and British Guiana, and bounded on the west by the Rio Negro, is known as Brazilian Guiana. It is the southern watershed of a tortuous, low chain of mountains running, roughly, east and west. Their northern slope, which is occupied by the three Guianas first named, is saturated and river-torn; but their southern one, Brazilian Guiana, is in general thirsty and semi-barren, and the driest region of the Amazon valley. It is an area which has been left almost in the undisturbed possession of nomadic Indian tribes, whose scanty numbers find it difficult to solve the food problem. From the *divortium aquarum* between French Guiana and Brazil, known as the Tumuc-humac range of highlands, two minor streams, the Yary and the Parou, reach the Amazon across the intervening broken and barren tableland. They are full of rapids and reefs.

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[1] A *furo* is a natural canal—sometimes merely a deviation from the main channel, which it ultimately rejoins, sometimes a connexion across low flat country between two entirely separate streams.

[2] Pongo is a corruption of the Quichua *puncu* and the Aymará *ponco*, meaning a door. The Pongo de Manseriche was first named Marañon, then Santiago, and later Manseric, afterwards Mansariche and Manseriche, owing to the great numbers of parrakeets found on the rocks there.

The TROMBETAS is the first river of importance we meet on the northern side as we ascend the Amazon. Its confluence with this is just above the town of Obidos. It has its sources in the Guiana highlands, but its long course is frequently interrupted by violent currents, rocky barriers, and rapids. The inferior zone of the river, as far up as the first fall, the Porteira, has but little broken water and is low and swampy; but above the long series of cataracts and rapids the character and aspect of the valley completely change, and the climate is much better. The river is navigable for 135 m. above its mouth.

The NEGRO, the great northern tributary of the Amazon, has its sources along the watershed between the Orinoco and the Amazon basins, and also connects with the Orinoco by way of the Casiquiare canal. Its main affluent is the Uaupes, which disputes with the headwaters of the Guaviari branch of the Orinoco the drainage of the eastern slope of the "oriental" Andes of Colombia. The Negro is navigable for 450 m. above its mouth for 4 ft. of water in the dry season, but it has many sandbanks and minor difficulties. In the wet season, it overflows the country far and wide, sometimes to a breadth of 20 m., for long distances, and for 400 m. up, as far as Santa Isabella, is a succession of lagoons, full of long islands and intricate channels, and the slope of the country is so gentle that the river has almost no current. But just before reaching the Uaupes there is a long series of reefs, over which it violently flows in cataracts, rapids and whirlpools. The Uaupes is full of similar obstacles, some fifty rapids barring its navigation, although a long stretch of its upper course is said to be free from them, and to flow gently through a forested country. Despite the impediments, canoes ascend this stream to the Andes.

The Branco is the principal affluent of the Negro from the north; it is enriched by many streams from the sierras which separate Venezuela and British Guiana from Brazil. Its two upper main tributaries are the Urariquira and the Takutú. The latter almost links its sources with those of the Essequibo. The Branco flows nearly south, and finds its way into the Negro through several channels and a chain of lagoons similar to those of the latter river. It is 350 m. long, up to its Urariquira confluence. It has numerous islands, and, 235 m. above its mouth, it is broken by a bad series of rapids.

CASIQUIARE CANAL. In 1744 the Jesuit Father Roman, while ascending the Orinoco river, met some Portuguese slave-traders from the settlements on the Rio Negro. He accompanied them on their return, by way of the Casiquiare canal, and afterwards retraced his route to the Orinoco. La Condamine, seven months later, was able to give to the French Academy an account of Father Roman's extraordinary voyage, and thus confirm the existence of this wonderful waterway first reported by Father Acuña in 1639. But little credence was given to Father Roman's statement until it was verified, in 1756, by the Spanish Boundary-line Commission of Yturriaga y Solano. The actual elevation of the canal above sea-level is not known, but is of primary importance to the study of the hydrography of South America. Travellers in general give it at from 400 to 900 ft., but, after much study of the question of altitudes throughout South America, the writer believes that it does not exceed 300 ft. The canal connects the upper Orinoco, 9 m. below the mission of Esmeraldas, with the Rio Negro affluent of the Amazon near the town of San Carlos. The general course is south-west, and its length, including windings, is about 200 m. Its width, at its bifurcation with the Orinoco, is approximately 300 ft., with a current towards the Negro of three-quarters of a mile an hour; but as it gains in volume from the very numerous tributary streams, large and small, which it receives en route, its velocity increases, and in the wet season reaches 5 and even 8 m. an hour in certain stretches. It broadens considerably as it approaches its mouth, where it is about 1750 ft. in width. It will thus be seen that the volume of water it captures from the Orinoco is small in comparison to what it accumulates in its course. In flood-time it is said to have a second connexion with the Rio Negro by a branch which it throws off to the westward called the Itinivini, which leaves it at a point about 50 m. above its mouth. In the dry season it has shallows, and is obstructed by sandbanks, a few rapids and granite rocks. Its shores are densely wooded, and the soil more fertile than that along the Rio Negro. The general slope of the plains through which the canal runs is south-west, but those of the Rio Negro slope south-east. The whole line of the Casiquiare is infested with myriads of tormenting insects. A few miserable groups of Indians and half-breeds have their small villages along its southern portion. It is thus seen that this marvellous freak of nature is not, as is generally supposed, a sluggish canal on a flat tableland, but a great, rapid river which, if its upper waters had not found contact with the Orinoco, perhaps by cutting back, would belong entirely to the Negro branch of the Amazon. To the west of the Casiquiare there is a much shorter and more facile connexion between the Orinoco and Amazon basins, called the isthmus of Pimichin, which is reached by ascending the Terni branch of the Atabapo affluent of the Orinoco. Although the Terni is somewhat obstructed, it is believed that it could easily be made navigable for small craft. The isthmus is 10 m. across, with undulating ground, nowhere over 50 ft. high, with swamps and marshes. It is much used for the transit of large canoes, which are hauled across it from the Terni river, and which reach the Negro by the little stream called the Pimichin.

The YAPURÁ. West of the Negro the Amazon receives three more imposing streams from the north-west—the Yapurá, the Iça or Putumayo, and the Napo. The first was formerly known as the Hyapora, but its Brazilian part is now called the Yapurá, and its Colombian portion the Caquetá. Barão de Marajo gives it 600 m. of navigable stretches. Jules Crevaux, who descended it, describes it as full of obstacles to navigation, the current very strong and the stream frequently interrupted by rapids and cataracts. It rises in the Colombian Andes, nearly in touch with the sources of the Magdalena, and augments its volume from many branches as it courses through Colombia. It was long supposed to have eight mouths; but Ribeiro de Sampaio, in his voyage of 1774, determined that there was but one real mouth, and that the supposed others are all *furos* or *caños*.[1] In 1864–1868 the Brazilian government made a somewhat careful examination of the Brazilian part of the river, as far up as the rapid of Cupaty. Several very easy and almost complete water-routes exist between the Yapurá and Negro across the low, flat intervening country. Barão de Marajo says there are six of them, and one which connects the upper Yapurá with the Uaupes branch of the Negro; thus the Indian tribes of the respective valleys have facile contact with each other.

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[1] One of the most daring deeds of exploration ever known in South America was done by the engineer A. Wertheman. He fitted out three rafts, in August 1870, and descended this whole series of rapids and cascades from the Rio Chinchipe to Borja.

The Iça or Putumayo, west of and parallel to the Yapurá, was found more agreeable to navigate by Crevaux. He ascended it in a steamer drawing 6 ft. of water, and running day and night. He reached Cuemby, 800 m. above its mouth, without finding a single rapid. Cuemby is only 200 m. from the Pacific Ocean, in a straight line, passing through the town of Pasto in southern Colombia. There was not a stone to be seen up to the base of the Andes; the river banks were of argillaceous earth and the bottom of fine sand.

The Napo rises on the flanks of the volcanoes of Antisana, Sincholagua and Cotopaxi. Before it reaches the plains it receives a great number of small streams from impenetrable, saturated and much broken mountainous districts, where the dense and varied vegetation seems to fight for every square foot of ground. From the north it is joined by the river Coca, having its sources in the gorges of Cayambé on the equator, and also a powerful river, the Aguarico, having its headwaters between Cayambé and the Colombian frontier. From the west it receives a secondary tributary, the Curaray, from the Andean slopes, between Cotopaxi and the volcano of Tunguragua. From its Coca branch to the mouth of the Curaray the Napo is full of snags and shelving sandbanks, and throws out numerous caños among jungle-tangled islands, which in the wet season are flooded, giving the river an immense width. From the Coca to the Amazon it runs through a forested plain where not a hill is visible from the river—its uniformly level banks being only interrupted by swamps and lagoons. From the Amazon the Napo is navigable for river craft up to its Curaray branch, a distance of about 216 m., and perhaps a few miles farther; thence, by painful canoe navigation, its upper waters may be ascended as far as Santa Rosa, the usual point of embarkation for any venturesome traveller who descends from the Quito tableland. The Coca river may be penetrated as far up as its middle course, where it is jammed between two mountain walls, in a deep canyon, along which it dashes over high falls and numerous reefs. This is the stream made famous by the expedition of Gonzalo Pizarro.

The Nanay is the next Amazon tributary of importance west of the Napo. It belongs entirely to the lowlands, and is very crooked, has a slow current and divides much into caños and strings of lagoons which flood the flat, low areas of country on either side. It is simply the drainage ditch of districts which are extensively overflowed in the rainy season. Captain Butt ascended it 195 m., to near its source.

The Tigre is the next west of the Nanay, and is navigable for 125 m. from its confluence with the Amazon. Like the Nanay, it belongs wholly to the plains. Its mouth is 42 m. west of the junction of the Ucayali with the Amazon. Continuing west from the Tigre we have the Parinari, Chambira, and Nucuray, all short lowland streams, resembling the Nanay in character.

The Pastaza (the ancient river Sumatara) is the next large river we meet. It rises on the Ecuadorian tableland, where a branch from the valley of Riobamba unites with one from the Latacunga basin and breaks through the inland range of the Andes; and joined, afterwards, by several important tributaries, finds its way south-east among the gorges; thence it turns southward into the plains, and enters the Amazon at a point about 60 m. west of the mouth of the Hualiaga. So far as known, it is a stream of no value except for canoe navigation. Its rise and fall are rapid and uncertain, and it is shallow and full of sandbanks and snags. It is a terrible river when in flood.

The Morona flows parallel to the Pastaza and immediately to the west of it, and is the last stream of any importance on the northern side of the Amazon before reaching the Pongo de Manseriche. It is formed from a multitude of water-courses which descend the slopes of the Ecuadorian Andes south of the gigantic volcano of Sangay; but it soon reaches the plain, which commences where it receives its Cusulima branch. The Morona is navigable for small craft for about 300 m. above its mouth, but it is extremely tortuous. Canoes may ascend many of its branches, especially the Cusulima and the Miazal, the latter almost to the base of Sangay. The Morona has been the scene of many rude explorations, with the hope of finding it serviceable as a commercial route between the inter-Andean tableland of Ecuador and the Amazon river. A river called the Paute dashes through the eastern Andes from the valley of Cuenca; and a second, the Zamora, has broken through the same range from the basin of Loja. Swollen by their many affluents, they reach the lowlands and unite their waters to form the Santiago, which flows into the Marañon at the head of the Pongo de Manseriche. There is but little known of a trustworthy character regarding this river, but Wolf says that it is probably navigable up to the junction of the Paute with the Zamora.

The Main River.

Physical characteristics.

The Amazon Main River is navigable for ocean steamers as far as Iquitos, 2300 m. from the sea, and 486 m. higher up for vessels drawing 14 ft. of water, as far as Achual Point. Beyond that, according to Tucker, confirmed by Wertheman, it is unsafe; but small steamers frequently ascend to the Pongo de Manseriche, just above Achual Point. The average current of the Amazon is about 3 m. an hour; but, especially in flood, it dashes through some of its contracted channels at the rate of 5 m. The U.S. steamer "Wilmington" ascended it to Iquitos in 1899. Commander Todd reports that the average depth of the river in the height of the rainy season is 120 ft. It commences to rise in November, and increases in volume until June, and then falls until the end of October. The rise of the Negro branch is not synchronous; for the steady rains do not commence in its valley until February or March. By June it is full, and then it begins to fall with the Amazon. According to Bates, the Madeira "rises and sinks" two months earlier than the Amazon. The Amazon at times broadens to 4 and 6 m. Occasionally, for long distances, it divides into two main streams with inland, lateral channels, all connected by a complicated system of natural canals, cutting the low, flat *igapo* lands, which are never more than 15 ft. above low river, into almost numberless islands.[1] At the narrows of Obidos, 400 m. from the sea, it is compressed into a single bed a mile wide and over 200 ft. deep, through which the water rushes at the rate of 4 to 5 m. an hour. In the rainy season it inundates the country throughout its course to the extent of several hundred thousand square miles, covering the flood-plain, called *vargem*. The flood-levels are in places from 40 to 50 ft. high above low river. Taking four roughly equidistant places, the rise at Iquitos is 20 ft., at Teffé 45, near Obidos 35, and at Pará 12 ft.

The first high land met in ascending the river is on the north bank, opposite the mouth of the Xingú, and extends for about 150 m. up, as far as Monte Alegre. It is a series of steep, table-topped hills, cut down to a kind of terrace which lies between them and the river. Monte Alegre reaches an altitude of several hundred feet. On the south side, above the Xingú, a line of low bluffs extends, in a series of gentle curves with hardly any breaks nearly to Santarem, but a considerable distance inland, bordering the flood-plain, which is many miles wide. Then they bend to the south-west, and, abutting upon the lower Tapajos, merge into the bluffs which form the terrace margin of that river valley. The next high land on the north side is Obidos, a bluff, 56 ft. above the river, backed by low hills. From Serpa, nearly opposite the river Madeira, to near the mouth of the Rio Negro, the banks are low, until approaching Manãos, they are rolling hills; but from the Negro, for 600 m., as far up as the village of Canaria, at the great bend of the Amazon, only very low land is found, resembling that at the mouth of the river. Vast areas of it are submerged at high water, above which only the upper part of the trees of the sombre forests appear. At Canaria, the high land commences and continues as far as Tabatinga, and thence up stream.

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[1] A *caño*, like *furo*, is a kind of natural canal; it forms a lateral discharge for surplus water from a river.

[1] *Igapo* is thus the name given to the recent alluvial tracts along the margins of rivers, submerged by moderate floods, whereas *vargem* is the term used for land between the levels of moderate and high floods, while for land above this the people use the term *terra firma*.

On the south side, from the Tapajos to the river Madeira, the banks are usually low, although two or three hills break the general monotony. From the latter river, however, to the Ucayali, a distance of nearly 1500 m., the forested banks are just out of water, and are inundated long before the river attains its maximum flood-line. Thence to the Huallaga the elevation of the land is somewhat greater; but not until this river is passed, and the Pongo de Manseriche approached, does the swelling ground of the Andean foot-hills raise the country above flood-level.

The Amazon is not a continuous incline, but probably consists of long, level stretches connected by short inclined planes of extremely little fall, sufficient, however, owing to its great depth, to give the gigantic volume of water a continuous impulse towards the ocean. The lower Amazon presents every evidence of having once been an ocean gulf, the upper waters of which washed the cliffs near Obidos. Only about 10% of the water discharged by the mighty stream enters it below Obidos, very little of which is from the northern slope of the valley. The drainage area of the Amazon basin above Obidos is about 1,045,000 sq. m., and, below, only about 423,000 sq. m., or say 20%, exclusive of the 354,000 sq. m. of the Tocantins basin.

The width of the mouth of the monarch river is usually measured from Cabo do Norte to Punto Patijoca, a distance of 207 statute m.; but this includes the ocean outlet, 40 m. wide, of the Pará river, which should be deducted, as this stream is only the lower reach of the Tocantins. It also includes the ocean frontage of Marajo, an island about the size of the kingdom of Denmark lying in the mouth of the Amazon.

Following the coast, a little to the north of Cabo do Norte, and for 100 m. along its Guiana margin up the Amazon, is a belt of half-submerged islands and shallow sandbanks. Here the tidal phenomenon called the *bore*, or Pororoca, occurs, where the soundings are not over 4 fathoms. It commences with a roar, constantly increasing, and advances at the rate of from 10 to 15 m. an hour, with a breaking wall of water from 5 to 12 ft. high. Under such conditions of warfare between the ocean and the river, it is not surprising that the former is rapidly eating away the coast and that the vast volume of silt carried by the Amazon finds it impossible to build up a delta.

The Amazon is not so much a river as it is a gigantic reservoir, extending from the sea to the base of the Andes, and, in the wet season, varying in width from 5 to 400 m. Special attention has already been called to the fourteen great streams which discharge into this reservoir, but it receives a multitude of secondary rivers, which in any other part of the world would also be termed great.

Population, trade, &c.

For 350 years after the discovery of the Amazon, by Pinzon, the Portuguese portion of its basin remained almost an undisturbed wilderness, occupied by Indian tribes whom the food quest had split into countless fragments. It is doubtful if its indigenous inhabitants ever exceeded one to every 5 sq. m. of territory, this being the maximum it could support under the existing conditions of the period in question, and taking into account Indian methods of life. A few settlements on the banks of the main river and some of its tributaries, either for trade with the Indians or for evangelizing purposes, had been founded by the Portuguese pioneers of European civilization. The total population of the Brazilian portion of the Amazon basin in 1850 was perhaps 300,000, of whom about two-thirds were white and slaves, the latter numbering about 25,000. The principal commercial city, Pará, had from 10,000 to 12,000 inhabitants, including slaves. The town of Manãos, at the mouth of the Rio Negro, had from 1000 to 1500 population; but all the remaining villages, as far up as Tabatinga, on the Brazilian frontier of Peru, were wretched little groups of houses which appeared to have timidly effected a lodgment on the river bank, as if they feared to challenge the mysteries of the sombre and gigantic forests behind them. The value of the export and import trade of the whole valley in 1850 was but £500,000.

On the 6th of September 1850 the emperor, Dom Pedro II., sanctioned a law authorizing steam navigation on the Amazon, and confided to an illustrious Brazilian, Barão Mauá (Irineu Evangilista de Sousa), the task of carrying it into effect. He organized the "Compania de Navigação e Commercio do Amazonas" at Rio de Janeiro in 1852; and in the following year it commenced operations with three small steamers, the "Monarch," the "Marajo" and "Rio Negro." At first the navigation was principally confined to the main river; and even in 1857 a modification of the government contract only obliged the company to a monthly service between Pará and Manãos, with steamers of 200 tons cargo capacity, a second line to make six round voyages a year between Manãos and Tabatinga, and a third, two trips a month between Pará and Cametá. The government paid the company a subvention of £3035 monthly. Thus the first impulse of modern progress was given to the dormant valley. The success of the venture called attention to the unoccupied field; a second company soon opened commerce on the Madeira, Purús and Negro; a third established a line between Pará and Manãos; and a fourth found it profitable to navigate some of the smaller streams; while, in the interval, the Amazonas Company had largely increased its fine fleet. Meanwhile private individuals were building and running small steam craft of their own, not only upon the main river but upon many of its affluents. The government of Brazil, constantly pressed by the maritime powers and by the countries encircling the upper Amazon basin, decreed, on the 31st of July 1867, the opening of the Amazon to all flags; but limited this to certain defined points—Tabatinga, on the Amazon; Cameta, on the Tocantins; Santarem, on the Tapajos; Borba, on the Madeira; Manãos, on the Rio Negro; the decree to take effect on the 7th of September of the same year. Pará, Manãos and Iquitos are now thriving commercial centres. The first direct foreign trade with Manãos was commenced about 1874.

The local trade of the river is carried on by the English successors to the Amazonas Company—the Amazon Steam Navigation Company. In addition to its excellent fleet there are numerous small river steamers, belonging to companies and firms engaged in the rubber trade, navigating the Negro, Madeira, Purús and many other streams. The principal exports of the valley are india-rubber, cacao, Brazil nuts and a few other products of very minor importance. The finest quality of india-rubber comes from the Acre and Beni districts of Bolivia, especially from the valley of the Acre (or Aquiry) branch of the river Purús. Of the rubber production of the Amazon basin, the state of Pará gives about 35%. The cacao tree is not cultivated, but grows wild in great abundance. There is but one railway in the whole valley; it is a short line from Pará towards the coast. The cities of Pará and Manãos have excellent tramways, many fine public buildings and private residences, gardens and public squares, all of which give evidence of artistic taste and great prosperity.

The number of inhabitants in the Brazilian Amazon basin (the states of Amazonas and Pará) is purely a matter of rough estimate. There may be 500,000 or 600,000, or more; for the immigration during recent years from the other parts of Brazil has been large, due to the rubber excitement. The influx from the state of Ceará alone, from 1892 to 1899 inclusive, reached 98,348.

As Commander Todd, in his report to the United States government, says: "The crying need of the Amazon valley is food for the people. . . . At the small towns along the river it is nearly impossible to obtain beef, vegetables, or fruit of any sort, and the inhabitants depend largely upon river fish, mandioc, and canned goods for their subsistence." Although more than four centuries have passed since the discovery of the Amazon river, there are probably not 25 sq. m. of its basin under cultivation, excluding the limited and rudely cultivated areas among the mountains at its extreme headwaters, which are inaccessible to commerce. The extensive exports of the mighty valley are almost entirely derived from the products of the forest. (G. E. C.)

AMAZONAS, the extreme north-western and largest state of Brazil, bounded N. by Colombia and Venezuela, E. by the state of Pará, S. by the state of Matto Grosso and Bolivia, and W. by Peru and Colombia. It embraces an area of 742,123 sq. m., wholly within the Amazon basin. A small part bordering the Venezuelan sierras is elevated and mountainous, but the greater part forms an immense alluvial plain, densely wooded, traversed by innumerable rivers, and subjected to extensive annual inundations. The climate is tropical and generally unfavourable to white settlement, the exceptions being the elevated localities on the Amazon exposed to the strong winds blowing up that river. The state is very sparsely populated; two-thirds of the inhabitants are Indians, forming small tribes, and subject only in small part to government control. The principal products are rubber, cacao and nuts; cattle are raised on the elevated plains of the north, while curing fish and collecting turtle eggs for their oil give occupation to many people on the rivers. Coffee, tobacco, rice and various fruits of superior quality are produced with ease, but agriculture is neglected and production is limited to domestic needs. The capital, Manáos, is the only city and port of general commercial importance in the state; other prominent towns are Serpa and Teffé on the Amazon, Borba and Crato on the Madeira, and Barcellos on the Rio Negro. Up to 1755 all the Portuguese territory on the Amazon formed part of the capitania of Pará. The upper districts were then organized into a separate capitania, called S. José do Rio Negro, to facilitate administration. When Brazil became independent in 1822, Rio Negro was overlooked in the reorganization into provinces and reverted, notwithstanding the protests and an attempted revolution (1832) of the people, to a state of dependence upon Pará. In 1850 autonomy was voted by the general assembly at Rio de Janeiro, and on the 1st of January 1852 the province of Amazonas was formally installed. In 1889 it became a federal state in the Brazilian republic.

AMAZONAS, a northern department of Peru, covering a mountainous district between the departments of Loreto and Cajamarca, with Ecuador on the N. The Marañon river forms the greater part of its W. boundary-line. Area, 13,943 sq. m.; pop. (1896) 70,676. The rainfall is abundant, and the soil of the heavily wooded valleys and lower mountain slopes is exceptionally fertile and productive. Its settlement and development is seriously impeded by the lack of transportation facilities. The capital, Chachapoyas, is a small town (pop. about 6000) situated on a tributary of the Marañon, 7600 ft. above sea-level. It is the seat of a bishopric, created in 1802, which covers the departments of Amazonas and Loreto, and one province of Libertad. It has an imposing cathedral and a university. The climate is equable and delightful, the mean temperature for the year being 62° F.

AMAZONAS, a territory belonging to Venezuela, and occupying the extreme southern part of that republic, adjoining the Brazilian state of Amazonas. It lies partly within the drainage basin of the Orinoco and partly within that of the Rio Negro, an affluent of the Amazon. The territory is covered with dense forests and is filled with intricate watercourses, one of which, the Casiquiare, forms an open communication between the Orinoco and the Rio Negro and is navigable for large canoes. The capital of the territory is Maroa, situated on the Guainia river, an affluent of the Rio Negro.

AMAZONS, an ancient legendary nation of female warriors. They were said to have lived in Pontus near the shore of the Euxine sea, where they formed an independent kingdom under the government of a queen, the capital being Themiscyra on the banks of the river Thermodon (Herodotus iv. 110-117). From this centre they made numerous warlike excursions—to Scythia, Thrace, the coasts of Asia Minor and the islands of the Aegean, even penetrating to Arabia, Syria and Egypt. They were supposed to have founded many towns, amongst them Smyrna, Ephesus, Sinope, Paphos. According to another account, they originally came to the Thermodon from the Palus Maeotis (Sea of Azov). No men were permitted to reside in their country; but once a year, in order to prevent their race from dying out, they visited the Gargareans, a neighbouring tribe. The male children who were the result of these visits were either put to death or sent back to their fathers; the female were kept and brought up by their mothers, and trained in agricultural pursuits, hunting, and the art of war (Strabo xi. p. 503). It is said that their right breast was cut off or burnt out, in order that they might be able to use the bow more freely; hence the ancient derivation of Ἀμάζονες from ἀ-μαζός, "without breast." But there is no indication of this practice in works of art, in which the Amazons are always represented with both breasts, although the right is frequently covered. Other suggested derivations are: ἀ (intensive) and μαζός, breast, "full-breasted"; ἀ (privative) and μάσσω, touch, "not touching men"; *masa*, a Circassian word said to signify "moon," has suggested their connexion with the worship of a moon-goddess, perhaps the Asiatic representative of Artemis.

The Amazons appear in connexion with several Greek legends. They invaded Lycia, but were defeated by Bellerophon, who was sent out against them by Iobates, the king of that country, in the hope that he might meet his death at their hands (*Iliad*, vi. 186). They attacked the Phrygians, who were assisted by Priam, then a young man (*Iliad*, iii. 189), although in his later years, towards the end of the Trojan war, his old opponents took his side against the Greeks under their queen Penthesileia, who was slain by Achilles (Quint. Smyr. i.; Justin ii. 4; Virgil, *Aen.* i. 490). One of the tasks imposed upon Heracles by Eurystheus was to obtain possession of the girdle of the Amazonian queen Hippolyte (Apollodorus ii. 5). He was accompanied by his friend Theseus, who carried off the princess Antiope, sister of Hippolyte, an incident which led to a retaliatory invasion of Attica, in which Antiope perished fighting by the side of Theseus. The Amazons are also said to have undertaken an expedition against the island of Leuke, at the mouth of the Danube, where the ashes of Achilles had been deposited by Thetis. The ghost of the dead hero appeared and so terrified the horses, that they threw and trampled upon the invaders, who were forced to retire. They are heard of in the time of Alexander the Great, when their queen Thalestris visited him and became a mother by him, and Pompey is said to have found them in the army of Mithradates.

The origin of the story of the Amazons has been the subject of much discussion. While some regard them as a purely mythical people, others assume an historical foundation for them. The deities worshipped by them were Ares (who is consistently assigned to them as a god of war, and as a god of Thracian and generally northern origin) and Artemis, not the usual Greek goddess of that name, but an Asiatic deity in some respects her equivalent. It is conjectured that the Amazons were originally the temple-servants and priestesses (*hierodulae*) of this goddess; and that the removal of the breast corresponded with the self-mutilation of the *galli*, or priests, of Rhea Cybele. Another theory is that, as the knowledge of geography extended, travellers brought back reports of tribes ruled entirely by women, who carried out the duties which elsewhere were regarded as peculiar to man, in whom alone the rights of nobility and inheritance were vested, and who had the supreme control of affairs. Hence arose the belief in the Amazons as a nation of female warriors, organized and governed entirely by women. According to J. Vürtheim (*De Ajacis origine*, 1907), the Amazons were of Greek origin: "all the Amazons were Dianas, as Diana herself was an Amazon." It has been suggested that the fact of the conquest of the Amazons being assigned to the two famous heroes of Greek mythology, Heracles and Theseus—who in the tasks assigned to them were generally opposed to monsters and beings impossible in themselves, but possible as illustrations of permanent danger and damage,—shows that they were mythical illustrations of the dangers which beset the Greeks on the coasts of Asia Minor; rather perhaps, it may be intended to represent the conflict between the Greek culture of the colonies on the Euxine and the barbarism of the native inhabitants.

In works of art, combats between Amazons and Greeks are placed on the same level as and often associated with combats of Greeks and centaurs. The belief in their existence, however, having been once accepted and introduced into the national poetry and art, it became necessary to surround them as far as possible with the appearance of not unnatural beings. Their occupation was hunting and war; their arms the bow, spear, axe, a half shield, nearly in the shape of a crescent, called *pelta*, and in early art a helmet, the model before the Greek mind having apparently been the goddess Athena. In later art they approach the model of Artemis, wearing a thin dress, girt high for speed; while on the later painted vases their dress is often peculiarly Persian—that is, close-fitting trousers and a high cap called the *kidaris*. They were usually on horseback but sometimes on foot. The battle between Theseus and the Amazons is a favourite subject on the friezes of temples (*e.g.* the reliefs from the frieze of the temple of Apollo at Bassae, now in the British Museum), vases and sarcophagus reliefs; at Athens it was represented on the shield of the statue of Athena Parthenos, on wall-paintings in the Theseum and in the Poikile Stoa. Many of the sculptors of antiquity, including Pheidias, Polyclitus, Cresilas and Phradmon, executed statues of Amazons; and there are many existing reproductions of these.

The history of Bohemia affords a parallel to the Greek Amazons. During the 8th century a large band of women, under a certain Vlasta, carried on war against the duke of Bohemia, and enslaved or put to death all men who fell into their hands. In the 16th century the Spanish explorer Orellana asserted that he had come into conflict with fighting women in South America on the river Marañon, which was named after them the Amazon (*q.v.*) or river of the Amazons, although others derive its name from the Indian *amassona* (boat-destroyer), applied to the tidal phenomenon known as the "bore." The existence of "Amazons" (in the sense of fighting women) in the army of Dahomey in modern times is an undoubted fact, but they are said to have died out during the French protectorate. For notable cases of women who have become soldiers, reference may be made to Mary Anne Talbot and Hannah Snell.

See A. D. Mordtmann, *Die Amazonen* (1862); W. Stricker, *Die A. in Sage und Geschichte* (1868); A. Klügmann, *Die A. in der attischen Literatur und Kunst* (1875); H. L. Krause, *Die Amazonensage* (1893); F. G. Bergmann, *Les Amazones dans l'histoire et dans la fable* (1853); P. Lacour, *Les Amazones* (1901); articles in Pauly-Wissowa's *Realencyclopädie* and Roscher's *Lexikon der Mythologie*; Grote, *Hist. of Greece*, pt. i. ch. 11. In article Greek Art, fig. 40 represents three types of Amazons, and fig. 70 (pl. iv.) a battle between Amazons and Greeks.

AMAZON-STONE, or Amazonite, a green variety of microcline-felspar. The name is taken from that of the river Amazon, whence certain green stones were formerly obtained, but it is doubtful whether green felspar occurs in the Amazon district. The modern amazon-stone is a mineral of restricted occurrence. Formerly it was obtained almost exclusively from the neighbourhood of Miyask, in the Ilmen mountains, 50 m. S.W. of Cheliabinsk, Russia, where it occurs in granitic rocks. Of late years, magnificent crystals have been obtained from Pike's Peak, Colorado, where it is found associated with smoky quartz, orthoclase and albite in a coarse granite or pegmatite. Some other localities in the United States yield amazon-stone, and it is also found in pegmatite in Madagascar. On account of its lively green colour, it is cut and polished to a limited extent as an ornamental stone. The colour has been attributed to the presence of copper, but as it is discharged by heat it is likely to be due to some pigment of organic origin, and an organic salt of iron has been suggested. (See Microcline.)

AMBARVALIA, an annual festival of the ancient Romans, occurring in May, usually on the 29th, the object of which was to secure the growing crops against harm of all kinds. The priests were the Arval Brothers (*q.v.*), who conducted the victims—ox, sheep and pig (*suovetaurilia*)—in procession with prayer to Ceres round the boundaries of the *ager Romanus*. As the extent of Roman land increased, this could no longer be done, and in the Acta of the Fratres, which date from Augustus, we do not find this procession mentioned (Henzen, *Acta Fratrum Arvalium*, 1874); but there is a good description of this or a similar rite in Virgil, *Georg.* i. 338 ff., and in Cato's work *de Re Rustica* (141) we have full details and the text of the prayers used by the Latin farmer in thus "lustrating" his own land. In this last case the god invoked is Mars. The Christian festival which seems to have taken the place of these ceremonies is the Rogation or Gang week of the Roman Church. The perambulation or beating of bounds is probably a survival of the same type of rite.

See W. W. Fowler, *Roman Festivals* (1899), p. 124 ff.

(W. W. F.*)

AMBASSADOR (also Embassador, the form sometimes still used in America; from the Fr. *ambassadeur*, with which compare Ital. *ambasciatore* and Span. *embajador*, all variants of the Med. Lat. *ambasciator*, *ambassiator*, *ambasator*, &c., derived from Med. Lat. *ambasciare* or *ambactiare*, "to go on a mission, to do or say anything in another's name," from Lat. *ambactus*,[1] a vassal or servant; see Du Cange, *Glossarium*, s.v. *ambasciare*), a public minister of the first rank, accredited and sent by the head of a sovereign state as his personal representative to negotiate with a foreign government, and to watch over the interests of his own nation abroad. The power thus conferred is defined in the credentials or letters of credence of which the ambassador is the bearer, and in the instructions under the sign-manual delivered to him. The credentials consist of a sealed letter addressed by the sovereign whom the ambassador represents to the sovereign to whom he is accredited, and they embody a general assurance that the sovereign by whom the ambassador is sent will confirm whatever is done by the ambassador in his name. In Great Britain letters of credence are under the royal sign-manual, and are not countersigned by a minister. Ambassadors are distinguished as *ordinary* and *extraordinary*, which implied originally the difference between a permanent mission and one appointed to conduct a particular negotiation. The style of *ambassador extraordinary* is, however, now often given to a minister accredited to a court for an indefinite time and implies a somewhat more dignified rank.

By the protocol of the 19th of March 1815, afterwards embodied in the treaty of Vienna (1815) and confirmed by an instrument signed by the five great powers at Aix-la-Chapelle on the 21st of November 1818, it was finally determined that "ambassadors and papal legates and nuncios alone have a representative character," *i.e.* in the most exalted and peculiar sense, as representing the person of the sovereign, or the head of a republic, as well as the state to which they belong. It follows that only states enjoying "royal honours," *i.e.* empires, kingdoms, grand duchies, the great republics (*e.g.* France, Switzerland, the United States of America) and the Holy See, have the right to send or to receive ambassadors. By custom it has moreover been established that, as a general rule, only the greater "royal states" are represented by ambassadors, and then only when these are accredited to states esteemed, for one reason or another, to be of equal rank. Thus the promotion of the Japanese legations in Europe and the United States to the rank of embassies, and the corresponding change in the representation of the various powers at Tokio, marked in 1905 the definite recognition of Japan as a great power. To this rule the United States of America long remained an exception, and was content, in accordance with the tradition of republican simplicity, to be represented abroad only by ministers of the second rank. The subordinate position given to the representatives of so great a power, however, inevitably led to many inconveniences, and in 1893 an act of Congress empowered the president to accredit ambassadors to the great powers.

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[1] *Ambactus* is explained by Festus (*Paulus Diaconus ex Festo*, ed. C. O. Müller) as a Gallic word used by Ennius and meaning *servus*. Caesar (*De Bello Gallico*, vi. 15) says of the Gallic *equites*, "atque eorum ut quisque est genere copiisque amplissimus, plurimos circum se ambactos clientesque habent." Accepting the Celtic origin of the word, it has been connected with the Welsh *amaeth*, a tiller of the ground. A Teutonic origin has been suggested in the Old High Ger. *ambaht*, a retainer, which appears in a Scandinavian word *amboht*, bondwoman or maid, in the *Ormulum* (*c.* 1200).

The distinction between an ambassador and ministers of the second rank is one rather of rank and dignity than of power or functions. His special immunities he shares with other diplomatic representatives of all classes. The peculiar privilege which he claims of free access to the sovereign has, in common practice, been reduced to the right of being received on presenting his credentials in public or private audience by the sovereign in person, it being obviously against public policy that a foreign representative should negotiate with the ruler otherwise than through his responsible ministers. In Great Britain the sovereign, when granting an audience to a foreign ambassador, is always attended by one or more ministers, and the same is usual in other states.

An ambassador, however, unless specially armed with plenary authority, cannot decide any questions beyond his instructions without reference to his government. Thus Lord Londonderry (Lord Stewart), who represented Great Britain at the conferences of Troppau in 1820 and Laibach in 1821, had not the same standing as the plenipotentiaries of the other powers present, and efforts were even made to exclude him from some of the more important discussions in consequence, not on the ground of inferior rank but of defective powers.

Socially, the position of an ambassador is one of great dignity. The pomp and magnificence which in earlier days characterized his progresses and his "entries" are indeed no longer observed. He is received, however, by the sovereign to whom he is accredited with elaborate state, of which every detail is minutely regulated, and ranks, as representing his own sovereign, next to the princes of the blood in the court where he resides. The controversies that once raged as to the order of precedence of the various ambassadors accredited to any one court were settled by the treaties already mentioned, it being decided that they should rank in order of seniority according to the date of the presentation of their credentials. In Roman Catholic countries, however—as in France before the abrogation of the concordat,—the position of *doyen* (dean) of the diplomatic body is given by courtesy to the nuncio of the pope.

The special immunities and privileges enjoyed by ambassadors are dealt with in the articles Exterritoriality and Diplomacy. See also the latter for the history of the subject.

The most authoritative modern hand-book on the subject is Charles de Martens, *Manuel diplomatique* (Paris, 1822; new ed., 1868). See also Henry Wheaton, *Hist. of the Law of Nations* (New York, 1845); L. Oppenheim, *International Law* (London, 1905); and the list of books attached to the article Diplomacy. (W. A. P.)

AMBATO, or Asiento de Ambato, an inland town of Ecuador, capital of the province of Tunguragua, 80 m. S. of Quito by the highway, and near the northern foot of Chimborazo. Pop. (est.) 10,000. The town stands in a bowl-like depression, 8606 ft. above sea-level, surrounded by steep, sandy, barren mountains, and has an equable climate, which has been likened to a perpetual autumn. The immediate environs are very fertile and produce a great variety of fruits, including many of the temperate zone, but the surrounding country is arid and sterile, producing scanty crops of barley, Indian corn and pease. The cochineal insect is found on the cactus which grows in abundance in the vicinity, and the town is known throughout Ecuador for its manufacture of boots and shoes, and for a cordage made from *cabuya*, the fibre of the agave plant. Ambato was destroyed by an eruption of Cotopaxi in 1698, and has been badly damaged two or three times by earthquakes.

Ambato is also the name of a range of mountains in northern Argentina, being a spur of the Sierra de Aconquija crossing the province of Catamarca from north to south.

AMBER, a ruined city of India, the ancient capital of Jaipur state in the Rajputana agency. The name of Amber is first mentioned by Ptolemy. It was founded by the Minas and was still flourishing in A.D. 967. In 1037 it was taken by the Rajputs, who held it till it was deserted. In 1728 it was supplanted by the modern city of Jaipur, from which it is 5 m. distant. The picturesque situation of Amber at the mouth of a rocky mountain gorge, in which nestles a lovely lake, has attracted the admiration of all travellers, including Jacquemont and Heber. It is now only remarkable for its architecture. The old palace begun by Man Sing in 1600 ranks second only to Gwalior. The chief building is the Diwan-i-Khas built by Mirza Raja. "No sooner" (it is related) "had Mirza completed the Diwan-i-Khas than it came to the ears of the emperor Jehangir that his vassal had surpassed him in magnificence, and that this last great work quite eclipsed all the marvels of the imperial city; the columns of red sandstone having been particularly noticed as sculptured with exquisite taste and elaborate detail. In a fit of jealousy the emperor commanded that this masterpiece should be thrown down, and sent commissioners to Amber charged with the execution of this order; whereupon Mirza, in order to save the structure, had the columns plastered over with stucco, so that the messengers from Agra should have to acknowledge to the emperor that the magnificence, which had been so much talked of, was after all pure invention. Since then his apathetic successors have neglected to bring to light this splendid work; and it is only by knocking off some of the plaster that one can get a glimpse of the sculptures, which are perfect as on the day they were carved."

AMBER, a fossil resin much used for the manufacture of ornamental objects. The name comes from the Arab. *anbar*, probably through the Spanish, but this word referred originally to ambergris, which is an animal substance quite distinct from yellow amber. True amber has sometimes been called *karabe*, a word of oriental derivation signifying "that which attracts straw," in allusion to the power which amber possesses of acquiring an electric charge by friction. This property, first recorded by Thales of Miletus, suggested the word "electricity," from the Greek, *ἤλεκτρον*, a name applied, however, not only to amber but also to an alloy of gold and silver. By Latin writers amber is variously called *electrum*, *sucinum* (*succinum*), and *glaesum* or *glesum*. The Hebrew *ḥashmal* seems to have been amber.

Amber is not homogeneous in composition, but consists of several resinous bodies more or less soluble in alcohol, ether and chloroform, associated with an insoluble bituminous substance. The average composition of amber leads to the general formula $C_{10}H_{16}O$. Heated rather below 300° C. amber suffers decomposition, yielding an "oil of amber," and leaving a black residue which is known as "amber colophony," or "amber pitch"; this forms, when dissolved in oil of turpentine or in linseed oil, "amber varnish" or "amber lac."

True amber yields on dry distillation succinic acid, the proportion varying from about 3 to 8%, and being greatest in the pale opaque or "bony" varieties. The aromatic and irritating fumes emitted by burning amber are mainly due to this acid. True Baltic amber is distinguished by its yield of succinic acid, for many of the other fossil resins which are often termed amber contain either none of it, or only a very small proportion; hence the name "succinite" proposed by Professor. J. D. Dana, and now commonly used in scientific writings as a specific term for the real Prussian amber. Succinite has a hardness between 2 and 3, which is rather greater than that of many other fossil resins. Its specific gravity varies from 1·05 to 1·10.

The Baltic amber or succinite is found as irregular nodules in a marine glauconitic sand, known as "blue earth," occurring in the Lower Oligocene strata of Samland in East Prussia, where it is now systematically mined. It appears, however, to have been partly derived from yet earlier Tertiary deposits (Eocene); and it occurs also as a derivative mineral in later formations, such as the drift. Relics of an abundant flora occur in association with the amber, suggesting relations with the flora of Eastern

Asia and the southern part of North America. H. R. Göppert named the common amber-yielding pine of the Baltic forests *Pinites succinifer*, but as the wood, according to some authorities, does not seem to differ from that of the existing genus it has been also called *Pinus succinifera*. It is improbable, however, that the production of amber was limited to a single species; and indeed a large number of conifers belonging to different genera are represented in the amber-flora. The resin contains, in addition to the beautifully preserved plant-structures, numerous remains of insects, spiders, annelids, crustaceans and other small organisms which became enveloped while the exudation was fluid. In most cases the organic structure has disappeared, leaving only a cavity, with perhaps a trace of chitin. Even hair and feathers have occasionally been represented among the enclosures. Fragments of wood not infrequently occur, with the tissues well-preserved by impregnation with the resin; while leaves, flowers and fruits are occasionally found in marvellous perfection. Sometimes the amber retains the form of drops and stalactites, just as it exuded from the ducts and receptacles of the injured trees. The abnormal development of resin has been called "succinosis." Impurities are often present, especially when the resin dropped on to the ground, so that the material may be useless except for varnish-making, whence the impure amber is called firniss. Enclosures of pyrites may give a bluish colour to amber. The so-called "black amber" is only a kind of jet. "Bony amber" owes its cloudy opacity to minute bubbles in the interior of the resin.

Although amber is found along the shores of a large part of the Baltic and the North Sea, the great amber-producing country is the promontory of Samland. Pieces of amber torn from the sea-floor are cast up by the waves, and collected at ebb-tide. Sometimes the searchers wade into the sea, furnished with nets at the end of long poles, by means of which they drag in the sea-weed containing entangled masses of amber; or they dredge from boats in shallow water and rake up amber from between the boulders. Divers have been employed to collect amber from the deeper waters. Systematic dredging on a large scale was at one time carried on in the Kurisches Haff by Messrs Stantien and Becker, the great amber merchants of Königsberg. At the present time extensive mining operations are conducted in quest of amber. The "pit amber" was formerly dug in open works, but is now also worked by underground galleries. The nodules from the "blue earth" have to be freed from matrix and divested of their opaque crust, which can be done in revolving barrels containing sand and water. The sea-worn amber has lost its crust, but has often acquired a dull rough surface by rolling in sand.

Amber is extensively used for beads and other trivial ornaments, and for cigar-holders and the mouth-pieces of pipes. It is regarded by the Turks as specially valuable, inasmuch as it is said to be incapable of transmitting infection as the pipe passes from mouth to mouth. The variety most valued in the East is the pale straw-coloured, slightly cloudy amber. Some of the best qualities are sent to Vienna for the manufacture of smoking appliances. In working amber, it is turned on the lathe and polished with whitening and water or with rotten stone and oil, the final lustre being given by friction with flannel. During the working much electricity is developed.

By gradually heating amber in an oil-bath it becomes soft and flexible. Two pieces of amber may be united by smearing the surfaces with linseed oil, heating them, and then pressing them together while hot. Cloudy amber may be clarified in an oil-bath, as the oil fills the numerous pores to which the turbidity is due. Small fragments, formerly thrown away or used only for varnish, are now utilized on a large scale in the formation of "ambroid" or "pressed amber." The pieces are carefully heated with exclusion of air and then compressed into a uniform mass by intense hydraulic pressure; the softened amber being forced through holes in a metal plate. The product is extensively used for the production of cheap jewellery and articles for smoking. This pressed amber yields brilliant interference colours in polarized light. Amber has often been imitated by other resins like copal and kauri, as well as by celluloid and even glass. True amber is sometimes coloured artificially.

Amber was much valued as an ornamental material in very early times. It has been found in Mycenaean tombs; it is known from lake-dwellings in Switzerland, and it occurs with neolithic remains in Denmark, whilst in England it is found with interments of the bronze age. A remarkably fine cup turned in amber from a bronze-age barrow at Hove is now in the Brighton Museum. Beads of amber occur with Anglo-Saxon relics in the south of England; and up to a comparatively recent period the material was valued as an amulet. It is still believed to possess certain medicinal virtue.

Rolled pieces of amber, usually small but occasionally of very large size, may be picked up on the east coast of England, having probably been washed up from deposits under the North Sea. Cromer is the best-known locality, but it occurs also on other parts of the Norfolk coast, as well as at Yarmouth, Southwold, Aldeburgh and Felixstowe in Suffolk, and as far south as Walton-on-the-Naze in Essex, whilst northwards it is not unknown in Yorkshire. On the other side of the North Sea, amber is found at various localities on the coast of Holland and Denmark. On the shores of the Baltic it occurs not only on the Prussian and Pomeranian coast but in the south of Sweden, in Bornholm and other islands, and in S. Finland. Amber has indeed a very wide distribution, extending over a large part of northern Europe and occurring as far east as the Urals. Some of the amber districts of the Baltic and North Sea were known in prehistoric times, and led to early trade with the south of Europe. Amber was carried to Olbia on the Black Sea, Massilia on the Mediterranean, and Hatria at the head of the Adriatic; and from these centres it was distributed over the Hellenic world.

Whilst succinite is the common variety of European amber, the following varieties also occur:—

Gedanite, or "brittle amber," closely resembling succinite, but much more brittle, not quite so hard, with a lower melting-point and containing no succinic acid. It is often covered with a white powder easily removed by wiping. The name comes from Gedanum, the Latin name of Danzig.

Stantienite, a brittle, deep brownish-black resin, destitute of succinic acid.

Beckerite, a rare amber in earthy-brown nodules, almost opaque, said to be related in properties to gutta-percha.

Glessite, a nearly opaque brown resin, with numerous microscopic cavities and dusty enclosures, named from *glesum*, an old name for amber.

Krantzite, a soft amber-like resin, found in the lignites of Saxony.

Allingite, a fossil resin allied to succinite, from Switzerland.

Roumanite, or Rumanian amber, a dark reddish resin, occurring with lignite in Tertiary deposits. The nodules are penetrated by cracks, but the material can be worked on the lathe. Sulphur is present to the extent of more than 1 %, whence the smell of sulphuretted hydrogen when the resin is heated. According to G. Murgoci the Rumanian amber is true succinite.

Simetite, or Sicilian amber, takes its name from the river Simeto or Giaretta. It occurs in Miocene deposits and is also found washed up by the sea near Catania. This beautiful material presents a great diversity of tints, but a rich hyacinth red is common. It is remarkable for its fluorescence, which in the opinion of some authorities adds to its beauty. Amber is also found in many localities in Emilia, especially near the sulphur-mines of Cesena. It has been conjectured that the ancient Etruscan ornaments in amber were wrought in the Italian material, but it seems that amber from the Baltic reached the Etruscans at Hatria. It has even been supposed that amber passed from Sicily to northern Europe in early times—a supposition said to receive some support from the fact that much of the amber dug up in Denmark is red; but it must not be forgotten that reddish amber is found also on the Baltic, though not being fashionable it is used rather for varnish-making than for ornaments. Moreover, yellow amber after long burial is apt to acquire a reddish colour. The amber of Sicily seems not to have been recognized in ancient times, for it is not mentioned by local authorities like Diodorus Siculus.

Burmite is the name under which the Burmese amber is now described. Until the British occupation of Burma but little was known as to its occurrence, though it had been worked for centuries and was highly valued by the natives and by the Chinese. It is found in flat rolled pieces, irregularly distributed through a blue clay probably of Miocene age. It occurs in the Hukawng valley, in the Nangotaimaw hills, where it is irregularly worked in shallow pits. The mines were visited some years ago by Dr Fritz Noetling, and the mineral has been described by Dr Otto Helm. The Burmese amber is yellow or reddish, some being of ruby tint, and like the Sicilian amber it is fluorescent. Burmite and simetite agree also in being destitute of succinic acid. Most of the Burmese amber is worked at Mandalay into rosary-beads and ear-cylinders.

Many other fossil resins more or less allied to amber have been described. Schraufite is a reddish resin from the Carpathian sandstone, and it occurs with jet in the cretaceous rocks of the Lebanon; ambrite is a resin found in many of the coals of New Zealand; retinite occurs in the lignite of Bovey Tracey in Devonshire and elsewhere; whilst copaline has been found in the London clay of Highgate in North London. Chemawinite or cedarite is an amber-like resin from the Saskatchewan river in Canada.

Amber and certain similar substances are found to a limited extent at several localities in the United States, as in the greensand of New Jersey, but they have little or no economic value. A fluorescent amber is said, however, to occur in some abundance in Southern Mexico. Amber is recorded also from the Dominican Republic.

References.—See, for Baltic amber, P. Dahms, "Ueber die Vorkommen und die Verwendung des Bernsteins," *Zeitsch. für praktische Geologie*, 1901, p. 201; H. Conwentz, *Monographie der baltischen Bernsteinbäume* (Danzig, 1890); R. Klebs, *Guide to Exhibit of the German Amber Industry at World's Fair* (St Louis, 1904); and abstract by G. F. Kunz in *Mineral Resources of the U. S.* (1904). For Sicilian amber, W. Arnold Buffum, *The Tears of the Heliades, or Amber as a Gem* (London, 1896). For Burmese amber, papers by Fritz Noetling and Otto Helm in *Records of Geol. Surv. of India*, vol. xxvi. (1893), pp. 31, 61. For British amber, Clement Reid in *Trans. Norfolk Nat. Soc.*, vol. iii. (1884) p. 601; vol. iv. (1886) p. 247; and H. Conwentz in *Natural Science*, vol. ix. (1896) pp. 99, 161. (F. W. R.*)

AMBERG, a town of Germany, in the kingdom of Bavaria, formerly the capital of the Upper Palatinate, situated on both sides of the Vils, 42 m. E. of Nuremberg by rail. Pop. 22,089. It has a town hall with handsome rooms, a library, a gymnasium, a lyceum, elementary schools, an arsenal, and eleven churches, the finest of which is St Martin's, of the 15th century, with many excellent paintings and a tower 300 ft. high. A former Jesuit monastery is now used for a grammar school and seminary. There are also a pilgrimage church on a hill 1621 ft. high, a large convict prison for men, an industrial, commercial and other schools. The principal manufactures are firearms, ironmongery, earthenware, woollen cloth, beer, stoneware, zinc goods, colours and salt; in the neighbourhood are iron and coal mines. The French under Jourdan were defeated by the Austrians under the Archduke Charles near Amberg in 1796.

AMBERGRIS (*Ambra grisea*, *Ambre gris*, or grey amber), a solid, fatty, inflammable substance of a dull grey or blackish colour, the shades being variegated like marble, possessing a peculiar sweet, earthy odour. It occurs as a biliary concretion in the intestines of the spermaceti whale (*Physeter macrocephalus*), and is found floating upon the sea, on the sea-coast, or in the sand near the sea-coast. It is met with in the Atlantic Ocean; on the coasts of Brazil and Madagascar; also on the coast of Africa, of the East Indies, China, Japan and the Molucca islands; but most of the ambergris which is brought to England comes from the Bahama Islands, Providence, &c. It is also sometimes found in the abdomen of whales, always in lumps of various shapes and sizes, weighing from ½ oz. to 100 or more pounds. Ambergris, when taken from the intestinal canal of the sperm whale, is of a deep grey colour, soft consistence and a disagreeable smell. On exposure to the air it gradually hardens, becomes pale and develops its peculiar sweet, earthy odour. In that condition its specific gravity ranges from 0·780 to 0·926. It melts at about 62° C. to a fatty, yellow resinous-like liquid; and at 100° C. it is volatilized into a white vapour. It is soluble in ether, and in volatile and fixed oils; it is only feebly acted on by acids. By digesting in hot alcohol, a substance termed *ambrein*, closely resembling cholesterin, is obtained, which separates in brilliant white crystals as the solution cools. The use of ambergris in Europe is now entirely confined to perfumery, though it formerly occupied no inconsiderable place in medicine. In minute quantities its alcoholic solution is much used for giving a "floral" fragrance to bouquets, washes and other preparations of the perfumer. It occupies a very important place in the perfumery of the East, and there it is also used in pharmacy and as a flavouring material in cookery. The high price it commands makes it peculiarly liable to adulteration, but its genuineness is easily tested by its solubility in hot alcohol, its fragrant odour, and its uniform fatty consistence on being penetrated by a hot wire.

AMBERT, a town of central France, capital of an arrondissement of the department of Puy-de-Dôme, on the Dore, 52 m. E.S.E. of Clermont-Ferrand by rail. Pop. (1906), town, 3889; commune, 7581. The town has a church of the 15th and 16th centuries and carries on the manufacture of paper, lace, ribbon, rosaries, &c., and trade in cheese. It is the seat of a sub-prefect, and the public institutions include tribunals of first instance and of commerce, a chamber of arts and manufactures, and a communal college.

AMBIENT (from Lat. *ambi*, on both sides, and *ire*, to go), surrounding; a word implying a moving rather than a stationary encircling. It is used mostly in the phrase the "ambient air," though Bacon applied it as an adjective to the clergy, suggesting "ambition." In astrology it means the sky.

AMBIGU, a French game of cards, composed of the characteristic elements of whist, bouillotte and piquet. A whist pack with the court cards deleted is used, and from two to six persons may play. Each player is given an equal number of counters, and a limit of betting is agreed upon. Two cards are dealt, one at a time, to each player, after each has placed two counters in a pool. Each player then either keeps his hand, saying "Enough," or takes one or two new cards from the top of the stock, after which the stock is reshuffled and cut, and each player receives two more cards, one at a time. The players then either "play" or "pass." If a person "plays," he bets a number of counters and the others may equal this bet or raise it. Should no player meet the first bet, the bettor takes back his bet, leaving the pool intact, and receives two counters from the last player who refuses to play. When two or more bet the same number, they again draw cards and "pass" or "play" as before. If all "pass," each pays a counter to the pool and a new deal ensues. The player betting more than the others call wins the pool. He then exposes his hand and is paid by each adversary according to its value. The hands rank as follows:—"Point," the number of pips on two or more cards of a suit (one counter). "Prime," four cards of different suits (two counters). "Grand Prime," the same with the number of pips over 30 (three counters). "Sequence," a hand containing three cards of the same suit in sequence (three counters). "*Tricon*," three of a kind (four counters). "Flush," four cards of the same suit (five counters). "Doublet," a hand containing two counting combinations at once, as 2, 3, 4 and 7 of spades, amounting to both a "sequence" and a "flush" (eight counters). "*Fredon*," four of a kind (the highest possible hand), ten or eleven counters, according to the number of pips. Ties are decided by the number of pips.

AMBIGUITY (Fr. *ambiguïté*, med. Lat. *ambiguitas*, from Lat. *ambiguus*, doubtful; *ambi*, both ways, *agere*, to drive), doubtfulness or uncertainty. In law an ambiguity as to the meaning of the words of a written instrument may be of considerable importance. Ambiguity, in law, is of two kinds, *patent* and *latent*. (1) Patent ambiguity is that ambiguity which is apparent on the face of an instrument to any one perusing it, even if he be unacquainted with the circumstances of the parties. In the case of a patent ambiguity parol evidence is admissible to explain only what has been writen, not what it was intended to write. For example, in *Saunderson* v. *Piper*, 1839, 5 B.N.C. 425, where a bill was cdrawn in figures for £245 and in words for two hundred pounds, evidence that "and forty-five" had been omitted by mistake was rejected. But where it appears from the general context of the instrument what the parties really meant, the instrument will be construed as if there was no ambiguity, as in *Saye and Sele's* case, 10 Mod. 46, where the name of the grantor had been omitted in the operative part of a grant, but, as it was clear from another part of the grant who he was, the deed was held to be valid. (2) Latent ambiguity is where the wording of an instrument is on the face of it clear and intelligible, but may, at the same time, apply equally to two different things or subject matters, as where a legacy is given "to my nephew, John," and the testator is shown to have two nephews of that name. A latent ambiguity may be explained by parol evidence, for, as the ambiguity has been brought about by circumstances extraneous to the instrument, the explanation must necessarily be sought for from such circumstances. (See also EVIDENCE.)

AMBIORIX, prince of the Eburones, a tribe of Belgian Gaul. Although Caesar (*q.v.*) had freed him from paying tribute to the Aduatuci, he joined Catuvolcus (winter, 54 B.C.) in a rising against the Roman forces under Q. Titurius Sabinus and L. Aurunculeius Cotta, and almost annihilated them. An attack on Quintus Cicero (brother of the orator), then quartered with a legion in the territory of the Nervii, failed owing to the timely appearance of Caesar. Ambiorix is said to have found safety across the Rhine.

Caesar, *Bell. Gall.* v. 26-51, vi. 29-43, viii. 24; Dio Cassius xl. 7-11; Florus iii. 10.

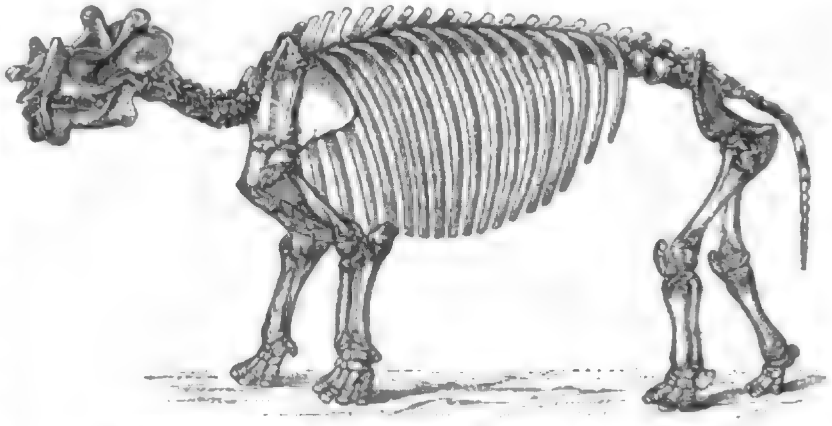
AMBLESIDE, a market-town in the Appleby parliamentary division of Westmorland, England, a mile from the head of Windermere. Pop. of urban district (1901) 2536. It is most beautifully situated, for though the lake is hardly visible from the town, the bare, sharply rising hills surrounding the richly wooded valley of the Rothay afford a series of equisite views. The hills immediately above this part of the valley are Wansfell on the east, Loughrigg Fell on the west, and Rydal Fell and the ridge below Snarker Pike (2096 ft.) to the north. At the head of Windermere is Waterhead, the landing-stage of Ambleside, which is served by the lake steamers of the Furness Railway Company. The chief roads which centre upon Ambleside are—one from the town of Windermere, following the eastern shore of the lake; one from Ullswater, by Patterdale and Kirkstone Pass; one from Keswick, by Dunmail Raise and Grasmere, and the two lovely lakes of Grasmere and Rydal Water; and one from the Brathay valley and the Langdales to the west. Ambleside is thus much frequented by tourists. In its vicinity is Rydal Mount, for many years the residence of the poet Wordsworth. The town has some industry in bobbin-making, and there are slate quarries in the neighbourhood.

Close by the lake side the outlines are still visible of a Roman fort, the name of which is not known. It appears to have guarded a route over the hills by Hardknott and Wrynose Pass to Ravenglass on the coast of Cumberland.

AMBLYGONITE, a mineral usually found as cleavable or columnar, and compact masses; it is translucent and has a vitreous lustre, and the colour varies from white to pale shades of violet, grey, green or yellow. There are good cleavages in two directions. The hardness is 6 and the specific gravity 3·0. The mineral is thus not unlike felspar in general appearance, but it is readily distinguished from this by its chemical characters, being an aluminium and lithium fluophosphate, $Li(AlF)PO_4$, with part of the lithium replaced by sodium and part of the fluorine by hydroxyl. Crystals, which are rarely distinctly developed, belong to the anorthic system, and frequently show twin lamellae.

The mineral was first discovered in Saxony by A Breithaupt in 1817, and named by him from the Greek ἀμβλύς, blunt, and γωνία, angle, because of the obtuse angle between the cleavages. Later it was found at Montebras, dep. Creuse, France, and at Hebron in Maine; and on account of slight differences in optical character and chemical composition the names montebrasite and hebronite have been applied to the mineral from these localities. Recently it has been discovered in considerable quantity at Pala in San Diego county, California, and at Cáceres in Spain. Amblygonite occurs with lepidolite, tourmaline and other lithia-bearing minerals in pegmatite-veins. It contains about 10% of lithia, and, since 1886, has been utilized as a source of lithium salts, the chief commercial sources being the Montebras deposits, and later the Californian. (L. J. S.)

AMBLYPODA, a suborder of primitive ungulate mammals, taking its name from the short and stumpy feet, which were furnished with five toes each, and supported massive pillar-like limbs. The brain-cavity was extremely small, and insignificant in comparison to the bodily bulk, which was equal to that of the largest rhinoceroses. These animals are, in fact, descendants of the small ancestral ungulates which have retained all the primitive characters of the latter accompanied by a huge increase in bodily size. They are confined to the Eocene period, and occur both in North America and Europe. The cheek teeth are short crowned (brachyodont), with the tubercles more or less completely fused into transverse ridges, or cross-crests (lophodont type); and the total number of teeth is in one case the typical 44, but in another is reduced below this. The vertebrae of the neck unite by nearly flat surfaces, the humerus has lost the foramen, or perforation, at the lower end, and the third trochanter to the femur may also be wanting. In the fore-limb the upper and lower series of carpal bones scarcely alternate, but in the hind-foot the astragalus overlaps the cuboid, while the fibula, which is quite distinct from the tibia (as is the radius from the ulna in the fore-limb), articulates with both astragalus and calcaneum. The most generalized type is *Coryphodon*, representing the family *Coryphodontidae*, from the lower Eocene of Europe and North America, in which there were 44 teeth, and no horn-like excrescences on the long skull, while the femur had a third trochanter. The canines are somewhat elongated, and were followed by a short gap in each jaw, and the cheek-teeth were adapted for succulent food. The length of the body reached about 6 ft. in some cases.



Restored skeleton of *Uintatherium* (*Dinoceras*) *mirabile*. $\frac{1}{30}$.
(After O. C. Marsh.)

In the middle Eocene formations of North America occurs the more specialized *Uintatherium* (or *Dinoceras*), typifying the family *Uintatheriidae*, which also contains species sometimes separated as *Tinoceras*. Uintatheres were huge creatures, with long narrow skulls, of which the elongated facial portion carried three pairs of bony horn-cores, probably covered with short horns in life, the hind-pair being much the largest. The dental formula is *i.* $\frac{0}{3}$, *c.* $\frac{1}{1}$, *p.* $\frac{3}{3-4}$, *m.* $\frac{3}{3}$; the upper canines being long sabre-like weapons, protected by a descending flange on each side of the front of the lower jaw.

In the basal Eocene of North America the Amblypoda were represented by extremely primitive, five-toed, small ungulates such as *Periptychus* and *Pantolambda*, each of these typifying a family. The full typical series of 44 teeth was developed in each, but whereas in the *Periptychidae* the upper molars were bunodont and tritubercular, in the *Pantolambdidae* they have assumed a selenodont structure. Creodont characters (see CREODONTA) are displayed in the skeleton.

See also H. F. Osborn, "Evolution of the Amblypoda," *Bull. Amer. Mus.* vol. x. p. 169. (R. L.*)

AMBO, or AMBON (Gr. *ἄμβων*, from *ἀναβαίνειν*, to walk up, the reading-desk of early Basilican churches, also called *πύργος*. Originally small and movable, it was afterwards made of large proportions and fixed in one place. In the Byzantine and early Romanesque periods it was an essential part of church furniture; but during the middle ages it was gradually superseded in the Western Church by the pulpit and lectern. The gospel and epistle are still read from the ambo in the Ambrosian rite at Milan. The position of the ambo was not absolutely uniform; sometimes in the central point between the sanctuary and the nave, sometimes in the middle of the church, and sometimes at one or both of the sides of the chancel. The normal ambo, when the church contained only one, had three stages or degrees, one above the other, and it was usually mounted by a flight of steps at each end. The uppermost stage was reserved for the deacon who sang the gospel (facing the congregation); for promulgating episcopal edicts; reciting the names inscribed on the diptychs (see DIPTYCH); announcing fasts, vigils and feasts; reading ecclesiastical letters or acts of the martyrs celebrated on that day; announcing new miracles for popular edification, professions by new converts or recantations by heretics; and (for priests and deacons) preaching sermons,—bishops as a general rule preaching from their own throne. The second stage was for the sub-deacon who read the epistle (facing the altar); and the third for the subordinate clergy who read other parts of scripture. The inconvenience of having a single ambo led to the substitution of two separate ambones, between which these various functions were divided, one on the south side of the chancel being for the reading of the gospel, and one on the north for reading the epistle. In the Russian Orthodox Church the term "ambo" is used of the semicircular steps leading to the platform in front of the iconostasis (*q.v.*), but in cathedrals the bishop has an ambo in the centre of the church. In the Greek Church the older form remains, usually placed at the side. In the Uniate Greek Catholic Church the "ambo" has become a table, on which are placed a crucifix and lights, before the doors of the iconostasis; here baptisms, marriages and confirmations take place.

Ambones were made of wood or else of costly marbles, and were decorated with mosaics, reliefs, gilding, &c.; sometimes also covered with canopies supported on columns. They were often of enormous size; that at St Sophia in Constantinople was large enough for the ceremonial of coronation.

The churches in Rome possess many fine examples of ambones in marble, of which the oldest is probably that in S. Clemente, reconstructed in the beginning of the 12th century. Those of slightly later date are enriched with marble mosaic known as Cosmati work, of which the examples in S. Maria-in-Ara-Coeli, S. Maria-in-Cosmedin and S. Lorenzo are those which are best known. Some early ambones are found in Ravenna, and in the south of Italy are many fine examples; the epistle ambo in the cathedral at Ravello (1130), which is perhaps the earliest, shows a Scandinavian influence in the design of its mosaic inlay, an influence which is found in Sicilian work and may be a Norman importation. The two ambones in the cathedral of Salerno, which are different in design, are magnificent in effect and are enriched with sculpture as well as with mosaic. In the gospel ambo in the cathedral of Ravello (1272), and also in that of the convent of the Trinita della Cava near Salerno, the spiral columns inlaid with mosaic stand on the backs of lions. In the epistle ambo at Salerno and the gospel ambones at Cava and San Giovanni del Toro in Ravello, the columns support segmental arches carrying the ambones; the epistle ambo at Ravello and all those in Rome are raised on solid marble bases.

See the liturgical and ecclesiastical dictionaries of Martigny, Migne, and Smith and Cheetham, *sub voce*, where all the scattered references are collected together and summarized. In Ciampinus, *Vetera Monumenta* (Rome, 1747), plates xii., xiii., are several illustrations of actual examples.

AMBOISE, GEORGES D' (1460–1510), French cardinal and minister of state, belonged to a noble family possessed of considerable influence. His father, Pierre d'Amboise, seigneur de Chaumont, was chamberlain to Charles VII. and Louis XI. and ambassador at Rome. His eldest brother, Charles d'Amboise, was governor of the Isle of France, Champagne and Burgundy, and councillor of Louis XI. Georges d'Amboise was only fourteen when his father procured for him the bishopric of Montauban, and Louis XI. appointed him one of his almoners. On arriving at manhood d'Amboise attached himself to the party of the duke of Orleans, in whose cause he suffered imprisonment, and on whose return to the royal favour he was elevated to the archbishopric of Narbonne, which after some time he changed for that of Rouen (1493). On the appointment of the duke of Orleans as governor of Normandy, d'Amboise became his lieutenant-general. In 1498 the duke of Orleans mounted the throne as Louis XII., and d'Amboise was suddenly raised to the high position of cardinal and prime minister. His administration was, in many respects, well-intentioned and useful. Having the good fortune to serve a king who was both economical and just, he was able to diminish the imposts, to introduce order among the soldiery, and above all, by the ordinances of 1499, to improve the organization of justice. He was also zealous for the reform of the church, and particularly for the reform of the monasteries; and it is greatly to his credit that he did not avail himself of the extremely favourable opportunities he possessed of becoming a pluralist. He regularly spent a large income in charity, and he laboured strenuously to stay the progress of the plague and famine which broke out in 1504. His foreign policy, less happy and less wise, was animated by two aims—to increase the French power in Italy and to seat himself on the papal throne; and these aims he sought to achieve by diplomacy, not by force. He, however, sympathized with, and took part in, the campaign which was begun in 1499 for the conquest of Milan. In 1500 he was named lieutenant-general in Italy and charged with the organization of the conquest. On the death of Alexander VI. he aspired to the papacy. He had French troops at the gates of Rome, by means of which he could easily have frightened the conclave and induced them to elect him; but he was persuaded to trust to his influence; the troops were dismissed, and an Italian was appointed as Pius III.; and again, on the death of Pius within the month, another Italian, Julius II., was chosen (1503). D'Amboise received in compensation the title of legate for life in France and in the Comtat Venaissin. He was one of the negotiators of the disastrous treaties of Blois (1504), and in 1508 of the League of Cambrai against Venice. In 1509 he again accompanied Louis XII. into Italy, but on his return he was seized at the city of Lyons with a fatal attack of gout in the stomach. He died there on the 25th of May 1510. His body was removed to Rouen, and a magnificent tomb, on which he is represented kneeling in the attitude of prayer, was erected to his memory in the cathedral of that town. Throughout his life he was an enlightened patron of letters and art, and it was at his orders that the château of Gaillon near Rouen was built.

See *Lettres du roi Louis XII. et du cardinal d'Amboise* (Brussels, 1712); L. Legendre, *Vie du cardinal d'Amboise* (Rouen, 1726); E. Lavisse, *Histoire de France* (vol. v. by H. Lemonnier, Paris, 1903);

J. A. Deville, *Tombeaux de la cathédrale de Rouen* (3rd ed., 1881). For a bibliography of the printed sources, see H. Hauser, *Les Sources de l'histoire de France, XVIe siècle*, vol. i. (1906). (J. I.)

AMBOISE, a town of central France in the department of Indre-et-Loire, on the left bank of the Loire, 12 m. E. of Tours by the Orléans railway. Pop. (1906) 4632. Amboise owes its celebrity to the imposing château which overlooks the Loire from the rocky eminence above the town. The Logis du Roi, the most important portion, was the work of Charles VIII.; the other wing was built under Louis XII. and Francis I. The ramparts are strengthened by two massive towers containing an inclined plane on which horses and carriages may ascend. The chapel of St Hubert, said to contain the remains of Leonardo da Vinci, who was summoned to Amboise by Francis I., king of France, and died there in 1519, is in the late Gothic style; a delicately carved relief over the doorway represents the conversion of St Hubert. The hôtel de ville is established in a mansion of Renaissance architecture; a town gateway of the 15th century, surmounted by a belfry, is also of architectural interest. Iron-founding, wool-weaving, and the manufacture of boots and farm implements are among the industries.

Amboise at the end of the 11th century was a lordship under the counts of Anjou, one of whom, Hugues I., rebuilt the ancient castle. Its territory was united to the domain of the crown of France by Charles VII. about the middle of the 15th century, and thenceforth the château became a favourite residence of the French kings. The discovery in 1560 of the "conspiracy of Amboise," a plot of the Huguenots to remove Francis II. from the influence of the house of Guise, was avenged by the death of 1200 members of that party. In 1563 Amboise gave its name to a royal edict allowing freedom of worship to the Huguenot nobility and gentry. After that period the château was frequently used as a state prison, and Abd-el-Kader was a captive there from 1848 to 1852. In 1872 it was restored by the National Assembly to the house of Orleans, to which it had come by inheritance from the duke of Penthièvre in the latter half of the 18th century.

AMBOYNA (Dutch *Ambon*), the name of a residency, its chief town, and the island on which the town is situated, in the Dutch East Indies.

The residency shares with that of Ternate the administration of the Moluccas, the previous government of which was abolished in 1867. It includes a mass of islands in the Banda Sea (2° 30′–8° 20′ S. and 125° 45′–135° E.), including the island-belt which surrounds the sea on the north, east and south; and is divided for administrative purposes into nine districts (*afdeelingen*): 1) Amboyna, the island of that name; (2) Saparua, with Oma and Nusa Laut; (3) Kajeli (Eastern Buru); (4) Masareti (Western Buru); (5) Kairatu (Western Ceram); (6) Wahai (the northern part of Mid-Ceram); (7) Amahai (the southern part of Mid-Ceram); (8) the Banda Isles, with East Ceram, Ceram Laut and Gorom; (9) the islands of Aru, Kei, Timor Laut or Tenimber, and the south-western islands. The total area of the residency is about 19,861 sq. m., and its population 296,000, including 2400 Europeans.

Amboyna Island lies off the south-west of Ceram, on the north side of the Banda Sea, being one of a series of volcanic isles in the inner circle round the sea. It is 32 m. in length, with an area of about 386 sq. m., and is of very irregular figure, being almost divided into two. The south-eastern and smaller portion (called Leitimor) is united to the northern (Hitoe) by a neck of land a few yards in breadth. The highest mountains, Wawani (3600 ft.) and Salhutu (4020 ft.), have hot springs and solfataras. They are considered to be volcanoes, and the mountains of the neighbouring Uliasser islands the remains of volcanoes. Granite and serpentine rocks predominate, but the shores of Amboyna Bay are of chalk, and contain stalactite caves. The surface is fertile, the rivers are small and not navigable, and the roads are mere footpaths. Cocoa is one of the products. The climate is comparatively pleasant and healthy; the average temperature is 80° F., rarely sinking below 72°. The rainfall, however, after the eastern monsoons, is very heavy, and the island is liable to violent hurricanes. It is remarkable that the dry season (October to April) is coincident with the period of the west monsoon. Indigenous mammals are poor in species as well as few in number; birds are more abundant, but of no greater variety. The entomology of the island, however, is very rich, particularly in respect of *Lepidoptera*. Shells are obtained in great numbers and variety. Turtle-shell is also largely exported. The vegetation is also rich, and Amboyna produces most of the common tropical fruits and vegetables, including the sago-palm, bread-fruit, cocoa-nut, sugar-cane, maize, coffee, pepper and cotton. Cloves, however, form its chief product, though the trade in them is less important than formerly, when the Dutch prohibited the rearing of the clove-tree in all the other islands subject to their rule, in order to secure the monopoly to Amboyna. Amboyna wood, of great value for ornamental work, is obtained from the hard knots which occur on certain trees in the forests of Ceram. The population (about 39,000) is divided into two classes—*orang burger* or citizens, and *orang negri* or villagers, the former being a class of native origin enjoying certain privileges conferred on their ancestors by the old Dutch East India Company. The natives are of mixed Malay-Papuan blood. They are mostly Christians or Mahommedans. There are also, besides the Dutch, some Arabs, Chinese and a few Portuguese settlers.

Amboyna, the chief town, and seat of the resident and military commander of the Moluccas, is protected by Fort Victoria, and is a clean little town with wide streets, well planted. Agriculture, fisheries and import and export trade furnish the chief means of subsistence. It lies on the north-west of the peninsula of Leitimor, and has a safe and commodious anchorage. Its population is about 8000.

The Portuguese were the first European nation to visit Amboyna (1511). They established a factory there in 1521, but did not obtain peaceable possession of it till 1580, and were dispossessed by the Dutch in 1609. About 1615 the British formed a settlement in the island, at Cambello, which they retained until 1623, when it was destroyed by the Dutch, and frightful tortures inflicted on the unfortunate persons connected with it. In 1654, after many fruitless negotiations, Cromwell compelled the United Provinces to give the sum of £300,000, together with a small island, as compensation to the descendants of those who suffered in the "Amboyna massacre." In 1673 the poet Dryden produced his tragedy of *Amboyna, or the Cruelties of the Dutch to the English Merchants*. In 1796 the British, under Admiral Rainier, captured Amboyna, but restored it to the Dutch at the peace of Amiens in 1802. It was retaken by the British in 1810, but once more restored to the Dutch in 1814.

AMBRACIA (more correctly AMPRACIA), an ancient Corinthian colony, situated about 7 m. from the Ambracian Gulf, on a bend of the navigable river Aracthus (or Aratthus), in the midst of a fertile wooded plain. It was founded between 650 and 625 B.C. by Gorgus, son of the Corinthian tyrant Cypselus. After the expulsion of Gorgus's son Periander its government developed into a strong democracy. The early policy of Ambracia was determined by its loyalty to Corinth (for which it probably served as an entrepôt in the Epirus trade), its consequent aversion to Corcyra, and its frontier disputes with the Amphilochians and Acarnanians. Hence it took a prominent part in the Peloponnesian War until the crushing defeat at Idomene (426) crippled its resources. In the 4th century it continued its traditional policy, but in 338 surrendered to Philip II. of Macedon. After forty-three years of autonomy under Macedonian suzerainty it became the capital of Pyrrhus, king of Epirus, who adorned it with palace, temples and theatres. In the wars of Philip V. of Macedon and the Epirotes against the Aetolian league (220–205) Ambracia passed from one alliance to the other, but ultimately joined the latter confederacy. During the struggle of the Aetolians against Rome it stood a stubborn siege. After its capture and plunder by M. Fulvius Nobilior in 189, it fell into insignificance. The foundation by Augustus of Nicopolis (*q.v.*), into which the remaining inhabitants were drafted, left the site desolate. In Byzantine times a new settlement took its place under the name of Arta (*q.v.*). Some fragmentary walls of large, well-dressed blocks near this latter town indicate the early prosperity of Ambracia.

Authorities.—Thucydides ii. 68–iii. 114; Aristotle, *Politics*, 1303a sqq.; Strabo p. 325; Polybius xxii. 9-13; Livy xxxviii. 3-9; G. Wolfe, *Journal of Geographical Society* (London), iii. (1833) pp. 77-94; E. Oberhummer, *Akarnanien, Ambrakien, &c. im Altertum* (Munich, 1887). (M. O. B. C.)

AMBRIZ, a West African seaport belonging to Portugal, at the mouth of the Loje River, in 7° 50′ S., 13° E., some 70 m. N. of Loanda. It forms a part of the province of Angola (*q.v.*). The town is within the free-trade area of the conventional basin of the Congo river. Its chief exports are rubber, gum, coffee and copper. Pop. about 2500. Ambriz was, previously to 1884, the northernmost point of Africa south of the equator acknowledged as Portuguese territory.

AMBROS, AUGUST WILHELM (1816–1876), Austrian composer and historian of music, was born at Mauth near Prague. His father was a cultured man, and his mother was the sister of R. G. Kiesewetter (1773–1850), the musical archaeologist and collector. Ambros was well educated in music and the arts, which were his abiding passion; but he was destined for the law and an official career in the Austrian civil service, and he occupied various important posts under the ministry of justice, music being the employment of his leisure. From 1850 onwards he became well known as a critic and essay-writer, and in 1860 he began working on his *magnum opus*, his *History of Music*, which was published at intervals from 1864 in five volumes, the last two (1878, 1882) being edited and completed by Otto Kade and Langhaus. Ambros became professor of the history of music at Prague in 1869. He was an excellent pianist, and the author of numerous compositions somewhat reminiscent of Mendelssohn. He died at Vienna on the 28th of June 1876.

AMBROSE (fl. 1190), Norman poet, and chronicler of the Third Crusade, author of a work called *L'Estoire de la guerre sainte*, which describes in rhyming French verse the adventures of Richard Cœur de Lion as a crusader. The poem is known to us only through one Vatican MS., and long escaped the notice of historians. The credit for detecting its value belongs to the late Gaston Paris, although his edition (1897) was partially anticipated by the editors of the *Monumenta Germaniae Historica*, who published some selections in the twenty-seventh volume of their *Scriptores* (1885). Ambrose followed Richard I. as a non-combatant, and not improbably as a court-minstrel. He speaks as an eye-witness of the king's doings at Messina, in Cyprus, at the siege of Acre, and in the abortive campaign which followed the capture of that city. Ambrose is surprisingly accurate in his chronology; though he did not complete his work before 1195, it is evidently founded upon notes which he had taken in the course of his pilgrimage. He shows no greater political insight than we should expect from his position; but relates what he had seen and heard with a naive vivacity which compels attention. He is prejudiced against the Saracens, against the French, and against all the rivals or enemies of his master; but he is never guilty of deliberate misrepresentation. He is rather to be treated as a biographer than as a historian of the Crusade in its broader aspects. None the less he is the chief authority for the events of the years 1190–1192, so far as these are connected with the Holy Land. The *Itinerarium Regis Ricardi* (formerly attributed to Geoffrey Vinsauf, but in reality the work of Richard, a canon of Holy Trinity, London) is little more than a free paraphrase of Ambrose. The first book of the *Itinerarium* contains some additional facts; and the whole of the Latin version is adorned with flowers of rhetoric which are foreign to the style of Ambrose. But it is no longer possible to regard the *Itinerarium* as a first-hand narrative. Stubbs's edition of the *Itinerarium* (Rolls Series, 1864), in which the contrary hypothesis is maintained, appeared before Gaston Paris published his discovery.

See the edition of *L'Estoire de la guerre sainte* by Gaston Paris in the *Collection des documents inédits sur l'histoire de France* (1897); the editor discusses in his introduction the biography of Ambrose, the value of the poem as a historical source, and its relation to the *Itinerarium*. R. Pauli's remarks (in *Monumenta Germaniae Historica. Scriptores*, xxvii.) also deserve attention. (H. W. C. D.)

AMBROSE, SAINT (*c.* 340–397), bishop of Milan, one of the most eminent fathers of the church in the 4th century, was a citizen of Rome, born about 337–340 in Trèves, where his father was prefect of Gallia Narbonensis. His mother was a woman of intellect and piety. Ambrose was early destined to follow his father's career, and was accordingly educated in Rome. He made such progress in literature, law and rhetoric, that the praetor Anicius Probus first gave him a place in the council and then made him consular prefect of Liguria and Emilia, with headquarters at Milan, where he made an excellent administrator. In 374 Auxentius, bishop of Milan, died, and the orthodox and Arian parties contended for the succession. An address delivered to them at this crisis by Ambrose led to his being acclaimed as the only competent occupant of the see; though hitherto only a catechumen, he was baptized, and a few days saw him duly installed as bishop of Milan. He immediately betook himself to the necessary studies, and acquitted himself in his new office with ability, boldness and integrity. Having apportioned his money among the poor, and settled his lands upon the church, with the exception of making his sister Marcellina tenant during life, and having committed the care of his family to his brother, he entered upon a regular course of theological study, under the care of Simplician, a presbyter of Rome, and devoted himself to the labours of the church, labours which were temporarily interrupted by an invasion of Goths, which compelled Ambrose and other churchmen to retire to Illyricum.

The eloquence of Ambrose soon found ample scope in the dispute between the Arians and the orthodox or Catholic party, whose cause the new bishop espoused. Gratian, the son of the elder Valentinian, took the same side; but the younger Valentinian, who had now become his colleague in the empire, adopted the opinions of the Arians, and all the arguments and eloquence of Ambrose could not reclaim the young prince to the orthodox faith. Theodosius, the emperor of the East, also professed the orthodox belief; but there were many adherents of Arius scattered throughout his dominions. In this distracted state of religious opinion, two leaders of the Arians, Palladius and Secundianus, confident of numbers, prevailed upon Gratian to call a general council from all parts of the empire. This request appeared so equitable that he complied without hesitation; but Ambrose, foreseeing the consequence, prevailed upon the emperor to have the matter determined by a council of the Western bishops. A synod, composed of thirty-two bishops, was accordingly held at Aquileia in the year 381. Ambrose was elected president; and Palladius, being called upon to defend his opinions, declined, insisting that the meeting was a partial one, and that, all the bishops of the empire not being present, the sense of the Christian church concerning the question in dispute could not be obtained. A vote was then taken, when Palladius and his associate Secundianus were deposed from the episcopal office.

Ambrose was equally zealous in combating the attempt made by the upholders of the old state religion to resist the enactments of Christian emperors. The pagan party was led by Quintus Aurelius Symmachus (*q.v.*), consul in 391, who presented to Valentinian II. a forcible but unsuccessful petition praying for the restoration of the altar of Victory to its ancient station in the hall of the senate, the proper support of seven vestal virgins, and the regular observance of the other pagan ceremonies. To this petition Ambrose replied in a letter to Valentinian, arguing that the devoted worshippers of idols had often been forsaken by their deities; that the native valour of the Roman soldiers had gained their victories, and not the pretended influence of pagan priests; that these idolatrous worshippers requested for themselves what they refused to Christians; that voluntary was more honourable than constrained virginity; that as the Christian ministers declined to receive temporal emoluments, they should also be denied to pagan priests; that it was absurd to suppose that God would inflict a famine upon the empire for neglecting to support a religious system contrary to His will as revealed in the Scriptures; that the whole process of nature encouraged innovations, and that all nations had permitted them, even in religion; that heathen sacrifices were offensive to Christians; and that it was the duty of a Christian prince to suppress pagan ceremonies. In the epistles of Symmachus and of Ambrose both the petition and the reply are preserved. They are a strange blend of sophistry, superstition, sound sense and solid argument.

The increasing strength of the Arians proved a formidable task for Ambrose. In 384 the young emperor and his mother Justina, along with a considerable number of clergy and laity professing the Arian faith, requested from the bishop the use of two churches, one in the city, the other in the suburbs of Milan. Ambrose refused, and was required to answer for his conduct before the council. He went, attended by a numerous crowd of people, whose impetuous zeal so overawed the ministers of Valentinian that he was permitted to retire without making the surrender of the churches. The day following, when he was performing divine service in the Basilica, the prefect of the city came to persuade him to give up at least the Portian church in the suburbs. As he still continued obstinate, the court proceeded to violent measures: the officers of the household were commanded to prepare the Basilica and the Portian churches to celebrate divine service upon the arrival of the emperor and his mother at the ensuing festival of Easter. Perceiving the growing strength of the prelate's interest, the court deemed it prudent to restrict its demand to the use of one of the churches. But all entreaties proved in vain, and drew forth the following characteristic declaration from the bishop:—"If you demand my person, I am ready to submit: carry me to prison or to death, I will not resist; but I will never betray the church of Christ. I will not call upon the people to succour me; I will die at the foot of the altar rather than desert it. The tumult of the people I will not encourage: but God alone can appease it."

Many circumstances in the history of Ambrose are strongly characteristic of the general spirit of the times. The chief causes of his victory over his opponents were his great popularity and the superstitious reverence paid to the episcopal character at that period. But it must also be noted that he used several indirect means to obtain and support his authority with the people. He was liberal to the poor; it was his custom to comment severely in his preaching on the public characters of his times; and he introduced popular reforms in the order and manner of public worship. It is alleged, too, that at a time when the influence of Ambrose required vigorous support, he was admonished in a dream to search for, and found under the pavement of the church, the remains of two martyrs, Gervasius and Protasius. The applause of the vulgar was mingled with the derision of the court party.

Although the court was displeased with the religious principles and conduct of Ambrose, it respected his great political talents; and when necessity required, his aid was solicited and generously granted. When Maximus usurped the supreme power in Gaul, and was meditating a descent upon Italy, Valentinian sent Ambrose to dissuade him from the undertaking, and the embassy was successful. On a second attempt of the same kind Ambrose was again employed; and although he was unsuccessful, it cannot be doubted that, if his advice had been followed, the schemes of the usurper would have proved abortive; but the enemy was permitted to enter Italy; and Milan was taken. Justina and her son fled; but Ambrose remained at his post, and did good service to many of the sufferers by causing the plate of the church to be melted for their relief. Theodosius, the emperor of the East, espoused the cause of Justina, and regained the kingdom. This Theodosius was sternly rebuked by Ambrose for the massacre of 7000 persons at Thessalonica in 390, and was bidden imitate David in his repentance as he had imitated him in guilt.

In 392, after the assassination of Valentinian and the usurpation of Eugenius, Ambrose fled from Milan; but when Theodosius was eventually victorious, he supplicated the emperor for the pardon of those who had supported Eugenius. Soon after acquiring the undisputed possession of the Roman empire, Theodosius died at Milan in 395, and two years later (4th April 397) Ambrose also passed away. He was succeeded by Simplician.

A man of pure character, vigorous mind, unwearying zeal and uncommon generosity, Ambrose ranks high among the fathers of the ancient church on many counts. His chief faults were ambition and bigotry. Though ranking with Augustine, Jerome, and Gregory the Great, as one of the Latin "doctors," he is most naturally compared with Hilary, whom he surpasses in administrative excellence as much as he falls below him in theological ability. Even here, however, his achievements are of no mean order, especially when we remember his juridical training and his comparatively late handling of Biblical and doctrinal subjects. In matters of exegesis he is, like Hilary, an Alexandrian; his chief productions are homiletic commentaries on the early Old Testament narratives, *e.g.* the Hexaëmeron (Creation) and Abraham, some of the Psalms, and the Gospel according to Luke. In dogmatic he follows Basil of Caesarea and other Greek authors, but nevertheless gives a distinctly Western cast to the speculations of which he treats. This is particularly manifest in the weightier emphasis which he lays upon human sin and divine grace, and in the place which he assigns to faith in the individual Christian life. His chief works in this field are *De fide ad Gratianum Augustum*, *De Spiritu Sancto*, *De incarnationis Dominicae sacramento*, *De mysteriis*. His great spiritual successor, Augustine, whose conversion was helped by Ambrose's sermons, owes more to him than to any writer except Paul. Ambrose's intense episcopal consciousness furthered the growing doctrine of the Church and its sacerdotal ministry, while the prevalent asceticism of the day, continuing the Stoic and Ciceronian training of his youth, enabled him to promulgate a lofty standard of Christian ethics. Thus we have the *De officiis ministrorum*, *De viduis*, *De virginitate* and *De paenitentia*.

Ambrose has also left several funeral orations and ninety-one letters, but it is as a hymn-writer that he perhaps deserves most honour. Catching the impulse from Hilary and confirmed in it by the success of Arian psalmody, Ambrose composed several hymns, marked by dignified simplicity, which were not only effective in themselves but served as a fruitful model for later times. We cannot certainly assign to him more than four or five (*Deus Creator Omnium*, *Aeterne rerum conditor*, *Jam surgit hora tertia*, and the Christmas hymn *Veni redemptor gentium*) of those that have come down to us. Each of these hymns has eight four-line stanzas and is written in strict iambic tetrameter.

On the Ambrosian ritual see LITURGY; on the Ambrosian library see LIBRARIES; on the church founded by him at Milan in 387 see MILAN. EDITIONS: The Benedictine (4 vols., Venice, 1748 ff.); Migne, *Patrol. Lat.* xiv.-xvii.; P. A. Ballerini (6 vols., Milan, 1875 ff.). LITERATURE: Th. Förster, *Ambrose, B. of Mailand* (Halle, 1884), and art. in Herzog-Hauck, *Realencyk.*, where the literature is cited in full; A. Ebert, *Gesch. der christlich-latein. Litt.* (2nd ed., 1889); O. Bardenhewer, *Patrologie* (2nd ed., 1891); A. Harnack, *Hist. of Dogma*, esp. vol. v.; W. Bright, *Age of the Fathers*. (A. J. G.)

AMBROSE (ANDREY SERTIS-KAMENSKIY) (1708–1771), archbishop of Moscow, was born at Nezhine in the government of Chernigov, and studied in the school of St Alexander Nevskiy, where he afterwards became a tutor. At the age of thirty-one he entered a monastery, where he took the name of Ambrose. Subsequently he was appointed archimandrite of the convent of New Jerusalem at Voznesensk. From this post he was transferred as bishop, first to the diocese of Pereyaslav, and afterwards to that of Krusitsy near Moscow, finally becoming archbishop of Moscow in 1761. He was famous not only for his interest in schemes for the alleviation of poverty in Moscow, but also as the founder of new churches and monasteries. A terrible outbreak of plague occurred in Moscow in 1771, and the populace began to throng round an image of the Virgin to which they attributed supernatural healing power. Ambrose, perceiving that this crowding together merely enabled the contagion to spread, had the image secretly removed. The mob, suspecting that he was responsible for its removal, attacked a monastery to which he had retired, dragged him away from the sanctuary, and, having given him time to receive the sacrament, strangled him. Ambrose's works include a liturgy and translations from the Fathers.

AMBROSE (Ambroise), **AUTPERT** (d. 778), French Benedictine monk. He became abbé of St Vincent on the Volturno "in the time of Desiderius, king of the Lombards." He wrote a considerable number of works on the Bible and religious subjects generally. Among these are commentaries on the Apocalypse (see *Bibl. Patrum*, xiii. 403), on the Psalms, on the Song of Solomon; *Lives of SS. Paldo, Tato and Vaso* (according to Mabillon); *Assumption of the Virgin*; *Combat between the Virtues and the Vices.*

See Mabillon, *Acta sanct. Bolland.* III. ii. 259, 266; Georg Lommel, *Der ostfrankische Reformator Ambrosius* (Giessen, 1847); Bollandist *Bibl. hag. lat.* (1898), 61.

AMBROSE, ISAAC (1604–1663/4), English Puritan divine, was the son of Richard Ambrose, vicar of Ormskirk, and was probably descended from the Ambroses of Lowick in Furness, a well-known Catholic family. He entered Brazenose College, Oxford, in 1621, in his seventeenth year. Having graduated B.A. in 1624 and been ordained, he received in 1627 the little cure of Castleton in Derbyshire. By the influence of William Russell, earl of Bedford, he was appointed one of the king's itinerant preachers in Lancashire, and after living for a time in Garstang, he was selected by the Lady Margaret Hoghton as vicar of Preston. He associated himself with Presbyterianism, and was on the celebrated committee for the ejection of "scandalous and ignorant ministers and schoolmasters" during the Commonwealth. So long as Ambrose continued at Preston he was favoured with the warm friendship of the Hoghton family, their ancestral woods and the tower near Blackburn affording him sequestered places for those devout meditations and "experiences" that give such a charm to his diary, portions of which are quoted in his *Prima Media and Ultima* (1650, 1659). The immense auditory of his sermon (*Redeeming the Time*) at the funeral of Lady Hoghton was long a living tradition all over the county. On account of the feeling engendered by the civil war Ambrose left his great church of Preston in 1654, and became minister of Garstang, whence, however, in 1662 he was ejected with the two thousand ministers who refused to conform. His after years were passed among old friends and in quiet meditation at Preston. He died of apoplexy about the 20th of January 1663/4. As a religious writer Ambrose has a vividness and freshness of imagination possessed by scarcely any of the Puritan Nonconformists. Many who have no love for Puritan doctrine, nor sympathy with Puritan experience, have appreciated the pathos and beauty of his writings, and his *Looking to Jesus* long held its own in popular appreciation with the writings of John Bunyan.

AMBROSE THE CAMALDULIAN, the common name of Ambrogio Traversari (1386–1439), French ecclesiastic, born near Florence at the village of Portico. At the age of fourteen he entered the Camaldulian Order in the monastery of Sta Maria degli Angeli, and rapidly became a leading theologian and Hellenist. In Greek literature his master was Emmanuel Chrysoloras. He became general of the order in 1431, and was a leading advocate of the papacy. This attitude he showed clearly when he attended the council of Basel as legate of Eugenius IV. So strong was his hostility to some of the delegates that he described Basel as a western Babylon. He likewise supported the pope at Ferrara and Florence, and worked hard in the attempt to reconcile the Eastern and Western Churches. Though this cause was unsuccessful, Ambrose is interesting as typical of the new humanism which was growing up within the church. Voigt says that he was the first monk in Florence in whom the love of letters and art became predominant over his ecclesiastical views. Thus while among his own colleagues he seemed merely a hypocritical and arrogant priest, in his relations with his brother humanists, such as Cosimo de Medici, he appeared as the student of classical antiquities and especially of Greek theological authors. His chief works are:—*Hodoeporicon*, an account of a journey taken by the pope's command, during which he visited the monasteries of Italy; a translation of Palladius' *Life of Chrysostom*; of *Nineteen Sermons of Ephraem Syrus*; of the *Book of St Basil on Virginity.* A number of MSS. remain in the library of St Mark at Venice. He died on the 20th of October 1439.

See G. Voigt, *Die Wiederbelebung des klass. Altertums* (2 vols., 3rd ed., 1893); his *Epistolae* were published by Cannato (Florence, 1759) with a life by Mehus; Bollandist *Bibl. hag. lat.* (1898), 63; A. Masius, *Über die Stellung des Kamaldulensers Ambrogio Traversari zum Papst Eugen IV. und zum Basler Konzil* (Döbeln, 1888); Savigny, *Geschichte röm. Rechts, Mittel.* (1850), vi. 422-424.

AMBROSIA, in ancient mythology, sometimes the food, sometimes the drink of the gods. The word has generally been derived from Gr. ἀ-, not, and *μβρότος*, mortal; hence the food or drink of the immortals. A. W. Verrall, however, denies that there is any clear example in which the word *ἀμβρόσιος* necessarily means "immortal," and prefers to explain it as "fragrant," a sense which is always suitable; cf. W. Leaf, *Iliad* (2nd ed.), on the phrase *ἀμβρόσιος ὕπνος* (ii. 18). If so, the word may be derived from the Semitic *ambar* (ambergris) to which Eastern nations attribute miraculous properties. W. H. Roscher thinks that both nectar and ambrosia were kinds of honey, in which case their power of conferring immortality would be due to the supposed healing and cleansing power of honey (see further Nectar). Derivatively the word *Ambrosia* (neut. plur.) was given to certain festivals in honour of Dionysus, probably because of the predominance of feasting in connexion with them.

The name *Ambrosia* was also applied by Dioscorides and Pliny to certain herbs, and has been retained in modern botany for a genus of plants from which it has been extended to the group of dicotyledons called *Ambrosiaceae*, including *Ambrosia*, *Xanthium* and *Iva*, all annual herbaceous plants represented in America. *Ambrosia maritima* and some other species occur also in the Mediterranean region.

There is also an American beetle, the Ambrosia beetle, belonging to the family of Scolytidae, which derives its name from its curious cultivation of a succulent fungus, called ambrosia. Ambrosia beetles bore deep though minute galleries into trees and timber, and the wood-dust provides a bed for the growth of the fungus, on which the insects and larvae feed.

AMBROSIANS, the name given to several religious brotherhoods which at various times since the 14th century have sprung up in and around Milan; they have about as much connexion with St Ambrose as the "Jeromites" who were found chiefly in upper Italy and Spain have with their patron saint. Only the oldest of them, the *Fratres S. Ambrosii ad Nemus*, had anything more than a very local significance. This order is known from a bull of Gregory XI. addressed to the monks of the church of St Ambrose outside Milan. These monks, it would appear, though under the authority of a prior, had no rule. In response to the request of the archbishop, the pope had commanded them to follow the rule of Augustine and to be known by the above name. They were further to recite the Ambrosian office. Subsequently the order had a number of independent establishments in Italy which were united into one congregation by Eugenius IV., their headquarters being at Milan. Their discipline afterwards became so slack that an appeal was made to Cardinal Borromeo asking him to reform their houses. By Sixtus V. the order was amalgamated with the congregation of St Barnabas, but Innocent X. dissolved it in 1650.

The name Ambrosians is also given to a 16th-century Anabaptist sect, which laid claim to immediate communication with God through the Holy Ghost. Basing their theology upon the words of the Gospel of St John i. 9—"There was the true light which lighteth every man, coming into the world"—they denied the necessity of any priests or ministers to interpret the Bible. Their leader Ambrose went so far as to hold further that the revelation which was vouchsafed to him was a higher authority than the Scriptures. The doctrine of the Ambrosians, who belonged probably to that section of the Anabaptists known as *Pneumatici*, may be compared with the "Inner Light" doctrine of the Quakers.

See Herzog-Hauck's *Realencyklopädie*, i. 439.

AMBROSIASTER. A commentary on St Paul's epistles, "brief in words but weighty in matter," and valuable for the criticism of the Latin text of the New Testament, was long attributed to St Ambrose. Erasmus in 1527 threw doubt on the accuracy of this ascription, and the author is usually spoken of as Ambrosiaster or pseudo-Ambrose. Owing to the fact that Augustine cites part of the commentary on Romans as by "Sanctus Hilarius" it has been ascribed by various critics at different times to almost every known Hilary. Dom G. Morin (*Rev. d'hist. et de litt. religieuses*, tom. iv. 97 f.) broke new ground by suggesting in 1899 that the writer was Isaac, a converted Jew, writer of a tract on the Trinity and Incarnation, who was exiled to Spain in 378–380 and then relapsed to Judaism, but he afterwards abandoned this theory of the authorship in favour of Decimus Hilarianus Hilarius, proconsul of Africa in 377. With this attribution Professor Alex. Souter, in his *Study of Ambrosiaster* (Cambridge Univ. Press, 1905), agrees. There is scarcely anything to be said for the possibility of Ambrose having written the book before he became a bishop, and added to it in later years, incorporating remarks of Hilary of Poitiers on Romans. The best presentation of the case for Ambrose is by P. A. Ballerini in his complete edition of that father's works.

In the book cited above Professor Souter also discusses the authorship of the *Quaestiones Veteris et Novi Testamenti*, which the MSS. ascribe to Augustine. He concludes, on very thorough philological and other grounds, that this is with one possible slight exception the work of the same "Ambrosiaster." The same conclusion had been arrived at previously by Dom Morin.

AMBROSINI, BARTOLOMEO (1588–1657), Italian naturalist, was born and died at Bologna. He was a pupil of Aldrovandi, several of whose works he published, and whom he succeeded eventually as director of the university botanical garden. He studied at the university, and became successively professor of philosophy, of botany and of medicine; and during the plague of 1630 in Bologna he worked assiduously for the relief of the sufferers. He was the author of several medical works of some importance in their day.

His brother, GIACINTO AMBROSINI (1605–1672), was a distinguished botanist, who succeeded Bartolomeo as professor of botany and director of the university garden in 1657. He published a catalogue of its plants and also a botanical dictionary.

AMBROSIUS AURELIANUS, leader of the Britons against the Saxons in the 5th century, was, according to the legends preserved in Gildas and the *Historia Brittonum*, of Roman extraction. There are signs of the existence of two parties in the national opposition to the invaders, but as Pascent, son of Vortigern, is said by Nennius to have held his dominions in the west by leave of Ambrosius, the Roman element seems to have triumphed. Some measure of success appears to have attended the efforts of Ambrosius, and it has been suggested that Amesbury in Wiltshire is connected with Emrys, the Celtic form of his name.

See Bede, *Eccl. Hist.* (Plummer), i. 16; Nennius, *Hist. Britt.* § 31; Gildas, *De excidio Brittarum*, § 25; J. Rhys, *Celtic Britain* (1884), pp. 104, 105, 107.

AMBULANCE (from the Fr. *ambulance*, formerly *hôpital ambulant*, derived from the Lat. *ambulare*, to move about), a term generally applied in England and America to the wagon or other vehicle in which the wounded in battle, or those who have sustained injuries in civil life, are conveyed to hospital. More strictly, in military parlance, the term imports a hospital establishment moving with an army in the field, to provide for the collection, treatment and care of the wounded on the battlefield, and of the sick, until they can be removed to hospitals of a more stationary character. In 1905–1906 the term "field ambulance" was adopted in the British service to denote this organization, the former division of the ambulance service into "bearer companies" and "field hospitals" being done away with. The description of the British service given below applies generally to the system in vogue in the army after the experience gained in the South African War of 1899–1902; but in recent years the medical arrangements in connexion with the British army hospitals have been altered in various details, and the changes in progress showed no sign of absolute finality. Some of these, however, were rather of nomenclature than of substance, and hardly affect the principles as described below.

History.

The ambulance organization which, variously modified in details, now prevails in all civilized armies, only dates from the last decade of the 18th century. Before that time wounded soldiers were either carried to the rear by comrades or left unattended to and exposed until the fighting was over. Surgical assistance did not reach the battlefield till the day after the engagement, or even later; and for many of the wounded it was then too late. In 1792 Baron Dominique Jean Larrey (1766–1842) of the French army introduced his system of *ambulances volantes*, or flying field hospitals, capable of moving with speed from place to place, like the "flying artillery" of that time. They were adapted both for giving the necessary primary surgical treatment and for removing the wounded quickly from the sphere of fighting. Napoleon warmly supported Larrey in his efforts in this direction, and the system was soon brought to a high state of efficiency in the *Grande Armée*. About the same time another distinguished surgeon in the French army, Baron Pierre François Percy (1754–1825), organized a corps of *brancardiers*, or stretcher-bearers. These were soldiers trained and equipped for the duty of collecting the wounded while a battle was in progress, and carrying them to a place of safety, where their wounds and injuries could be attended to. An important step towards the amelioration of the condition of the wounded of armies in the field was the European Convention signed at Geneva in 1864, by the terms of which, subject to certain regulations, not only the wounded themselves but also the official staff of ambulances and their equipment were rendered neutral, the former, therefore, not being liable to be retained as prisoners of war, nor the latter to be taken as prize of war. This convention has greatly favoured the development of ambulance establishments, but as all combatants have not the same knowledge of the conditions of this convention, or do not interpret them in the same way, charges of treachery and abuse of the Red Cross flag are but too common in modern warfare.

Geneva Convention.

The American Civil War marked the beginning of the modern ambulance system. The main feature, however, of the hospital organization throughout that war was the railway hospital service, which provided for the rapid conveyance of the sick and wounded to the rear of the contending armies. Hospital carriages, equipped with medical stores and appliances, for the transport of cases from the front to the base, were rapidly introduced into other armies, and played a great part in the ambulance service of the Franco-German War.

German system.

The German hospital service as existing at the time of the Franco-German War of 1870–71 was modified and extended by the *Kriegs Sanitäts Ordnung* of 1878 and the *Kriegs Etappen Ordnung* of 1887, which completed the organization by the addition in time of war of numerous subordinate offices and departments. The main divisions of the ambulance organization of the German army in the field fall into: (1) sanitary detachments, (2) field hospitals, (3) flying hospitals, (4) hospital reserve depots, (5) "committees for the transport of the sick," and (6) railway hospital trains. The whole administration of the ambulance service of the grand army in the field is in the hands of the chief of the ambulance sanitary staff, who is attached to headquarters. Next in command come surgeons-general of armies in the field, surgeons-general of army corps, and under them again surgeons-in-chief of divisions and regiments. Civil consulting surgeons of eminence, and professors from the universities, are also attached to the various armies and divisions to co-operate with and act as advisers to the surgeons of the standing military surgical staff. The hospital transport service on the lines of communication is highly organized and the hospital railway carriages are elaborately equipped. The French ambulance system, finally settled by the *règlement* of 1884, is organized on almost identical lines with the German; one of the principal peculiarities of the former being the *ambulances volantes* already referred to. The peace

French system.

organization of the German and French systems does not materially differ from that of the British service.

Japanese system.

In the Japanese army a special feature is the sanitary corps, whose duty is the prevention of disease among the troops; it has been brought to a great pitch of perfection, with the result that in the Russo-Japanese War (1904–1905) the immunity of the troops from all forms of preventable disease surpassed all previous experience. Not only was the army accompanied by sanitary experts who advised on all questions of camping grounds, water supply, &c., but before the war began the Intelligence Department collected information as to the diseases of the country likely to be the scene of operations, unhealthy places to be avoided, and precautions to be taken.

British army system.

Coming now to the ambulance system of the British army, in which are comprised the arrangements and organization of the medical department for the care and treatment of the sick and wounded from the time they are injured or taken ill, till they are able to return to duty or are invalided home, we will trace the progress of a wounded man from the field of battle to his home; remembering that, as British troops are usually engaged overseas, hospital ships as well as land transport are necessary.

First field dressing.

Collecting station.

Regimental arrangements.

When a soldier falls wounded in action he is attended by the regimental surgeon and stretcher-bearers, who apply some extemporized method of stopping bleeding and dress the wounds with the "first field dressing"—a packet of antiseptic material which every officer and man on active service carries stitched to some part of his clothing, and which contains everything necessary for dressing an ordinary gunshot wound. Recent wars have demonstrated that in all uncomplicated cases it is better to leave this dressing undisturbed, as the wounds made by modern projectiles heal up at once if left alone, if air and dirt have been thus excluded. From the field he is carried on a stretcher by bearers (formerly of the "Bearer Companies") of the Royal Army Medical Corps to the collecting station, where he is placed on an ambulance wagon of the first line of assistance and taken to the dressing station. Here his wound will be examined if considered necessary, but as on the field the first medical officer who examined him has already attached a "specification tally" to the patient, giving particulars of the wound, it will probably not be disturbed unless complicated by bleeding, splintering of bone or some other condition requiring interference. Any operation, however, which is urgently called for will be here performed, nourishment, stimulants and opiates administered if required, and the patient moved to the field hospital in an ambulance wagon of the second line of assistance. From the field hospital he is transferred as soon as possible by the ambulance train to the general hospital at the advanced base of operations, and from there in due time in another train to the base of operations at the coast, from which he is ultimately either returned to duty or sent home in a hospital ship. The organization by which these requirements are fulfilled is the following:—Every regiment and fighting unit has posted to it, on proceeding on active service, a medical officer who looks after the health of the men and advises the commanding officer on sanitary matters. When the regiment goes into action he takes command of the regimental stretcher-bearers who, to the number of two per company, have been in peace time instructed in first aid and in the carrying of the wounded on stretchers. These men leave their arms behind and wear the Red Cross armlets, to indicate their non-combatant functions, but in these days, when a battle is often fought at long ranges, it is not to be wondered at, or attributed to disregard of the red cross flag by the enemy, if medical officers and stretcher-bearers are hit. The bearer company into whose charge the wounded man next passes is composed of men of the Royal Army Medical Corps, with a detachment of the Army Service Corps for transport duties. In future, bearer sections of the Field Ambulances will perform the duties of the bearer company. Its function is to collect and succour the wounded on the battlefield and to hand them over to the field hospitals, with which these bearer companies are closely associated, though separately organized. In the Indian army the bearer company is provided from the *personnel* of the field hospital when there is a battle, and reverts to the hospital again after it is over. The war in South Africa of 1899–1902 clearly demonstrated the superiority of the Indian plan; for after the action the bearer company staff should be available to give the much-needed help in the field hospital, and some amalgamation of the two organizations, or something after the plan of the *ambulance volante* of the French, is necessary. The bearers afford the wounded any treatment required, supply water and sedatives, and then carry them back on stretchers to the collecting station in the rear, whence they are conveyed to the dressing station in the wagons or other form of transport.

Indian bearers.

At the dressing station, which ought to be out of range of the firing, and should have a good water supply, the patient is made as comfortable as possible, nourishment and stimulants are administered, and he is then taken to the field hospital. In times of great stress, when it is desirable to remove the wounded quickly from the field, and there are no roads or wheeled transport is not available, large numbers of bearers are employed to carry them on stretchers, &c. These men are engaged locally and are soon given the slight training necessary. This was done in Natal after the battles on the Tugela (1899), in which there were some thousands of wounded to be conveyed; also in Egypt, where the local troops not required for the fighting line were requisitioned; the Japanese in Mongolia employed hundreds of Chinese coolies for this purpose, the general use of sedan-chairs in China having accustomed the poorer class of natives to this kind of labour. In India, the rank and file of the Royal Army Medical Corps not being employed, the bearer work is carried out by natives specially enlisted and organized into a corps. These men are bearers by caste—a reminiscence of the system which prevailed generally a hundred years ago, and is still met with in out-of-the-way places, of conveyance of travellers in dhoolies, which are closed wooden carriages fixed on long poles and carried on men's shoulders. The bearers convey the wounded in dandies, similar to dhoolies, but made mostly of canvas, so that they are much lighter. The courage of these bearers on the battlefield has often been praised. The old bearer caste is, however, rapidly dying out owing to the general discontinuance of the use of dhoolies. Thus the ambulance organization in India is entirely different from that in other parts of the British empire. The rank and file of the Royal Army Medical Corps are not employed there, although the medical officers are. The warrant and non-commissioned ranks are replaced by a most useful body of men of Anglo-Indian or Eurasian (half caste) birth, called the Subordinate Medical Department, the members of which, now called assistant surgeons (formerly apothecaries), receive a three years' training in medical work at the Indian medical schools and are competent to perform the compounding of medicines and to deal with all but the most serious cases of injury and illness. In the hospitals the men of the Royal Army Medical Corps are replaced by the Native Army Hospital Corps, subdivided into ward-servants, cooks, water-carriers, sweepers and washermen. The caste system necessitates this division of labour, and the men are not so efficient or trustworthy as the white soldiers whose places they take. The bearers of the wounded are a separate and distinct class, partly attached to regiments, &c., as part of the regimental transport, and partly organized into bearer companies, attached to field hospitals. The dandies in which they carry the wounded are much more comfortable than stretchers, being fitted with roofs and sides of canvas to keep off sun and rain, thus being collapsible so that the dandy is quite flat when not in use. Still they are heavy, clumsy, and cannot be folded up into a small compass for transport like a stretcher; they also take up a good deal of room in wagons and can scarcely be carried on the backs of animals owing to the length of the pole. Hence riding ponies and mules are much used in Indian warfare, especially in the mountains, for the carriage of less seriously wounded men. In India separate hospitals are necessary for white and native troops, and the latter have accommodation for the large numbers of non-combatant camp-followers, mule-drivers, cooks, officers' servants, &c., &c., which constitute one of the most remarkable features of the Indian army organization.

Field hospitals.

Hospitals on the lines of communication.

Field hospitals, under the new scheme furnished by tent sections of the Field Ambulances, are each supposed to provide accommodation for 100 patients, who live on their field rations suitably cooked and supplemented by various medical comforts. The patients are not supplied with hospital clothing, nor do they have beds, but lie on straw, which is spread on the ground and covered with waterproof sheets and blankets; of these latter a considerable reserve is carried. These hospitals can and must at times accommodate more than the regulation number of patients, but in the South African War their resources were at times considerably overtaxed, with consequent discomfort and hardship to the patients, the medical equipment proving insufficient for unexpectedly heavy calls upon its resources. These hospitals are supposed to move with the army, and therefore it is imperative to pass the wounded quickly back from these to the stationary hospitals on the lines of communication (which vary according to the length of these lines) and thence to the general hospitals at the base. The size of the lines of communication hospitals varies according to circumstances, and they are as a rule "dieted," that is to say, proper hospital diets and not field rations are issued to the patients, who also are supplied with beds and proper hospital clothing. In these hospitals also there may be nursing sisters, who of course are unsuited for the rough work and life nearer the front. Sisters are also employed on the hospital trains, which were found most useful and brought to great perfection in the South African War, being fitted with beds, kitchens, dispensaries, &c., so that patients were moved long distances in comfort.

General hospitals.

Civil general hospitals.

Arrived at the base of operations the wounded are admitted to the general hospitals, of which the numbers and situation vary with circumstances, but each is supposed to have an officers' ward. In the South African War, owing to the inability of the comparatively small Royal Army Medical Corps to meet all the requirements of the enormous force which was ultimately employed, many of the doctors were drawn from the civil profession, and the rank and file from the St John's Ambulance Association and the Volunteer Medical Staff Corps, while many nursing sisters belonged to the Army Nursing Reserve, ordinarily employed in civil hospitals but liable to be drafted out during war. In the South African War the patriotism and liberality of the British public furnished several large general hospitals, perfectly equipped, and officered by some of the most eminent members of the medical profession in the United Kingdom. Among others may be mentioned the Princess Christian, the Imperial Yeomanry (both field and general hospitals), the Langman, the Portland, the Scottish, Irish and Welsh hospitals. These were staffed entirely by civilians, except that an officer of the Royal Army Medical Corps was attached to each as administrator and organizer; and their *personnel* was made up of physicians, surgeons, nurses, dressers (medical students and in some cases fully qualified surgeons) and servants; the numbers, of course, varying with the size of the hospitals. In addition to the staff of these hospitals several eminent civil surgeons, including Sir William MacCormac and Sir F. Treves, went out to the seat of war as consultants: an innovation in the British service, but in accordance with the system long in vogue in Germany.

To the Army Medical organization is affiliated in war time that of the Red Cross Society and other charitable associations, which during the South African War aided the Army Medical Service greatly by gifts of clothing, money and numerous luxuries for the sick and wounded.

Hospital ships.

Lastly, the wounded man is transferred to a hospital ship, which is fitted up with comfortable swinging cots in airy wards, with refrigerators for preserving provisions and the supply of ice, punkahs for hot weather, &c. Each division of an army corps is supposed to have one such ship, with from 200 to 250 beds and the same staff of doctors, nurses, &c., as a hospital of similar size on shore, when necessary.

Red Cross societies.

Different regulations are made by various powers as to the work of the Red Cross societies under the Geneva flag. Whereas in Germany and France such aid is officially recognized and placed under direct military control, the English Red Cross societies have acted side by side with, but independently of, the military ambulance organization. In the South African War (1899–1902), however, the bonds of union were drawn considerably closer, and cordial co-operation was brought about to prevent overlapping and waste of money. In Germany the volunteer organization is presided over by an imperial commission or inspector-general appointed in peace time, who in time of war is attached to the headquarters staff. His functions are to control the relations of the various Red Cross societies and secure harmonious co-operation. Delegates appointed by him are attached to the various corps and transport commissions. No volunteer assistance can be utilized which is not entirely subordinate to the military control, and has not already in peace time received official recognition and been organized on a skeleton footing. Moreover, only persons of German nationality can be employed under it with the armies in the field. In case of base hospitals situated in Germany itself, the services of foreigners may be employed when specially authorized by the war office. In France, in the main, the same rules obtain in the case of volunteer hospital service.

St John's Ambulance Association.

Great attention has been paid to civil ambulance organization in England. In 1878 the British ambulance association of St John of Jerusalem was founded. Its object was to render first aid to persons injured in accidents on the road, railway, or in any of the occupations of civil life. As the result of the initiative taken by this society, ambulance corps have been formed in most large towns of the United Kingdom; and police, railway servants and workmen have been instructed how to render first aid pending the arrival of a doctor. This samaritan work has been further developed and extended to most parts of the British empire, notably Canada, Australia and India, and there is no doubt that many lives are saved annually by the knowledge, diffused by this association, as to how to stop bleeding, resuscitate the apparently drowned, &c. Moreover, during the South African War this association provided a most valuable reserve for the Royal Army Medical Corps, and drafted out some hundreds of partially trained men whose assistance was most valuable to the Army Medical Service in dealing with the enormous numbers of sick and wounded who came upon their hands.

Civil ambulance in America.

In America each city has its own system and organization of civil ambulance service. In some, as in Boston, the service is worked by the police; in others, notably New York, by the hospitals, while Chicago has an admirable service under municipal control. In most of the capitals of Europe similar systems prevail.

Ambulance wagons.

British ambulance wagons are built very strongly to stand rough roads, and are of several patterns; those used in the war in South Africa were reported on as heavy, uncomfortable, and so unwieldy as to be incapable very often of keeping up with the troops; but a new and more mobile vehicle, to convey four patients lying down as well as six seated, or fourteen all seated (whereas the old pattern wagons only accommodated two lying-down cases), has been introduced. All patterns of wagons weigh from 17½ to 18½ cwt., while the Boers and the British Colonial auxiliaries used much lighter carts, which were taken at a gallop over almost any country. The Indian ambulances are small two-wheeled carts, called *tongas*, drawn by two bullocks or mules; very strongly made, they are capable of holding two men lying down, or four sitting up, besides the native driver.

Various other forms of transport are found, such as mule litters in mountainous districts, where wheeled carriages cannot go, camel litters in the Sudan, dhoolies in India, hammocks on the west coast of Africa, or sedan-chairs in China. In the Russo-Japanese War an ingenious form of mule litter for serious cases was made by fixing the ends of two long springy poles about 15 ft. long into each side of the pack saddles of two mules, one in front of the other, so as to support a bed for the patient between them; the length and resiliency of the poles prevented jolting of the wounded man, and the mules were able to carry him long distances over any kind of ground. The ordinary mule or camel litter provides for a wounded man (lying down) being carried on a sort of stretcher on either side of the animal, or in cacolets in which the less serious cases are slung in seats (one on each side of the animal), sitting up.

Mobilization.

In Great Britain, the material and equipment required are stored in times of peace at the various headquarters stations and carefully examined twice a year; and on orders for mobilization being issued, the doctors and various ranks of attendants, who have previously been told off to each unit, repair to the allotted station, draw the equipment and transport, and embark with the brigade to which they are attached. The tendency of the present day is towards reduction in bulk and concentration of strength of drugs, points which simplify the question of transport of ambulance material. As the fighting man can carry concentrated nourishment enough for thirty-six hours, in the form of an emergency ration, in a tin the size of an ordinary cigar-case, and enough sweetening material in the form of saccharine to last a fortnight in a bottle smaller than an ordinary watch, so the medical department can take their drugs in the form of compressed tabloids, each the correct dose, and each occupying about one-tenth of the space the drug ordinarily would; while the medical officers can carry hypodermic cases, not so large as an ordinary cigarette-case, containing a syringe and hundreds of doses of highly concentrated remedies. Again, the traction engines which now accompany an army can also supply electricity for X-ray work, electric-lighting, ice-making, &c. (J. R. D.)

AMBULATORY (Med. Lat. *ambulatorium*, a place for walking, from *ambulare*, to walk), the covered passage round a cloister; a term applied sometimes to the procession way round the east end of a cathedral or large church and behind the high altar.

AMBUSH (older form, "embush," O. Fr. *embusche*, from the Ital. *imboscata*, *in* and *bosco*, a wood), the hiding of troops, primarily in a wood, and so any concealment for the purpose of a sudden attack.

AMEDEO FERDINANDO MARIA DI SAVOIA, duke of Aosta (1845–1890), third son of Victor Emmanuel II., king of Italy, and of Adelaide, archduchess of Austria, was born at Turin on the 30th of May 1845. Entering the army as captain in 1859 he fought through the campaign of 1866 with the rank of major-general, leading his brigade into action at Custozza and being wounded at Monte Torre. In May 1867 he married the princess Maria Carlotta del Pozzo della Cisterna. In 1868 he was created vice-admiral of the Italian navy, but, two years later, left Italy to ascend the Spanish throne, his reluctance to accept the invitation of the Cortes having been overridden by the Italian cabinet. On the 16th of November 1870 he was proclaimed king of Spain by the Cortes; but, before he could arrive at Madrid, Marshal Prim, chief promoter of his candidature, was assassinated. Undeterred by rumours of a plot against his own life, Amedeo entered Madrid alone, riding at some distance from his suite to the church where Marshal Prim's body lay in state. His efforts as constitutional king were paralysed by the rivalry between the various Spanish factions, but with the approval of his father he rejected all idea of a *coup d'état*. Though warned of a plot against his life (August 18, 1872) he refused to take precautions, and, while returning from Buen Retiro to Madrid in company with the queen, was repeatedly shot at in Via Avenal. The royal carriage was struck by several revolver and rifle bullets, the horses wounded, but its occupants escaped unhurt. A period of calm followed the outrage. On the 11th of February 1873, however, Amedeo, abandoned by his partisans and attacked more fiercely than ever by his opponents, signed his abdication. Upon returning to Italy he was cordially welcomed and reinstated in his former position. His consort, whose health had been undermined by anxiety in Spain, died on the 3rd of November 1876. Not until the 11th of September 1888 did Amedeo contract his second marriage, with his niece Princess Letitia Bonaparte. Less than two years later (January 18,1890) he died at Turin in the arms of his elder brother, King Humbert I., leaving four children—the duke of Aosta, the count of Turin, the duke of the Abruzzi (issue of his first marriage), and the count of Salemi. (H. W. S.)

AMÉLIE-LES-BAINS, a watering-place of south-western France, in the department of Pyrénées-Orientales, at the junction of the Mondony with the Tech, 28½ m. S.S.W. of Perpignan by rail. Pop. (1906) 1247. It has numerous sulphur springs (68°–145° F.) used as baths by sufferers from rheumatism and maladies of the lungs. The town is situated at a height of 770 ft. and has both a winter and summer season. There are two bathing establishments, one of which preserves remains of Roman baths, and a large military thermal hospital. The town, formerly called Arles-les-Bains, is named after Queen Amelia, wife of Louis Philippe.

AMELOT DE LA HOUSSAYE, ABRAHAM NICOLAS (1634–1706), French historian and publicist, was born at Orleans in February 1634, and died at Paris on the 8th of December 1706. Little is known of his personal history beyond the fact that he was secretary to an embassy from the French court to the republic of Venice. In his *Histoire du gouvernement de Venise* he undertook to explain, and above all to criticize, the administration of that republic, and to expose the causes of its decadence. The work was printed by the king's printer and dedicated to Louvois, which points to the probability that the government did not disapprove of it. It appeared in March 1676, and provoked a warm protest from the Venetian ambassador, Giustiniani. The author was sent to the Bastille, where he remained, however, only six weeks (*Archives de la Bastille*, vol. viii. pp. 93 and 94). A second edition with a supplement, published immediately after, drew forth fresh protestations, and the edition was suppressed. This persecution gave the book an extraordinary vogue, and it passed through twenty-two editions in three years, besides being translated into several languages; there is an English translation by Lord Falconbridge, son-in-law of Oliver Cromwell. Amelot next published in 1683 a translation of Fra Paolo Sarpi's *History of the Council of Trent*. This work, and especially certain notes added by the translator, gave great offence to the advocates of unlimited papal authority, and three separate memorials were presented asking for its repression. Under the pseudonym of La Motte Josseval, Amelot subsequently published a *Discours politique sur Tacite*, in which he analysed the character of Tiberius.

AMEN, a Hebrew word, of which the root meaning is "stability," generally adopted in Christian worship as a concluding formula for prayers and hymns. Three distinct biblical usages may be noted. (*a*) Initial Amen, referring back to words of another speaker, *e.g.* 1 Kings i. 36; Rev. xxii. 20. (*b*) Detached Amen, the complementary sentence being suppressed, *e.g.* Neh. v. 13; Rev. v. 14 (cf. 1 Cor. xiv. 16). (*c*) Final Amen, with no change of speaker, as in the subscription to the first three divisions of the Psalter and in the frequent doxologies of the New Testament Epistles. The uses of amen ("verily") in the Gospels form a peculiar class; they are initial, but often lack any backward reference. Jesus used the word to affirm his own utterances, not those of another person, and this usage was adopted by the church. The liturgical use of the word in apostolic times is attested by the passage from 1 Cor. cited above, and Justin Martyr (*c.* A.D. 150) describes the congregation as responding "amen" to the benediction after the celebration of the Eucharist. Its introduction into the baptismal formula (in the Greek Church it is pronounced after the name of each person of the Trinity) is probably later. Among certain Gnostic sects Amen became the name of an angel, and in post-biblical Jewish works exaggerated statements are multiplied as to the right method and the bliss of pronouncing it. It is still used in the service of the synagogue, and the Mahommedans not only add it after reciting the first *Sura* of the Koran, but also when writing letters, &c., and repeat it three times, often with the word *Qimtir*, as a kind of talisman.

AMENDMENT (through the O. Fr. *amender*, to correct, from Lat. *mendum*, a fault), an improvement, correction or alteration (nominally at least) for the better. The word is used either of moral character or, more especially, in connexion with "amending" a bill or motion in parliament or resolution at a meeting; and in law it signifies the correction of any defect or error in the record of a civil action or on a criminal indictment. All written constitutions also usually contain a clause providing for the method by which they may be amended. Another noun, in the plural form of "amends," is restricted in its meaning to that of the penalty paid for a fault or wrong committed. In its French form the *amende*, or *amende honorable*, once a public confession and apology when the offender passed to the seat of justice barefoot and bareheaded, now signifies in the English phrase a spontaneous and satisfactory rectification of an error.

AMENTIFERAE, or Amentaceae, a name which has been used to include in one class several natural orders of plants which bear their flowers in catkins (*amenta*). They are trees and shrubs chiefly of temperate climates, and include many common British trees. It comprised the following orders:—*Salicaceae*, willows and poplars; *Corylaceae*, hazel, hornbeam; *Betulaceae*, birch, alder; *Fagaceae*, oak, beech, chestnut; *Casuarinaceae*, *Casuarina* (beefwood); *Platanaceae*, plane; *Juglandaceae*, walnut; *Myricaceae*, bog myrtle. This class is not retained in the most modern systems of classification.

AMERCEMENT, or Amerciament (derived, through the Fr. *à merci*, from Lat. *merces*, pay), in English law, an arbitrary pecuniary penalty, inflicted in old days on an offender by the peers or equals of the party amerced. The word has in modern times become practically a poetical synonym for fine or deprivation. But an amercement differed from a fixed fine, prescribed by statute, by reason of its arbitrary nature; it represented a commutation of a sentence of forfeiture of goods, while a fine was originally a composition agreed upon between the judge and the prisoner to avoid imprisonment. The fixing or assessment of an amercement was termed an *affeerment*. In the lower courts the amercement was offered by a jury of the offender's neighbours (*affeerors*); in the superior courts by the coroner, except in the case of officers of the court, when the amount was affeered by the judges themselves. All judgments were entered on the court roll as "in mercy" (*sit in misericordia*), and the word *misericordia*, or some contracted form of it, was written on the margin. Articles twenty to twenty-two of Magna Carta regulated the assessment of amercements.

See Stephen, *History of Criminal Law*; Pollock and Maitland, *History of English Law*; W. S. McKechnie, *Magna Carta* (1905).

AMERIA (mod. *Amelia*), a city of Umbria, situated about 65 m. N. of Rome on the Via Amerina (which approached it from the S. starting from Falerii and passing through Castellum Amerinum, probably mod. Orte, where it crossed the Tiber). It has a fine position, 1332 ft. above sea-level, and still retains considerable remains of the city wall, built in polygonal masonry of carefully jointed blocks of limestone, some 12 ft. in total thickness, and showing traces of reconstruction at different periods. Various remains of the Roman period exist between the walls, including a large water reservoir divided into ten chambers. The lofty campanile of the cathedral was erected in 1050 with fragments of Roman buildings. Ameria is not mentioned in the history of the Roman conquest of Umbria, but is alluded to as a flourishing place, with a fertile territory extending to the Tiber, by Cicero in his speech in defence of Sextus Roscius Amerinus, and its fruit is often extolled by Roman writers. Augustus divided its lands among his veterans, but did not plant a colony here. The bishopric of Ameria was founded in the middle of the 4th century.

AMERICA. I. *Physical Geography.*—The accidental use of a single name, America, for the pair of continents that has a greater extension from north to south than any other continuous land area of the globe, has had some recent justification, since the small body of geological opinion has turned in favour of the theory of the tetrahedral deformation of the earth's crust as affording explanation of the grouping of continents and oceans. America, broadening in the north as if to span the oceans by reaching to its neighbours on the east and west, tapering between vast oceans far to the south where the nearest land is in the little-known Antarctic regions, roughly presents the triangular outline that is to be expected from tetrahedral warping; and although greatly broken in the middle, and standing with the northern and southern parts out of a meridian line, America is nevertheless the best witness among the continents of to-day to the tetrahedral theory. There seems to be, however, not a unity but a duality in its plan of construction, for the two parts, North and South America, resemble each other not only in outline but, roughly speaking, in geological evolution also; and the resemblances thus discovered are the more remarkable when it is considered how extremely small is the probability that among all the possible combinations of ancient mountain systems, modern mountain systems and plains, two continents out of five should present so many points of correspondence. Thus regarded, it becomes reasonable to suppose that North and South America have in a broad way been developed under a succession of somewhat similar strains in the earth's crust, and that they are, in so far, favourable witnesses to the theory that there is something individual in the plan of continental growth. The chief points of correspondence between these two great land masses, besides the southward tapering, are as follows:—(1) The areas of ancient fundamental rocks of the north-east (Laurentian highlands of North America, uplands of Guiana in South America), which have remained without significant deformation, although suffering various oscillations of level, since ancient geological times; (2) the highlands of the south-east (Appalachians and Brazilian highlands) with a north-east south-west crystalline axis near the ocean, followed by a belt of deformed and metamorphosed early Palaeozoic strata, and adjoined farther inland by a dissected plateau of nearly horizontal later Palaeozoic formations—all greatly denuded since the ancient deformation of the mountain axis, and seeming to owe their present altitude to broad uplifts of comparatively modern geological date; (3) the complex of younger mountains along the western side of the continents (Western highlands, or Cordilleras, of North America; Andean Cordilleras of South America) of geologically modern deformation and upheaval, with enclosed basins and abundant volcanic action, but each a system in itself, disconnected and not standing in alignment; (4) confluent lower lands between the highlands, giving river drainage to the north (Mackenzie, Orinoco), east (St Lawrence, Amazon), and south (Mississippi, La Plata). Differences of dimension and detail are numerous, but they do not suffice to mask what seems to be a resemblance in general plan. Indeed, some of the chief contrasts of the two continents arise not so much from geological unlikeness as from their unsymmetrical situation with respect to the equator, whereby the northern one lies mostly in the temperate zone, while the southern one lies mostly in the torrid zone. North America is bathed in frigid waters around its broad northern shores; its mountains bear huge glaciers in the north-west; the outlying area of Greenland in the north-east is shrouded with ice; and in geologically recent times a vast ice-sheet has spread over its north-eastern third; while warm waters bring corals to its southern shores. South America has warm waters and corals on the north-east, and cold waters and glaciers only on its narrowing southern end. If the symmetry that is so noticeable in geological history had extended to climate as well, many geographical features might now present likenesses instead of contrasts.

The relation of the Americas to each other and to the rest of the world, as the home of plants and animals, is greatly affected by the breadth of the adjacent oceans, and also by the geologically recent changes of altitude whereby the breadth of the narrower parts of the lands and the oceans has been significantly altered. Between the parallels of 60° and 70° N. the east and west widening of North America forms more than a third of the almost continuous land ring around a zone of sub-Arctic climate, through the middle of which runs the Arctic circle. As a result there is a remarkable community of resemblance of plant and animal life in the high northern latitudes of North America and Eurasia. In strong contrast with this relation of close fellowship is the exceptional isolation of far southern South America. Excepting the barren lands of the Antarctic regions, with which Patagonia is somewhat associated by a broken string of islands, the nearest continental lands of a more habitable kind are South Africa and New Zealand. In contrast to the sub-Arctic land ring, here is a sub-Antarctic ocean ring, and as a result the land flora and fauna of South America to-day are strongly unlike the life forms of the other south-ending continents.

For further treatment of the physical geography of the American continents, see NORTH AMERICA, SOUTH AMERICA.

(W. M. D.)

II. *General Historical Sketch.*— The name America was derived from that of Amerigo Vespucci (*q.v.*). In Waldseemüller's map of 1507 the name is given to a body of land roughly corresponding to the continent of South America. As discovery revealed the existence of another vast domain to the north, the name spread to the whole of the pair of continents by customary use, in spite of the protests of the Spaniards, by whom it was not officially used of North America till the 18th century.

The discovery of America is justly dated on the 12th (N.S. 21st) of October 1492, when Christopher Columbus (*q.v.*), the Genoese, made his landfall on the island of Guanahani, now identified with Watling Island in the Bahamas. In the 10th and 11th centuries Norse sea-rovers, starting from Iceland, had made small settlements in Greenland and had pushed as far as the coast of New England (or possibly Nova Scotia) in transient visits (see VINLAND and LEIF ERICSSON). But the Greenland colony was obscure, the country was believed to form part of Europe, and the records of the farther explorations were contained in sagas which were only rediscovered by modern scholarship. Throughout the middle ages, legendary tales of mythical lands lying in the western ocean—the Isle of St Brandan, of Brazil and Antilia—had been handed down. Scholars, guessing from isolated passages in classic writers, or arguing on general principles, had held that the "Indies" could be reached by sailing due west. But the venture was beyond the resources of the ships and the seamanship of the time. The opinions of scholars, and the fantasies of poets, became an enthusiastic belief in the mind of Columbus. After many disappointments he persuaded the Catholic sovereigns Ferdinand and Isabella of Spain to furnish him with a squadron of three small vessels. With it he sailed from Palos in Andalusia on the 3rd of August 1492, reached Guanahani on the 12th of October, touched on the coast of Cuba and Hispaniola, established a small post on the latter, and returned to Lisbon on the 4th of March 1493, and thence to Spain.

It was the belief of Columbus and his contemporaries that he had reached the islands described by Marco Polo as forming the eastern extremity of Asia. Hence he spoke of the "Indies," and "las Indias" continued to be the official name given to their American possessions by the Spaniards for many generations. His feat produced a diplomatic controversy with Portugal which was destined to have important political consequences. In 1454 Pope Nicholas V. had given the Portuguese the exclusive right of exploration and conquest on the road to the Indies. His bull contemplated only the use of the route by the coast of Africa to the south and east. In 1488 the Portuguese Bartholomeu Diaz had rounded the Cape of Good Hope. After the return of Columbus and his supposed demonstration that the Indies could be reached by sailing west, disputes might obviously arise between the two powers as to their respective "spheres of influence." The Catholic sovereigns applied to Pope Alexander VI., a Spaniard, for a confirmation of their rights. The pope drew a line from north to south one hundred leagues west of the Azores and Cape Verde Islands, and gave the Spaniards the claim to all to the west (May 4, 1493). The Portuguese thought the division unfair to them, and protested. A conference was held between the two powers at Tordesillas in 1494, and by common consent the line was shifted to three hundred and seventy leagues west of the Cape Verde Islands. The boundary line corresponded to the 50th[1] degree of longitude west of Greenwich, which strikes the mainland of South America about the mouth of the Amazon. Thenceforward the Spaniards claimed the right to exclude all other peoples from trade or settlement "beyond the line."

Between September 1493 and the time of his last voyage (May 1502 to November 1504), Columbus explored the West Indies, reached the mainland of South America at the mouth of the Orinoco and sailed along the coast of Central America from Cape Honduras to Nombre de Dios (near Colon). Henry VII. of England allowed the Bristol merchants to fit out a western voyage under the command of another Genoese, John Cabot (*q.v.*), in 1497. The history of the venture is very obscure, but Cabot is thought to have reached Newfoundland and the mainland. Between 1500 and 1503 a Portuguese family of the name of Cortereal carried out voyages of exploration on the eastern coast of North America, with the consent of their government, and with little regard for the treaty of Tordesillas. In 1500 the Portuguese Pedro Alvarez Cabral, while on his way to the East Indies, sighted the coast of Brazil at Monte Pascoal in the Aimores, and took formal possession. The belief that the eastern extremity of Asia had been reached died slowly, and the great object of exploration in America continued for some years to be the discovery of a passage through to the Spice Islands, in order to compete with the Portuguese, who had reached them by the Cape route. The first Spanish settlement in Hispaniola spread to the mainland by the adventure of Alonso de Ojeda and Diego de Nicuesa in Darien in 1509. Cuba was occupied by Diego de Velazquez in 1511. In 1512 (or 1513) Juan Ponce de Leon made the first recorded exploration of the coast of Florida and the Bahama Channel. In 1513, Vasco Nuñez de Balboa crossed the isthmus of Darien and saw the South Sea (Pacific). The hope that a passage through to the Spice Islands would be found near existing Spanish settlements was now given up. One was sought farther south, and in November 1520 Ferdinand Magellan (*q.v.*) passed through the strait which bears his name and sailed across the Pacific. At last the existence of a continent divided by a vast stretch of ocean from Asia, and mostly lying within the sphere of influence assigned to Spain by the pope, was revealed to the world.

The first aim of the Spaniards had been trade with the Indies. The *Casa de Contratacion*, a committee for the regulation of trade, was established at Seville in 1503. European plants and animals were introduced into Hispaniola and Cuba, and sugar plantations were set up. But the main object of the Spaniards, who could not labour in the tropics even if they had wished to do so, was always gold, to be won by slave labour. As the surface gold of the islands was exhausted, and the feeble island races perished before the invaders, the Spaniards were driven to go farther afield. In 1519 Pedrarias Davila transferred the Darien settlement to Panama. In that and the following year the coasts of Yucatan and of the Gulf of Mexico were explored successively by Francisco Hernandez Córdova and Juan de Grijalva, who both sailed from Cuba. From Cuba it was that Hernan Cortes (*q.v.*) sailed on the 10th (or 18th) of February 1519 for the conquest of Mexico. Hitherto the Spaniards had met only the weak islanders, or the more robust cannibal Caribs, both alike pure savages. In Mexico they found "pueblo" or town Indians who possessed an organized government and had made some progress in civilization. The hegemony of the Aztecs, who dominated the other tribes from the central valley of Mexico, was oppressive. Cortes, the most accomplished and statesmanlike of the Spanish conquerors, raised the subject peoples against them. His conquest was effected by 1521. His example stimulated the settlers at Panama, who had heard of a great people owning vast quantities of gold to the south of them. Between 1524 and 1535 Francisco Pizarro (*q.v.*) and Diego de Almagro had completed the conquest of Peru, which was followed, however, by a long period of strife among the Spaniards, and of rebellions. The country between Peru and Panama was subdued before 1537 by the conquest of Quito by Sebastian de Benalcazar and of New Granada by Jimenez de Quesada. From Peru the Spaniards advanced southwards to Chile, which was first unsuccessfully invaded (1535–37) by Diego de Almagro, and afterwards occupied (1540–53) by Pedro de Valdivia. Their advance to the south was checked by the indomitable opposition of the Araucanians, but from the southern Andes the Spaniards overflowed on to the great plains which now form the interior of the Argentine Republic. The first permanent settlement at the mouth of the river Plate at Buenos Aires dates from 1580. In its main lines the Spanish conquest was complete by 1550. What the Spaniards had then overrun from Mexico to Chile is still Spanish America. Brazil, after a period of exploration which began in 1510, was gradually settled by the Portuguese, though its bounds on the south remained a subject of dispute with the Spaniards till the 18th century.

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[1] The exact position has been disputed. According to John Fiske, the line would be between 41° and 44° long.

The vast territories acquired by Spain in this brief period were held to be, by virtue of the pope's bull, the peculiar property of the sovereign. When the wide and dangerous powers granted to Columbus by his patent were confiscated, Ferdinand first imposed Bishop Fonseca on him as a check. In 1509 the council of the Indies was established, but it did not take its final form till 1524. It consisted of a president, with a board of advisers, who possessed legislative and administrative powers, and who varied in number at different times. There was an appeal to it from all colonial governors and courts. The *Casa de Contratacion*, another board, regulated the trade. In America the crown was represented by governors. After the preliminary period of conquest the whole of the Spanish possessions were divided into the two "kingdoms" of New Spain,—consisting of Venezuela and the Spanish possessions north of the isthmus—and of New Castile, a title soon changed to Peru, which included the Central American isthmus and all of South America except Venezuela and Brazil. Each was ruled by a viceroy. As the Spanish dominions became more settled, the viceroyalty of Peru was found to be unwieldy. New Granada (which included the present republics of Venezuela, Colombia and Ecuador) was created a viceroyalty in 1718 (soon abolished, but re-created in 1740). A fourth viceroyalty for the river Plate was formed in 1778. Other governments known as captain-generalships were cut out of the viceroyalties at different periods—Guatemala in 1527, Venezuela in 1773, Cuba in 1777 and Chile in 1778. The captains-general corresponded directly with the council of the Indies, and were independent of the viceroys except in war time. The administrative powers of the viceroys were very great. They were, however, checked by the *audiencias*, or law courts, of which there were eleven from the reign of Philip IV.—Santo Domingo, Mexico, Panama, Lima, Guatemala, Guadalajara, Bogota, La Plata, Quito, Chile, Buenos Aires. They acted as councils to the governors, and had civil and criminal jurisdiction with an appeal to the council of the Indies at Seville. The towns had municipal franchises, exercised by a governing body comprised of Spaniards, either immigrants from Old Spain, or Creoles, *i.e.* descendants of Spanish settlers. The places were often sold, and were objects of ambition to the richer merchants. In practice the selling of a seat in the town councils, or *cabildos*, did not have the bad consequences which might have appeared inevitable. In the earlier stages of Spanish colonial history meetings of delegates (procurators) of the town councils, in imitation of the national cortes of Spain, were not uncommon. The kings of Spain had obtained from the popes Alexander VI. and Julius II. the right of levying the tithe, and of naming the holders of all ecclesiastical benefices. These immense concessions, made when the development of the Spanish settlements could not be foreseen, were regretted by later popes, but the crown adhered firmly to its regalities.

The government of Spain administered its dominions from the beginning in the strictest spirit of the "colonial system." The Indies were expected to supply precious metals and raw materials, and to take all manufactures from the mother country. In order to facilitate the regulation of the trade by the *Casa de Contratacion*, it was concentrated first in Seville, and when the Guadalquivir was found to be becoming too shallow for the growing tonnage of ships, at Cadiz. Merchant vessels were required for their protection to sail in convoy. The convoys or *flotas* sailed in October first to Cartagena in South America, and from thence to Nombre de Dios or, in later times, Porto Bello. The yearly fairs at these places received the imports from Europe and the colonial trade of the Pacific coast, first collected at Panama and then carried over the isthmus. From Nombre de Dios or Porto Bello the convoys went to La Vera Cruz for the trade of New Spain, and returned home in July by the Florida straits. One-fifth of the produce of the mines belonged to the crown. The collection of this bullion was at all times a main object with the Spanish government, and more especially so after the discovery of the great silver deposits of Potosi in Bolivia. Forced labour was required to work them and the natives were driven to the toil. The excesses of the earliest Spanish settlers have become a commonplace, largely through the passionate eloquence of Bartolomé de Las Casas (see Las Casas). The Spanish government made strenuous attempts to regulate forced labour by limiting the rights of the masters. An *encomienda* was required by anyone who wished to exact labour, *i.e.* the Indians of a district were given to him "*in commendam*" with the power to demand a *corvée* from them and a small yearly payment per head. The laws endeavoured to check abuses, but there can be no doubt that they were often defeated by the greed of the colonists—more especially in the viceroyalty of Peru, which was always less well governed than Mexico. But the bulk of the inhabitants of the Spanish possessions were of pure or mixed Indian blood, and many Indians were prosperous as traders, manufacturers, farmers and artisans.

The Portuguese settlement in Brazil was more purely colonial than the Spanish possessions. Until 1534 little was done to regulate the activity of private adventures. In that year the coast was divided into captaincies, which were united under a single governor-general in 1549. Between 1555 and 1567 the Portuguese had to contend with the French Huguenot invaders who seized Rio, and whom they expelled. Between 1572 and 1576 there were in Brazil the two governments of Rio de Janeiro and Bahia, but its history is of little importance till the occupation of Portugal by Philip II. drew the country into the wars of the Spanish monarchy.

The claim of the Peninsula powers to divide the American continent between them, based as it was on an award given in entire ignorance of the facts, would in no case have been respected. In the great upheaval of the Renaissance and the Reformation it was certain to be defied. As England was in general alliance with the sovereigns of Spain during the early 16th century, Englishmen turned their attention at first towards the discovery of a route to the Spice Islands round the north of Asia. But the rivalry of Francis I. and Charles V. gave France a strong motive for assailing the Spaniards in the New World now revealed to the ambition of Europe. King Francis encouraged the ill-recorded and disputed voyages of the Florentine Giovanni da Verrazano in 1524, and the undoubted explorations of Jacques Cartier. Between 1534 and 1542 this seaman, a native of St Malo, explored the Strait of Belle Isle and the Gulf of St Lawrence, and visited the Indian village of Hochelaga, now Montreal. The claims of France to the possession of a great part of the northern half of America were based on the voyages of Verrazano and Cartier. The death of King Francis, and the beginning of the wars of religion, suspended colonial enterprise under royal direction. But the Huguenots, under the inspiration of Coligny, made three attempts to found colonies to the south—at Rio de Janeiro in 1555–1567, near the present Beaufort, South Carolina, in 1562, and in Florida in 1565. These ventures were ruined partly by the hostility of the Spaniards and Portuguese, partly by the dissensions of the colonists. Meanwhile French corsairs from St Malo and Dieppe had been active in infesting the West Indies and the trade route followed by the Spanish convoys. After the accession of Queen Elizabeth, and the beginning of the breach between England and Spain, they were joined by English sea-rovers. The English claimed the right to trade with all Spanish possessions in or out of Europe by virtue of their treaty of trade and amity made in the reign of Charles V. The Spaniards disputed this interpretation of the treaty, and maintained that there was "no peace beyond the line," *i.e.* Pope Alexander's line as finally fixed by the conference at Tordesillas. The English retaliated by armed smuggling voyages.

It was, however, not till late that they attempted to found permanent settlements. In 1578 Sir Humphrey Gilbert obtained a patent for discovery and settlement. In 1583 he perished in an effort to establish a colony in Newfoundland. His work was taken up by his half-brother Sir Walter Raleigh in 1584. Between 1586 and 1603 Sir Walter made successive efforts to settle a colony in the wide territory called Virginia, in honour of Queen Elizabeth, a name of much wider significance then than in later days. His colony at Roanoke, in what is now the state of North Carolina, was unsuccessful, and after his fall his patent reverted to the crown, but the new Virginia Company carried on his schemes. In 1607 the first lasting settlement was made in Virginia, and after a period of struggle began to flourish by the cultivation of tobacco.

In 1620 another settlement was made. A small body of religious dissentients, one hundred and one men, women and children, including some who had fled to Holland to escape the discipline of the church of England, secured leave from the Virginia Company to plant themselves within its bounds. They sailed in a single ship, the "Mayflower," and landed near Cape Cod, where they founded the colony of Plymouth, afterwards (1621) obtaining a patent from the council for New England. From these two centres, and from later settlements, arose the "Plantations" of the English, which gradually increased to the number of thirteen and were destined to become the United States of America. Two strongly contrasted types were found among them. The Virginian or southern type, which may be said to have prevailed from Maryland southward, were for the most part planters producing tobacco, Indian corn, rice, indigo and cotton, largely by the labour of negro slaves. They had no very pronounced religious leaning, though Maryland was founded as a Roman Catholic refuge, but they had a prevailing leaning to the church of England. The northern or New England element began by endeavouring to establish a Puritan theocracy which broke down. But the tendency was towards "Independency," and the New Englanders were farmers tilling their own land, traders and seafaring men. In the middle region between them religion had a large share in promoting the formation of Pennsylvania, which was founded by the Quaker William Penn.

The English colonies, though divided by interest or character, were all alike jealous to defend, and eager to extend, their freedom of self-government, based on charters granted by, or extorted from, the crown. The settlers by degrees threw off the control of the proprietors who had received grants from the crown and had promoted the first settlements. It was a marked characteristic of the English colonists, and a strong element in their prosperity, that they were hospitable in welcoming men of other races,—Germans from the Palatinate, and French Huguenots driven out by persecution who brought with them some capital, more intelligence and an enduring hatred of Roman Catholic France. Though the British government gave, more or less unwillingly, a large measure of self-government to the Plantations, it was no less intent than the Spanish crown on retaining the whole colonial trade in British hands, and on excluding foreigners. Like the Spaniards it held that this trade should be confined to an exchange of colonial raw produce for home manufactures. Two foreign settlements within the English sphere—the Dutch colony of New Netherland, now New York, and the Swedish settlement on the Delaware—were absorbed by the growing English element.

While the English plantations were striking root along the coast, by somewhat prosaic but fruitful industry, and were growing in population with rapid strides, two other movements were in progress. To the south, the English, French and Dutch, though often in rivalry with one another, combined to break in on the monopoly of the Spaniards. They turned the maxim that "there is no peace beyond the line" against its inventors. They invaded the West Indies, seized one island after another, and formed the freebooting communities known as the Brethren of the Coast and the Buccaneers (*q.v.*). After the renewal of the war between Spain and Holland in 1621, the Dutch invaded the Portuguese colony of Brazil, and seized Bahia. A long period of struggle followed, but, after the declaration of Portuguese independence in 1640, local opposition, and the support given to the Portuguese by the French, led to the retreat of the Dutch.

To the north, to the west and to the south of the English settlements on the mainland, a most characteristic French colonial policy was being carried out. No sooner were the wars of religion over than the French again set about making good their claim to Canada, and to whatever they could represent as arising naturally out of Canada. In 1599, under the encouragement of Henry IV., speculators began to frequent the St Lawrence in pursuit of the fur trade. Their settlements were mainly trading posts. Their colonists were not farmers but trappers, woodrangers, *coureurs du bois*, who married Indian women, and formed a mixed race known as the *bois brulés*. Not a few of the leaders, notably Samuel de Champlain (*q.v.*), who founded Quebec in 1608, were brave ingenious men, but the population provided no basis for a lasting colony. It was adventurous, small, scattered and unstable. The religious impulse which was so strong both in the Spanish and the English colonies was prominent in the French, but in the most fatal form. Pious people were eager to bring about the conversion of the Indians, and were zealously served by missionaries. The Jesuits, whose first appearance in New France dates from 1611, were active and devoted. Their aim was to reduce the fierce Red men to a state of childlike docility to priests, and they discouraged all colonization in their neighbourhood. It was true that the most active French colonial element, the trappers, were barbarized by the natives, and that the pursuit of the fur trade and other causes had brought the French into sharp collision with the most formidable of the native races, the confederation known as the Five (or Six) Nations. During the reign of Louis XIV., after 1660, the French government paid great attention to Canada, but not in a way capable of leading to the formation of a colony. The king was as intent as the rulers of Spain had been to keep the American possessions free from all taint of heresy. Therefore he carried on the policy of excluding the Huguenots—the only colonizing element among his subjects,—and drove them into the English plantations. A small handful of obedient peasants, priest-ridden and over-administered, formed the basis of the colony. On this narrow foundation was raised a vast superstructure, ecclesiastical, administrative and military. His priests, and his officials civil and military, gave the French king many daring explorers. While the English colonies were slowly digging their way, taking firm hold of the soil, and growing in numbers, from the sea to the Alleghanies, French missionaries and explorers had ranged far and wide. In 1682 Robert Cavelier, sieur de la Salle, who had already explored the Ohio, sailed down the Mississippi and took possession of the region at the mouth by the name of Louisiana.

The problem which was to be settled by a century of strife was now posed. On the one hand were the English plantations, populated, cultivated, profitable, stretching along the east coast of North America; on the other were the Canadian settlements, poverty-stricken, empty, over-officialled, a cause of constant expense to the home government, and, at a vast distance, those of Louisiana, struggling and bankrupt. The French remedy for an unsuccessful colony has always been to annex more territory, and forestall a possible rival. Therefore the French government strove to unite the beggarly settlements in Canada and Louisiana by setting up posts all along the Ohio and the Mississippi, in order to confine the English between the Alleghanies and the sea.

The political history of North America till 1763 is mainly the story of the pressure of the English colonies on this paper barrier. As regards Spanish America, England was content to profit by the *Asiento* (*q.v.*) treaty, which gave her the monopoly of slave-hunting for the Spanish colonies and an opening for contraband trade. In the river Plate region, where the dissensions of Spaniards and Portuguese afforded another opening, English traders smuggled. The Spaniards, with monstrous fatuity, refused to make use of the superb waterways provided by the Paraná and Paraguay, and endeavoured to stifle all trade. England's main struggle was with France. It was prolonged by her entanglement in European disputes and by political causes, by the want of co-operation among the English colonies and their jealousy of control by the home government. The organization of the French colonies, though industrially ruinous, gave them

AMERICA

Illustrations representative of the primitive cultures of Central America, Mexico and Peru (*qq.v.*) selected and arranged by Dr Walter Lehmann of the Royal Ethnographical Museum, Norwich.

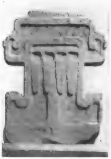


FIG. 1.—Stone Sculpture, from Teotihuacan, Mexico. Prae-Mexican culture (? Totonacan).

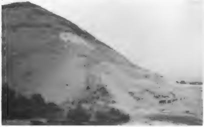


FIG. 2.—View of the Giant Pyramid of the Sun, Teotihuacan. Plateau region, Mexico. Prae-Mexican culture (? Totonacan).

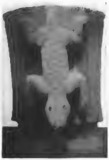


FIG. 3.—Alabaster Vessel, with carved lizard as handle. Teotihuacan, Mexico. Proto-Mexican culture.

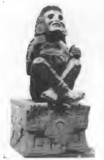


FIG. 5.—Carved Stone Figure of the god of sports and dancing (Xochipilli-Miacuilxochitl, "five flowers"), squatting on a stool, decorated with flowers and tonallo emblems. Plateau region, Mexico. Mexican culture.

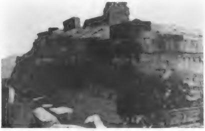


FIG. 6.—Sculptured Frieze of the Temple of Xochicalco. Plateau region, Mexico. Mexican culture with Mayan influence.

(*Figs. 2 and 6 from photos by Waite, Mexico.*)

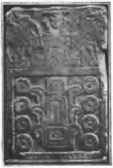


FIG. 7.—Stone Tablet in memory of the year *chicuei-acatl* ("8 reeds"), A.D. 1487, when the Great Temple in Mexico was consecrated; above are the figures of the Kings Tiçoc and Ahuitzotl, sacrificing, with the date of the beginning of the rebuilding, *chicome-acatl* ("7 reeds"), A.D. 1447. Mexico City. Mexican culture.

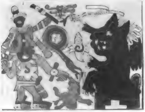


FIG. 8.—Leaf 3 of the *Tonalamatl*, or sacred cycle of 260 days, from the Aubin collection. Figures of the gods Quetzalcoatl and Tepeyollotli. Mexico. Mexican culture.

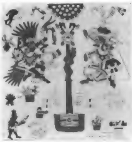


FIG. 9.—Leaf 10 of *Codex Borbonicus*, with figure of the god of the underworld (Mictlantecutli) as regent of the tenth of the 20 sections, each of 13 days of the *tonalamatl*, which begins with "one flint" (*ce tepcatl*). Mexico. Mexican culture.

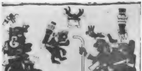


FIG. 10.—Leaf 54 of *Codex Borbonicus B.*, with figures of the ancient moon-god, the twelve months, and the rabbit as the animal moon-emblem. Mexico. Mexican culture.

(*Figs. 8-10 from the publications of the duke of Loubat.*)

PLATE II.

AMERICA

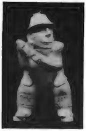


FIG. 1.—Male Clay Figure, holding weapon (?). From near Tzintzuntzan Michoacan, Mexico. (?) Tarascan culture.

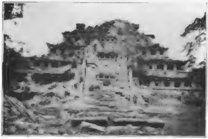


FIG. 2.—View of the Ruins of the Pyramid Temple of Papantla, near Vera Cruz, Mexico. Totonacan culture.

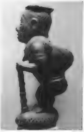


FIG. 3.—Hump-Backed Clay Figure, standing on a fish; a reed staff in one hand, and incised lines on face. From Tzintzuntzan. (?) Tarascan culture.

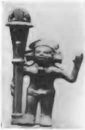


FIG. 4.—Human Figure, with a rattle-stick in the right hand. From near Alvarado, Vera Cruz, Mexico. Totonacan culture.

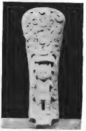


FIG. 5.—Stone Carving, deeply undercut, of the so-called Palma type. From Coatepec, Canton Falapa, Vera Cruz, Mexico. Totonacan culture.

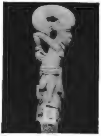


FIG. 6.—Similar Carving, with human figure. From Coatepec. Totonacan culture.

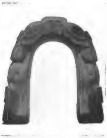


FIG. 7.—Stone Yoke, carved in the so-called frog-type. Vera Cruz, Mexico. Totonacan culture.

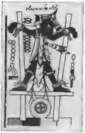


FIG. 8.—Crucified Figure, pierced with arrows, of the victim at the festival of the god Xipe (Mexican Tlacaxipenaliztli), with the symbols of the god. Culture of the Mayan transitional peoples of the Atlantic coast of the Gulf of Mexico. Totonacan culture.

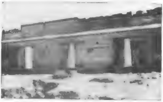


FIG. 9. — Temple Chambers, with stone pillars, from the ruins of Mitla, Oaxaca, with wall mosaic of joined stones. Zapotecan culture with proto-Mexican influence.

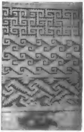


FIG. 10.—Wall Mosaic of joined Stone from the ruins of Mitla. Zapotecan culture with proto-Mexican influence.

Figs. 2, 9 and 10 are from photos by Waite, Mexico; Fig. 8, from the *Codex Nuttall*, publications of the Peabody Museum.

the command of more available military forces than were at the disposal of the English. Thus the fight dragged on, and was constantly maintained in Acadia, where the sovereignty had been early disputed, and the border never properly settled. At last, when under the leadership of the elder Pitt (see CHATHAM, EARL OF) England set to work resolutely to force a final settlement, the end came. The British navy cut off the French from all help from home, and after a gallant struggle, their dominion in Canada was conquered, and the French retired from the North American continent. They surrendered Louisiana to Spain, which had suffered much in an attempt to help them, and their possessions in America were reduced to their islands in the West Indies and French Guiana.

The fall of the French dominion on the continent of North America was practically the beginning of the existence of independent nations of European origin in the New World. The causes which led to the revolt of the Plantations, the political and military history of the War of Independence, are dealt with under the heading of UNITED STATES (*History*) and AMERICAN WAR OF INDEPENDENCE. The significance of these great events in the general history of America is that from 1783 onwards there was, in the New World, an autonomous community not wholly unified at once, nor without strife, but self-governing and self-subsisting, in entire separation from European control. Such a polity, surrounded as it was by territory dependent on European sovereigns, could not be without a profound influence on its neighbours. Of deliberate direct action there was not much, nor was it needed. The peoples of the thirteen states which had secured emancipation from British sovereignty were wisely intent on framing their own Federal Union, and in taking effective possession of the vast territories in the Ohio region and beyond the Mississippi. But their example worked. Their independence tempted, their prosperity stimulated. From the freedom of the United States came the revolt of Spanish America, and the grant by Great Britain to Canada of the amplest rights of self-government.

The effect which the establishment of the great northern republic was bound to have on their own colonies was not unknown to the wiser among the rulers of Spain. They took, however, few and weak steps to counteract the visible peril. During the later 17th century and the whole of the 18th, the history of the Spanish colonies and of the Portuguese in Brazil, was not, as has often been said, one of pure stagnation. Apart from such a peculiar development as the rise, formation and fall of the Jesuit missions in Paraguay, there was growth and change. The Creole population increased and was steadily recruited from home. Apart from settlers who came for trade, the flow of government officials, and soldiers, both officers and men, ended generally in recruiting the Creole element. The newcomers married in the country, and died there, leaving their families to grow up Americans. San Martin, the military leader of Buenos Aires in the revolt, was the son of a Spanish army officer and a Creole mother, and he is quoted as the example of thousands. He was educated in Spain, and began as an officer in the Spanish army. Increasing numbers of Creoles came home for education, and though they rarely went beyond Spain, yet Spain itself was being permeated by the influence of French philosophic and economic writers. The Creoles brought back new ideas. Slow as the Spanish government was to move, and obstinately as it clung to old ways, it was forced to remove restrictions on trade, largely by the discovery that it could not prevent smuggling, which was, in fact, carried on with the connivance of its own corrupt officials. The attempt to prevent all trade on the river Plate was given up, and a vigorous commercial community arose. A revolt of the Indians in Peru in 1780, which was savagely suppressed, forced the government to take note of the abuses of its colonial administration. Many reforms were introduced. Spanish America was never so well governed as at the end of the 18th century, and was on the whole prosperous. But the reforms and concessions of Spain came too late. In commerce it had to compete with the highly developed maritime industry of Great Britain. In government it had to meet with the growing discontent of the Creoles, who found themselves treated as children, and their country looked on as a milch cow. The wars of the French Revolution and of the emperor Napoleon, in which Spain was entangled, interrupted its communications with its colonies, and weakened its hold on them. The defeat, in 1806 and 1807, of two British expeditions to Buenos Aires and Montevideo, resulting in the capitulation of the English force, gave a great impulse to the self-reliance of the colonists, to whom the credit of the victory entirely belonged. When the intervention of Napoleon in Spain plunged the mother country into anarchy, the colonists began to act for themselves. They were still loyal, but they were no longer passive. The brutality of some Spanish governors on the spot provoked anger. The cortes assembled in Cadiz, being under the influence of the merchants and mob, could make no concessions, and all Spanish America flamed into revolt. For the details of the struggle the reader must refer to the articles ARGENTINA, BOLIVIA, CHILE, COLOMBIA, ECUADOR, PANAMA, PERU, PARAGUAY, URUGUAY, VENEZUELA. Brazil followed the same course in a milder way and a little later. The struggle of Spanish America for independence lasted from 1810 to 1826.

This vast extension of the area of independence in America could not but have its proportionate effect on the general balance of power among nations. So long as Spain retained her colonies on the mainland, while England held Canada, and the English, Dutch and French had possessions in Guiana, the New World must have remained in political dependence on the Old. When the Spanish colonies secured effective independence, and even before their freedom was formally recognized, foreign sovereignty became at once the exception in America. The change thus established *de facto* owed its first diplomatic consecration to the developments of international politics in the Old World. The committee of the great powers which, since the downfall of Napoleon, had succeeded to the authority which he had usurped in Europe (see EUROPE: *History*), was for the few years of its unbroken existence fully occupied with the task of preserving the "European Confederation" from the peril to its peace of renewed revolutionary outbreaks. As early as the congress of Aix-la-Chapelle (1818), however, the question of the relations of Spain and her colonies had been brought up and the suggestion made of concerted intervention, to put an end to a state of things scandalous in itself and dangerous, if only by force of example, to the monarchical principle. The proposal came to nothing, and fared no better when revived at subsequent conferences, owing to the opposition of Great Britain and of Spain herself. Spanish pride resented the interference of an alliance in which Spain had no part; Great Britain could not afford to allow any action to be taken which might end in the re-establishment of the old Spanish colonial system and the destruction of the considerable British trade, still nominally contraband, which had grown up with the colonies during the troubles. Had the Spanish government frankly accepted the situation and acknowledged the trade as legitimate, England would have had no objection to the re-establishment of the Spanish sovereignty in America. But the stubborn blindness of Ferdinand VII. and his ministers made any such solution impossible, and, before the meeting of the congress of Verona, in 1822, Castlereagh had realized the eventual necessity of recognizing the independence of the South American states. Matters were brought to a crisis by the outcome of the Verona conferences (see VERONA, CONGRESS OF), and the re-establishment, in 1823, of the absolute power of the king in Spain by French arms and under French influence, the logical consequence of which seemed to be the reconquest, with the aid of France, of the Spanish colonies. Great Britain could not afford to stand aside and watch the accomplishment of an ambition to prevent which she had, at immense sacrifice of blood and treasure, overthrown the power of Louis XIV. and of Napoleon. She had exhausted every art of diplomatic obstruction to the aggressive action of France; her counterstroke to the unexpectedly easy victory of the French arms was the formal recognition of the revolted colonies as independent states. "If France has Spain," cried Canning in parliament, "at least it shall be Spain without the Indies. We have called a New World into existence to redress the balance of the Old."

On the 23rd of July 1824, a commercial treaty was signed between Great Britain and Brazil; Colombia and Mexico were acknowledged in December of the same year; and the recognition of the other states followed, as each was able to give guarantees of stable government. Meanwhile the United States, acting in harmony, but not in formal co-operation, with England, had taken decisive action. President Monroe, in his message to Congress on the 2nd of December 1823, laid down the rule that no part of America was any longer *res nullius*, or open to colonial settlement. Though the vast ultimate consequences of this sudden appearance of the great western republic in the arena of international politics were not realized even by those in sympathy with Monroe's action, the weight of the United States thrown into the scale on the side of Great Britain made any effective protest by the European powers impossible; Russia, Austria and Prussia contented themselves with joining in a mild expression of regret that the action of Great Britain "tended to encourage that revolutionary spirit it had been found so difficult to control in Europe." Great Britain and the United States were, indeed, not in complete agreement as to the legitimacy of fresh colonial settlements in the New World, but they were practically resolved that nobody should make any new settlements except themselves. From President Monroe's declaration has grown up what is now known as the Monroe Doctrine (*q.v.*), which, in substance, insists that America forms a separate system apart from Europe, wherein still existing European possessions may be tolerated, but on the understanding that no extension of them, and no establishment of European control over a nominally independent American state, will be allowed.

The Monroe Doctrine is indeed the recognition, rather than the cause, of undeniable fact. Europe is still possessed of some measure of sovereign power in the New World, in Canada, in Guiana and in the West Indian islands. But Canada is bound only by a voluntary allegiance, Guiana is unimportant, and in the West Indian islands, where the independence of Hayti and the loss of Cuba and Porto Rico by Spain have diminished the European sphere, European dominion is only a survival of the colonial epoch. America, North and South, does form a separate system. Within that system power is divided as it has not been in Europe since the fall of the Roman empire. On the one hand are the United States and Canada. On the other are all the states formed out of the colonial empires of Spain and Portugal. The states of the American Union are non-tropical, adapted to the development of European races, not mixed with Indian blood, and possessed by long inheritance of the machinery needed for the successful conduct of self-government. They grew during the 19th century in population and wealth at a rate that placed them far ahead of the Spanish and Portuguese states, which in the year 1800 were the richer and the more populous. The Spanish and Portuguese states of America are mainly tropical, and therefore ill adapted to the health of a white race. Their population is divided between a white minority, among whom there are to be found strains of Indian blood, and a coloured majority, sometimes docile and industrious, sometimes mere savages. They inherited no machinery of self-government. Townships governed by close corporations, and all embedded in the despotic power of the crown, presented none of the elements out of which a commonwealth could be formed. It was inevitable that in the early stages of their history, the so-called Latin communities should fall under the control of "the single person," and no less inevitable that he should be a soldier. The sword and military discipline supplied the only effective instruments of government. It would have been a miracle if the first generation of Mexican and South American history had not been anarchical. And though in recent years Spanish America has seemingly settled down, and republican institutions have followed upon long periods of continual revolution, yet over the American continent as a whole there is an overwhelming predominance, material and intellectual, of the communities of English speech and politically of English origin.

AUTHORITIES.—Separate bibliographies will be found under the headings of the separate states. Amid the plethora of books, the reader cannot do better than consult the *Narrative and Critical History of America*, edited by Justin Winsor (1886–1889), in eight large octavo volumes, in which all the chapters are supplied with copious and carefully compiled bibliographies. (D. H.)

The American aborigines.

III. *Ethnology and Archaeology.*—A summary account is here given of the American aborigines, who are discussed in more detail under INDIANS, NORTH AMERICAN. Whether with Payne it is assumed that in some remote time a speechless anthropoid passed over a land bridge, now the Bering Sea, which then sank behind him; or with W. Boyd Dawkins and Brinton, that the French cave man came hither by way of Iceland; or with Keane, that two subvarieties, the long-headed Eskimo-Botocudo type and the Mexican round-headed type, prior to all cultural developments, reached the New World, one by Iceland, the other by Bering Sea; or that Malayoid wanderers were stranded on the coast of South America; or that no breach of continuity has occurred since first the march of tribes began this way—ethnologists agree that the aborigines of the western came from the eastern hemisphere, and there is lacking any biological evidence of Caucasoid or Negroid blood flowing in the veins of Americans before the invasions of historic times. The time question is one of geology.

Following *Notes and Queries on Anthropology*, published by the British Association for the Advancement of Science, the study of the American aborigines divides itself into two parts: that relating to their biology, and that relating to their culture. In the four subdivisions of humanity based on the hair, the Americans are straight-haired or Mongoloid. But it will free this account of them from embarrassments if they be looked upon as a distinct subspecies of *Homo sapiens*. Occupying 135 degrees of latitude, living on the shores of frozen or of tropical waters; at altitudes varying from sea-level to several thousands of feet; in forests, grassy prairies or deserts; here starved, there in plenty; with a night here of six months' duration, there twelve hours long; here among health-giving winds, and there cursed with malaria—this brown man became, in different culture provinces, brunette or black, tall or short, long-headed or short-headed, and developed on his own hemisphere variations from an average type.

Since the tribes practised far more in-breeding than out-breeding, the tendency was toward forming not only verbal linguistic groups, but biological varieties; the weaker the tribe, the fewer the captures, the greater the isolation and harder the conditions—producing dolichocephaly, dwarfism and other retrogressive characteristics. The student will find differences among anthropologists in the interpretation of these marks—some averring that comparative anatomy is worthless as a means of subdividing the American subspecies, others that biological variations point to different Old World origins, a third class believing these structural variations to be of the soil. The high cheek-bone and the hawk's-bill nose are universally distributed in the two Americas; so also are proportions between parts of the body, and the frequency of certain abnormalities of the skull, the hyoid bone, the humerus and the tibia. Viability, by which are meant fecundity, longevity and vigour, was low in average. The death-rate was high, through lack of proper weaning foods, and hard life. The readiness with which the American Indian succumbed to disease is well known. For these reasons there was not, outside of southern Mexico, northern Central America and Peru, a dense population. In the whole hemisphere there were not over ten million souls.

The materials for studying the American man biologically are abundant in the United States National Museum in Washington; the Peabody Museum, at Cambridge, Massachusetts; the American Museum of Natural History, New York; the Academy of Sciences and the Free Museum of Arts and Sciences, Philadelphia, Pennsylvania; the Field Museum in Chicago; the National Museum, city of Mexico, and the Museum of La Plata. In Europe there are excellent collections in London, Cambridge, Paris, Berlin, St Petersburg and Prague.

Professor Putnam measured for the World's Columbian Exposition 1700 living Indians, and the results have been summed up by Boas. The breadth of the Indian face is one centimetre more than that of the whites, and the half-breeds are nearer the Indian standard; this last is true also of colour in the skin, eyes and hair. In stature, the tall tribes exceed 170 cm.; middle stature ranges between 166 and 170; and short tribes are under 166 cm. The Indians are on the whole a tall people. Tribes that have changed residence have changed stature. The tallest statures are on the plains in both Americas. The mountains of the south-east and of the west reveal the shortest statures. The whole Mississippi valley was occupied by tall peoples. The Athapascans of New Mexico are of middle stature, the Pueblo peoples are short. The Shoshoni, Shahaptin and Salish tribes are of middle stature; on the coast of British Columbia, Puget Sound, in Oregon, and northern California, are the shortest of all the North Americans save the Eskimo, while among them, on the Columbia, are taller tribes. The comparison of cranial indexes is rendered difficult by intentional flattening of the forehead and undesigned flattening of the occiput by the hard cradle-board. The Mississippi valley tribes are nearly brachycephalic; the index increases around the Great Lakes, and lessens farther east. The eastern Eskimo are dolichocephalic, the western are less so, and the Aleuts brachycephalic. On the North Pacific coast, and in spots down to the Rio Grande, are short heads, but scattered among these are long heads, frequent in southern California, but seen northward to Oregon, as well as in Sonora and some Rio Grande pueblos.

The same variety of index exists in South America. In the regions of greatest linguistic mixture is the greatest heterogeneity of cephalic index.

Classification.

The concepts on which the peoples of the Old World have been classified, such as stature, colour, skeletal measurements, nationality, and so on, cannot as yet be used in America with success. The only basis of division practicable is language, which must be kept separate in the mind from the others. However, before the conquest, in no other part of the globe did language tally so nearly with kinship. Marriage was exogamic among clans in a tribe, but practically, though not wholly, endogamic as between tribes, wife and slave capture being common in places. In his family tree of *Homo Americanus* Keane follows out such a plan, placing the chief linguistic family names on the main limbs, North American on one side, and South American on the other. Deniker groups mankind into twenty-nine races and sub-races. Americans are numbered thus:—21, South American sub-race; Palaeo-Americans and South Americans. 22, North American sub-race; tall, mesocephalic. 23, Central American race; short, brachycephalic. 24, Patagonian race; tall, brachycephalic. 25, Eskimo race; short, dolichocephalic.

Farrand speaks of physical, linguistic, geographic, and cultural criteria, the first two the more exact, the latter more convenient and sometimes the only feasible bases.

Culture provinces.

Zoologists divide the earth into biological areas or regions, so both archaeologists and ethnologists may find it convenient to have in mind some such scheme of provinces as the following, named partly after the dominant ethnic groups:—Eskimo, on Arctic shores; Déné (Tinneh), in north-western Canada; Algonquin-Iroquois, Canada and eastern United States; Sioux, plains of the west; Muskhogee, Gulf States; Tlinkit-Haida, North Pacific coast; Salish-Chinook, Fraser-Columbia coasts and basins; Shoshoni, interior basin; California-Oregon, mixed tribes; Pueblo province, south-western United States and northern Mexico; Nahuatla-Maya, southern Mexico and Central America; Chibcha-Kechua, the Cordilleras of South America; Carib-Arawak, about Caribbean Sea; Tupi-Guarani, Amazon drainage; Araucanian, Pampas; Patagonian, peninsula; Fuegian, Magellan Strait. It is necessary to use geographical terms in the case of California and the North Pacific, the Caucasus or *cloaca gentium* of the western hemisphere, where were pocketed forty out of one hundred or more families of native tribes. The same is true in a limited sense of Matto Grosso. That these areas had deep significance for the native races is shown by the results, both in biology and culture. The presence or absence of useful minerals, plants and animals rendered some congenial, others unfriendly; some areas were the patrons of virile occupations, others of feminine pursuits.

Language.

Among the languages of America great differences exist in the sounds used. A collection of all the phonetic elements exhausts the standard alphabets and calls for new letters. A comparison of one family with another shows also that some are vocalic and soft, others wide in the range of sounds, while a third set are harsh and guttural, the speaking of them (according to Payne) resembling coughing, barking and sneezing. Powell also thinks that man lived in America before he acquired articulate speech. The utterance of these speech elements in definite order constitutes the roots and sentences of the various tongues. From the manner of assemblage, all American languages are agglutinative, or holophrastic, but they should not be called polysynthetic or incorporative or inflexional. They were more or less on the way to such organized forms, in which the world's literatures are preserved. As in all other languages, so in those of aboriginal America, the sentence is the unit. Words and phrases are the organic parts of the sentence, on which, therefore, the languages are classified. It is on this basis of sentential elements that Powell has arranged the linguistic families of North America. He has brought together, in the Bureau of American Ethnology in Washington, many hundreds of manuscripts, written by travellers, traders, missionaries, and scholars; and, better still, in response to circulars, carefully prepared vocabularies, texts and long native stories have been written out by trained collectors. A corps of specialists—Boas, Dall, Dorsey, Gatschet, Hewitt, Mooney, Pilling, J. R. Swanton—have studied many of these languages analytically and comparatively. Other institutional investigations have been prosecuted, the result of all which will be an intelligent comprehension of the philology of a primitive race.

Linguistic families.

Attention is frequently called to the large number of linguistic families in America, nearly 200 having been named, embracing over 1000 languages and dialects. A few of them, however, occupied the greater part of lands both north and south of Panama; the others were encysted in the territory of the prevailing families, or concealed in *culs-de-sac* of the mountains. They are, through poverty of material, unclassed languages, merely outstanding phenomena. Factions separated from the parent body developed dialects or languages by contact, intermarriage and incorporation with foreign tribes. To the old-time belief that languages multiplied by splitting and colonizing, must be added the theory that languages were formerly more numerous, and that those of the Americans were formed by combining.

The families of North America, Middle America and South America are here given in alphabetical order, the prevailing ones in small capitals:—

North America.

ALGONQUIN, E. Can., N. Atlantic States, middle States, middle western States; ATHAPASCAN, N.W. Can., Alaska, Wash., Or., Cal., Ariz., Mex.; Attacapan, La.; Beothukan, Nova Scotia; CADDOAN, Tex., Neb., Dak.; Chimakuan, Wash.; Chimarikan, N. Cal.; CHIMMESYAN, Brit. Col.; CHINOOKAN, Or.; Chitimachan, La.; Chumashan, S. Cal.; Coahuiltecan, Tex.; Copehan, N. Cal.; Costanoan, Cal.; ESKIMAUAN, Arctic province; Esselenian, Cal.; IROQUOIAN, N.Y., N.C.; Kalapooian, Or.; Karankawan, Tex.; KERESAN, N. Mex.; KIOWAN, Neb.; KITUNAHAN, Brit. Col.; KOLUSCHAN, S. Alaska; KULANAPAN, Cal.; Kusan, Cal.; Lutuamian, Or.; Mariposan, Cal.; Moquelumnan, Cal.; MUSKHOGEAN, Gulf States; NATCHESAN, Miss.; Palaihnihan, Cal.; PIMAN, Ariz.; Pujunan, Cal.; Quoratean, Or.; Salinan, Cal.; SALISHAN, Brit. Col.; Sastean, Or.; SHAHAPTIAN, Or.; SHOSHONEAN, Interior Basin; SIOUAN, Mo. Valley; SKITTAGETAN, Brit. Col.; Takilman, Or.; TANYOAN, Mex.; Timuquanan, Fla.; Tonikan, Miss.; Tonkawan, Tex.; Uchean, Ga.; Waiilatpuan, Or.; WAKASHAN, Vancouver I.; Washoan, Nev.; Weitspekan, Or.; Wishoskan, Cal.; Yakonan, Or.; Yanan, Or.; Yukian, Cal.; Yuman, L. Cal.; ZUNYAN, N. Mex.

Middle America.

CHAPANECAN, Chi.; Chinantecan, Oax.; Chontalan, S. Mex.; Huatusan, Nic.; Huavean, Tehuant.; Lencan, Hon.; MAYAN, Yuc. and Guat.; NAHUATLAN, Mex.; OTOMITLAN, Cen. Mex.; Raman, Hond.; Serian, Tiburon I.; Subtiaban, Nic.; TARASCAN, Mich.; Tehuantepecan, Isthmus; Tequistlatecan, Oax.; TOTONACAN, Mex.; Triquian, S. Mex.; Ulvan, Nic.; Xicaquean, Hond.; ZAPOTECAN, Oax.; ZOQUEAN, Tehuant.

South America.

Alikulufan, T. del Fuego; Arauan, R. Purús; ARAWAKIAN, E. Andes; Atacamenyan, S. Peru; ARAUCANIAN, Pampas; AYMARAN, Peru; Barbacoan, Colombia; Betoyan, Bogota; Canichanan, Bolivia; Carahan, S. Brazil; CARIBIAN, around Caribbean Sea; Catamarenyan, Chaco; Changuinan, Panama; Charruan, Paraná R.; CHIBCHAN, Colombia; Churoyan, Orinoco R.; Coconucan, Colombia; Cunan, Panama; GUAYCURUAN, Paraguay R.; JIVAROAN, Ecuador; KECHUAN, Peru; Laman, N.E. Peru; Lulean, Vermejo R.; Maiman, S. Ecuador; Matacoan, Vermejo R.; Mocoan, Colombia; Mosetenan, E. Bolivia; ONAN, T. del Fuego; Paniquitan, Colombia; Panoan, Ucayali R., Peru; Payaguan, Chaco; Puquinan, Titicaca L.; Samucan, Bolivia; Tacanan, N. Bolivia; TAPUYAN, Brazil; Timotean, Venezuela; TUPIAN, Amazon R.; TZONECAN, Patagonia; YAHGAN, T. del Fuego; Yuncan, Truxillo, Peru; Yurucarian, E. Bolivia; ZAPAROAN, Ecuador.

Written language was largely hierographic and heroic. The drama, the cult image, the pictograph, the synecdochic picture, the ideaglyph, were steps in a progress without a break. The warrior painted the story of conflicts on his robe only in part, to help him recount the history of his life; the Eskimo etched the prompters of his legend on ivory; the Tlinkit carved them on his totem post; the women fixed them in pottery, basketry, or blankets. At last, the central advanced tribes made the names of the abbreviated pictures useful in other connexions, and were far on the way to a syllabary. Intertribal communication was through gestures; it may be, survivals of a primordial speech, antedating the differentiated spoken languages. See publications of the *Bureau of American Ethnology*, by F. W. Hodge (1906); Farrand, *Basis of Am. History*, chap. xviii.; and Orozco y Berra, *Geografia de las lenguas, &c.* (Mexico, 1868).

Technology.

To supply their wants the Americans invented modifications in natural materials, the working of which was their industries. The vast collections in richly endowed European and American museums are the witnesses and types of these. There is danger of confounding the products of native industries. The following classes must be carefully discriminated:—(*a*) pre-Columbian, (*b*) Columbian, (*c*) pre-contact, (*d*) first contact, (*e*) post-contact, (*f*) present, and (*g*) spurious. Pre-Columbian or pre-historic material is further classified into that which had been used by Indians before the discovery, and such as is claimed to be of a prior geological period. Columbian, or 15th-century material, still exists in museums of Europe and America, and good descriptions are to be found in the writings of contemporary historians. Pre-contact material is such as continued to exist in any tribe down to the time when they were touched by the presence of the trade of the whites. In some tribes this would bring the student very near to the present time; for example, before Steinen, the Indians in Matto Grosso were in the pre-contact period. Post-contact material is genuine Indian work more or less influenced by acculturation. It is interesting in this connexion to study also first contact in its lists of articles, and the effects produced upon aboriginal minds and methods. For example, a tribe that would jump at iron arrow-heads stoutly declined to modify the shafts. Present material is such as the Indian tribes of the two Americas are making to-day. Spurious material includes all that mass of objects made by whites and sold as of Indian manufacture; some of it follows native models and methods; the rest is fraudulent and pernicious. The question whether similarities in technology argue for contact of tribes, or whether they merely show corresponding states of culture, with modifications produced by environment, divides ethnologists. (See Farrand, chap. xviii.)

Aboriginal mechanics.

The study of mechanics involves materials, tools, processes and products. No iron tools existed in America before the invasion of the whites. Mineral, vegetable and animal substances, soft and hard, were wrought into the supply of wants by means of tools and apparatus of stone, wood and bone—tools for cutting, or edged tools; tools for abrading and smoothing the surfaces of substances, like planes, rasps and sandpaper; tools for striking, that is, pounding for the sake of pounding, or for crushing and fracturing violently; perforating tools; devices for grasping and holding firmly. These varied in the different culture provinces according to the natural supply, and the presence or absence of good tool material counted for as much as the presence or absence of good substances on which to work. As a means of grading progress among the various tribes, the tool is valuable both in its working part and its hafting, or manual part. Fire drills were universal.

Besides chipped stone knives, the teeth of rodents, sharks, and other animals served an excellent purpose. In north-west America and in the Caribbean area the adze was highly developed. In Mexico, Colombia and Peru the cutting of friable stone with tough volcanic hammers and chisels, as well as rude metallurgy, obtained, but the evidences of smelting are not convincing. Engineering devices were almost wanting. The Eskimo lifted his weighted boat with sheer-legs made of two paddles; he also had a tackle without sheaves, formed by reaving a greased thong through slits cut in the hide of a walrus. The north-west coast Indians hoisted the logs that formed the plates of their house frames into position with skids and parbuckles of rope. The architectural Mexicans, Central Americans, and especially the Peruvians, had no derricks or other hoisting devices, but rolled great stones into place along prepared ways and up inclined planes of earth, which were afterwards removed. In building the fortress of Sacsahuaman, heights had to be scaled; in Tiahuanaco stones weighing 400 tons were carried seventeen miles; in the edifices of Ollantaytambo not only were large stones hauled up an ascent, but were fitted perfectly. The moving of vast objects by these simple processes shows what great numbers of men could be enlisted in a single effort, and how high a grade of government it was which could hold them together and feed them. In Arizona, Mexico and Peru, reservoirs and aqueducts prove that hydrotechny was understood. (Hodge, *Am. Anthrop.* vi. 323.)

Time-keeping devices were not common. Sun-dials and calendar monuments were known among the more advanced tribes. Fractional portions of time were gauged by shadows, and time of day indicated by the position of the sun with reference to natural features. No standards of weighing or measuring were known, but the parts of the body were the units, and money consisted in rare and durable vegetable and animal substances, which scarcely reached the dignity of a mechanism of exchange. If the interpretation of the Maya calculiform glyphs be trustworthy, these people had carried their numeral system into the hundreds of thousands and devised symbols for recording such high numbers. (See *Bulletin* 28, *Bur. Am. Ethnol.*)

Food.

The Americans were, in most places, flesh-eaters. The air, the waters and the land were their base of supplies, and cannibalism, it is admitted, was widespread. With this animal diet everywhere vegetable substances were mixed, even in the boreal regions. Where the temperature allowed, vegetable diet increased, and fruits, seeds and roots were laid under tribute. Storage was common, and also the drying of ripened fruits. The most favoured areas were those where corn and other plants could be artificially produced, and there barbaric cultures were elaborated. This farming was of the rudest kind. Plots of ground were burned over, trees were girdled, and seeds were planted by means of sharpened sticks. The first year the crop would be free from weeds, the second year only those grew whose seeds were wafted or carried by birds, the third year the crop required hoeing, which was done with sticks, and then the space was abandoned for new ground. Irrigation and terrace culture were practised at several points on the Pacific slope from Arizona to Peru. The steps along which plant and animal domestication passed upwards in artificiality are graphically illustrated in the aboriginal food quest.

Clothing and adornment.

Except in the boreal areas the breech-clout was nearly universal with men, and the cincture or short petticoat with women. Even in Mexican and Mayan sculptures the gods are arrayed in gorgeous breech-clouts. The foot-gear in the tropics was the sandal, and, passing northward, the moccasin, becoming the long boot in the Arctic. Trousers and the blouse were known only among the Eskimo, and it is difficult to say how much these have been modified by contact. Leggings and skin robes took their place southward, giving way at last to the nearly nude. Head coverings also were gradually tabooed south of the 49th parallel. Tattooing and painting the body were well-nigh universal. Labrets, *i.e.* pieces of bone, stone, shell, &c., were worn as ornaments in the lip (Latin, *labrum*) or cheek by Eskimo, Tlinkit, Nahuatlas and tribes on the Brazilian coast. For ceremonial purposes all American tribes were expert in the masquerade and dramatic apparel. A study of these in the

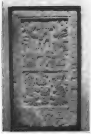
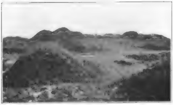


FIG. 1.—Stone Tablet with seated figures, and characteristic hieroglyphs (undeciphered). From Monte Alban, Oaxaca. Zapotecan culture.



Photo, Waite, Mexico.

FIG. 2.—General View of the Ruins of Monte Alban, Oaxaca, with terraced pyramids. Zapotecan culture.

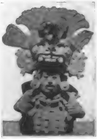


FIG. 3.—Sepulchral Clay Urn, with beast mask and rich head ornament. Oaxaca. Zapotecan culture.

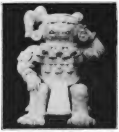


FIG. 4.—Sepulchral Clay Urn, in the form of a jaguar-like human figure, with shell ornament and loin-cloth. Oaxaca. Zapotecan culture.

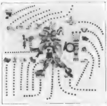


FIG. 5.—Leaf 44 of *Codex Fejerváry-Mayer*. Figure of the god Tezcatlipoca, surrounded by the 20 day symbols of the sacred cycle of 260 days, *tonalamatl*. Mexican culture with Mayan influence.
(*From publications of the Duke of Loubat.*)

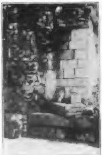


FIG. 6.—Temple Chamber, with richly carved wall facing and hieroglyph groups beneath the plinth. Copan, Honduras. Mayan culture.

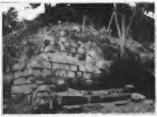


FIG. 7.—Temple Pyramid, with sculptured cornerstone at base. Copan, Honduras. Mayan culture.

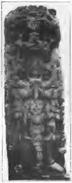


FIG. 8.—Stone Stele, with richly decorated human figure, the hands meeting across the breast. Copan, Honduras. Mayan culture.

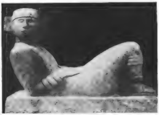


FIG. 9.—Stone Figure of the so-called Chac-Mol type, with round vessel resting on the body and characteristic breastplate. Chi-chen-itua, Yucatan. Proto-Mexican culture.

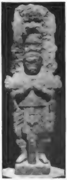


FIG. 10.—Stone Stele, with human figure. Chiapas, Mexico. Mayan culture.

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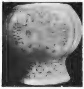

FIG. 1.—Polychrome Clay Bowl, with incised curves and figure of the earth monster. Necropolis of Santa Barbara, Guanacaste, Costa Rica. Mexican culture.

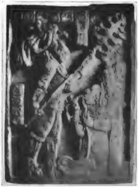

FIG. 2.—Stone Relief, with figure of a penitent (*çaca-quixtiani*) passing through his tonguea thong studded with thorns. It is accompanied by two groups of hieroglyphs. Lorillard City, Chiapas, Mexico. Mayan culture.

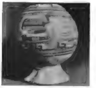

FIG. 3.—Polychrome Clay Bowl, with macander border and stencilled figures in three fields. Santa Barbara Necropolis. Guanacaste. Chorotega culture.

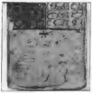

FIG. 4.—Lower Portion of Leaf 60 of *Codex Dresdensis*, with figures of four deities and groups of hieroglyphs on Agave paper. Mayan culture.
From E. Förstenann, 1892.

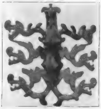

FIG. 5.—Gold Breast Ornament from the graveof achief, in the form of a crocodile with three reptiles on each side. S. E. Costa Rica (El General), Central America. Culture of the Coto and Quepo.

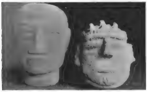

FIG. 6.—Two Typical Stone Sculptures in the form of human heads, with characteristic ornaments. Interior of Costa Rica, Central America. Culture of the Guetar.

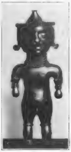

FIG. 7.—Large Gold Human Figure, with a gold coco-flask in each hand; gold diadem, nose and ear ornaments, and chains on neck and legs. Antioquia, Columbia. Chibcha culture.

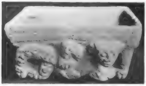

FIG. 8.—Stone Vessel supported by prone Human Figure. Interior of Costa Rica, Central America. Culture of the Guëtar.

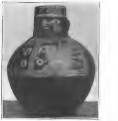

FIG. 9.—Painted Clay Vessel in polychrome, with neck in form of a human face with tear marks. Beneath a stencilled bird resembling a condor. Tiahuanaco style. Pachacamac, Peru. Pre-Inca culture.

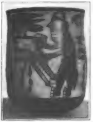

FIG. 10.—Painted Clay Vessel in polychrome on white stucco ground. A human figure with pearl chain and arrows in left hand, and parrot on a wooden stick in the right. Nasca style. Nasca, Peru. Pre-Inca culture.

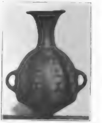

FIG. 11.—Typical painted Clay Vessel, with geometric pattern, standing on a conical point. Cuzco style. Cuzco, Peru.

historic tribes makes plain the motives in gorgeous Mexican sculptures.

Habitation.

The tribal system of family organization, universal in America, dominated the dwelling. The Eskimo underground houses of sod and snow, the Déné (Tinneh) and Sioux bunch of bark or skin wigwams, the Pawnee earth lodge, the Iroquois long house, the Tlinkit great plank house, the Pueblo with its honeycomb of chambers, the small groups of thatched houses in tropical America and the Patagonian toldos of skin are examples. The Indian habitation was made up of this composite abode, with whatever out-structures and garden plots were needed. A group of abodes, however joined together, constituted the village or home of the tribe, and there was added to these a town hall or large assembly structure where men gathered and gossiped, and where all dramatic and religious ceremonies were held. Powell contends that in a proper sense none of the Indian tribes was nomadic, but that, governed by water-supply, bad seasons and superstition (and discomfort from vermin must be added), even the Pueblo tribes often tore down and rebuilt their domiciles. The fur trade, the horse, the gun, disturbed the sedentary habit of American tribes. Little attention was paid to furniture. In the smoke-infested wigwam and hut the ground was the best place for sitting or sleeping. The communal houses of the Pacific coast had bunks. The hammock was universal in the tropics, and chairs of wood or stone. Eating was from the pot, with the hand or spoon. Tables, knives, forks and other prandial apparatus were as lacking as they were in the palaces of kings a few centuries before. (Morgan, *Houses and House Life*; Farrand, p. 286.)

Stone-working.

Stone-working was universal in America. The tribes quarried by means of crowbars and picks of wood and bone. They split the silicious rocks with stonehammers, and then chipped them into shape with bone tools. Soapstone for pottery was partly cut into the desired shape in the native ledge, broken or prised loose, and afterwards scraped into form. Paint was excavated with the ubiquitous digging-stick, and rubbed fine on stones with water or grease. For polished stonework the material was pecked by blows, ground with other stones, and smoothed with fine material. Sawing was done by means of sand or with a thin piece of harder stuff. Boring was effected with the sand-drill; the hardest rocks may have been pierced with specially hard sand. At any rate stones were sawed, shaped, polished, carved and perforated, not only by the Mexicans, but among other tribes. For building purposes stones were got out, dressed, carved and sculptured with stone hammers and chisels made of hard and tenacious rock. Stone-cutters' tools of metal are not known to have existed, and they were not needed. Their quarrying and stone-working were most wasteful. Those localities where chipping was done reveal hundreds of tons of splinters and failures, and these are often counted as ruder implements of an earlier time. The dressed stones for great buildings were pecked out of the ledges, and broken off with levers in pieces much too large for their needs. (McGuire, "The Stone Hammer," *Am. Anthrop.* iv., 1891; Holmes, *Archaeological Studies*; see Hodge's List, *Bur. Am. Ethnol.*, 1906, and *Handbook*.)

Metallurgy.

Metals were treated as malleable stones by the American aborigines. No evidence of smelting ores with fluxes is offered, but casting from metal melted in open fires is assumed. Gold, silver, copper, pure or mixed with tin or silver, are to be found here and there in both continents, and nuggets were objects of worship. Tools and appliances for working metals were of the rudest kind, and if moulds for casting were employed these were broken up; at least no museum contains samples of them, and the processes are not described. In the Arctic and Pacific coast provinces, about Lake Superior, in Virginia and North Carolina, as well as in ruder parts of Mexico and South America, metals were cold-hammered into plates, weapons, rods and wire, ground and polished, fashioned into carved blocks of hard, tenacious stone by pressure or blow, overlaid, cold-welded and plated. Soldering, brazing and the blowpipe in the Cordilleran provinces are suspected, but the evidence of their existence must be further examined. A deal of study has been devoted to the cunning Tubal Cains, the surprising productions of whose handiwork have been recovered in the art provinces of Mexico and the Cordilleras, especially in Chiriqui, between Costa Rica and Colombia. It must be admitted, however, that both the tools and the processes have escaped the archaeologist, as they did "the ablest goldsmiths in Spain, for they never could conceive how they had been made, there being no sign of a hammer or an engraver or any other instrument used by them, the Indians having none such" (Herrera).

Pottery.

The potter's wheel did not exist in the western world, but it was almost invented. Time and muscle, knack and touch, a trained eye and brain and an unlimited array of patterns hanging on fancy's walls, aided by a box of dry sand, were competent to give the charming results. No more striking contrast can be found between forlorn conditions and refined art products. Art in clay was far from universal in the two Americas. The Eskimo on Bering Sea had learned to model shallow bowls for lamps. No pottery existed in Athapascan boundaries. Algonquin-Iroquois tribes made creditable ware in Canada and eastern United States. Muskhogean tribes were potters, but Siouan tribes, as a rule, in all the Mississippi drainage were not. In their area, however, dwelt clay-working tribes, and the Mandans had the art. Moreover, the mound-builders in the eastern half of this vast plain, being sedentary, were excellent potters. The efflorescence of aboriginal pottery is to be found in the Pueblo region of south-western United States, in Mexico, Central America, Caribbean Islands, Colombia, Ecuador, Peru and restricted areas of eastern Brazil. (The literature on this subject is extensive. See Cushing, Fewkes, Holmes, Hough, Stevenson.) On the Pacific side of the continent not one of the forty linguistic families made pottery. The only workers in clay west of the Rockies and north of the Pueblo country belonged to the Shoshonean family of the Interior Basin.

Textile Industries.

The study of Indian textiles includes an account of their fibres, tools, processes, products, ornaments and uses. The fibres were either animal or vegetable; animal fibres were hair, fur on the skin, feathers, hide, sinew and intestines; vegetable fibres were stalks of small trees, brush, straw, cotton, bast, bark, leaves and seed vessels in great variety as one passes from the north southward through all the culture provinces. The products of the textile industry in America were bark cloth, wattling for walls, fences and weirs, paper, basketry, matting, loom products, needle or point work, net-work, lacework and embroidery. In the manufacture of these the substances were reduced to the form of slender filaments, shreds, rods, splints, yarn, twine and sennit or braid. All textile work was done by hand; the only devices known were the bark peeler and beater, the shredder, the flint-knife, the spindle, the rope-twister, the bodkin, the warp-beam and the most primitive harness. The processes involved were gathering the raw material, shredding, splitting, gauging, wrapping, twining, spinning and braiding. Twining and spinning were done with the fingers of both hands, with the palm on the thigh, with the spindle and with the twister. Ornamentation was in form, colour, technical processes and dyes. The uses to which the textiles were put were for clothing, furniture for the house, utensils for a thousand industries, fine arts, social functions and worship.

In order to comprehend the more intricate processes of the higher peoples it is necessary to examine the textile industry in all of the culture areas. It is essentially woman's work, though among the Pueblos, strangely enough, men are weavers.

The Eskimo woman did not weave, but was expert in sewing and embroidering with sinew thread by means of a bodkin. The Déné (Tinneh) peoples used strips of hide for snowshoes and game-bags, sewed their deerskin clothing with sinew thread, and embroidered in split quill. Their basketry, both in Canada and in Arizona, was coiled work. The northern Algonquin and Iroquoian tribes practised similar arts, and in the Atlantic states wove robes of animal and bird skins by cutting the latter into long strips, winding these strips on twine of hemp, and weaving them by the same processes employed in their basketry. Textile work in the Sioux province was chiefly the making of skin garments with sinew thread, but in the Gulf states the existence of excellent cane and grasses gave opportunity for several varieties of weaving. On the Pacific coast of America the efflorescence of basketry in every form of technic was known. This art reached down to the borders of Mexico. Loom-weaving in its simplest form began with the Chilkats of Alaska, who hung the warp over a long pole, and wrought mythological figures into their gorgeous blankets by a process resembling tapestry work. The forming of bird skins, rabbit skins and feathers into robes, and all basketry technic, existed from Vancouver Island to Central America. In northern Mexico net-work, rude lace-work in twine, are followed farther south, where finer material existed, by figured weaving of most intricate type and pattern; warps were crossed and wrapped, wefts were omitted and texture changed, so as to produce marvellous effects upon the surface. This composite art reached its climax in Peru, the llama wool affording the finest staple on the whole hemisphere. Textile work in other parts of South America did not differ from that of the Southern states of the Union. The addition of brilliant ornamentation in shell, teeth, feathers, wings of insects and dyed fibres completed the round of the textile art. A peculiar type of coiled basketry is found at the Strait of Magellan, but the motives are not American. (Consult the works of Boas, Dixon, G. T. Emmons, Holmes, Otis T. Mason, Matthews, John Murdoch, E. W. Nelson, A. P. Niblack, Lucien M. Turner.)

Zootechny.

Since most American tribes lived upon flesh, the activities of life were associated with the animal world. These activities were not confined to the land, but had to do also with those littoral meadows where invertebrate and vertebrate marine animals fed in unlimited numbers. An account of savage life, therefore, includes the knowledge of the animal life of America and its distribution, regarding the continent, not only as a whole, but in those natural history provinces and migrations which governed and characterized the activities of the peoples. This study would include industries connected with capture, those that worked up into products the results of capture, the social organizations and labours which were involved in pursuit of animals, the language, skill, inventions and knowledge resulting therefrom, and, finally, the religious conception united with the animal world, which has been named zootheism. In the capture of animals would be involved the pedagogic influence of animal life; the engineering embraced in taking them in large numbers; the cunning and strategy necessary to hunters so poorly armed giving rise to disguises and lures of many kinds. Capture begins among the lower tribes with the hand, without devices, developing knack and skill in seizing, pursuing, climbing, swimming, and maiming without weapons; and proceeds to gathering with devices that take the place of the hand in dipping, digging, hooking and grasping; weapons for striking, whether clubs, missiles or projectiles; edged weapons of capture, which were rare in America; piercing devices for capture, in lances, barbed spears, harpoons and arrows; traps for enclosing, arresting and killing, such as pens, cages, pits, pen-falls, nets, hooks, nooses, clutches, adhesives, deadfalls, impalers, knife traps and poisons; animals consciously and unconsciously aiding in capture; fire in the form of torches, beacons, burning out and smoking out; poisons and asphyxiators; the accessories to hunting, including such changes in food, dress, shelter, travelling, packing, mechanical tools and intellectual apparatus as demanded by these arts. Finally, in this connexion, the first steps in domestication, beginning with the improvement of natural corrals or spawning ground, and hunting with trained dogs and animals. Zootechnic products include food, clothing, ornaments, habitations, weapons, industrial tools, textiles, money, &c.

In sociology the dependence of the American tribes upon the animal world becomes most apparent. A great majority of all the family names in America were from animal totems. The division of labour among the sexes was based on zootechny. Labour organizations for hunting, communal hunt and migrations had to do with the animal world.

In the duel between the hunter and the beast-mind the intellectual powers of perception, memory, reason and will were developed; experience and knowledge by experience were enlarged, language and the graphic arts were fostered, the inventive faculty was evoked and developed, and primitive science was fostered in the unfolding of numbers, metrics, clocks, astronomy, history and the philosophy of causation. Beliefs and practices with reference to the heavenly world were inspired by zoic activities; its location, scenery and environment were the homes of beast gods. It was largely a zoopantheon; thus zootheism influenced the organization of tribes and societies in the tribes. The place, furniture, liturgies and apparatus of worship were hereby suggested. Myths, folk-lore, hunting charms, fetishes, superstitions and customs were based on the same idea. (For life zones, see C. H. Merriam, *Biol. Survey, U.S. Dept. of Agriculture*.)

Travel.

Excepting for extensive and rapid travel over the snow in the Arctic regions by means of dog sleds, the extremely limited transportation by dog travail (or sledge) in the Sioux province, and the use of the llama as a beast of burden throughout the Peruvian highlands, land travel was on foot, and land transportation on the backs of men and women. One of the most interesting topics of study is the trails along which the seasonal and annual migrations of tribes occurred, becoming in Peru the paved road, with suspension bridges and wayside inns, or tambos. In Mexico, and in Peru especially, the human back was utilized to its utmost extent, and in most parts of America harness adapted for carrying was made and frequently decorated with the best art. In the Mexican codices pictures of men and women carrying are plentiful. Travelling on the water was an important activity in aboriginal times. Hundreds of thousands of miles of inland waters and archipelagoes were traversed. Commencing in the Arctic region, the Eskimo in his kayak, consisting of a framework of driftwood or bone covered with dressed sealskin, could paddle down east Greenland, up the west shore to Smith Sound, along Baffin Land and Labrador, and the shores of Hudson Bay throughout insular Canada and the Alaskan coast, around to Mount St Elias, and for many miles on the eastern shore of Asia. In addition to this most delicate and rapid craft, he had his umiak or freight boat, sometimes called woman's boat. The Athapascan covered all north-western Canada with his open and portable birch-bark canoe, somewhat resembling the kayak in finish. The Algonquin-Iroquois took up the journey at Bear Lake and its tributaries, and by means of paddling and portages traversed the area of middle and eastern Canada, including the entire St Lawrence drainage. The absence of good bark, dugout timber, and chisels of stone deprived the whole Mississippi valley of creditable water-craft, and reduced the natives to the clumsy trough for a dugout and miserable bull-boat, made by stretching dressed buffalo hide over a crate. On the Atlantic coast of the United States the dugout was improved in form where the waters were more disturbed. John Smith's Indians had a fleet of dugouts. The same may be said of the Gulf states tribes, although they added rafts made of reed. Along the archipelagoes of the North Pacific coast, from Mount St Elias to the Columbia river, the dugout attained its best. The Columbia river canoe resembled that of the Amur, the bow and stern being pointed at the water-line. Poor dugouts and rafts, made by tying reeds together, constituted the water-craft of California and Mexico until Central America is reached.

The Caribs were the Haidas of the Caribbean Sea and northern South America. Their craft would vie in form, in size, and seaworthiness with those of the North Pacific coast. The catamaran and the reed boat were known to the Peruvians. The tribes of Venezuela and Guiana, according to Im Thurn, had both the dugout and the built-up hull. The simplest form of navigation in Brazil was the woodskin, a piece of bark stripped from a tree and crimped at the ends. The sangada, with its platform and sail, belonging to the Brazilian coast, is spoken of as a good seaworthy craft. Finally, the Fuegian bark canoe, made in three pieces so that it can be taken apart and transported over hills and sewed together, ends the series. The American craft was propelled by poling, paddling, rowing, and by rude sails of matting.

Fine art.

The aesthetic arts of the American aborigines cannot be studied apart from their languages, industries, social organizations, lore and worships. Art was limited most of all by poverty in technical appliances. There were just as good materials and inspirations, but what could the best of them do without metal tools? One and all skilful to a surpassing degree—weavers, embroiderers, potters, painters, engravers, carvers, sculptors and jewellers,—they were wearied by drudgery and overpowered by a never-absent, weird and grotesque theology. The Eskimo engraved poorly, the Déné (Tinneh) embroidered in quill, the North Pacific tribes carved skilfully in horn, slate and cedar, the California tribes had nimble fingers for basketry, the Sioux gloried in feathers and painted parfleche. The mound builders, Pueblo tribes, middle Americans and Peruvians, were potters of many schools; gorgeous colour fascinated the Amazonians, the Patagonians delighted in skins, and even the Fuegians saw beauty in the pretty snail shells of their desolate island shores. Of the Mexican and Central American sculpture and architecture a competent judge says that Yucatan and the southern states of Mexico are not rich in sculptures, apart from architecture; but in the valley of Mexico the human figure, animal forms, fanciful life motives in endless variety, were embodied in masks, yokes, tablets, calendars, cylinders, disks, boxes, vases and ornaments. The Nahuatl lapidaries had at hand many varieties of workable and beautiful stone—onyx, marble, limestone, quartz and quartz crystal, granite, syenite, basalt, trachyte, rhyolite, diorite and obsidian, the best of material prepared for them by nature; while the Mayas had only limestone, and hard, tenacious rock with which to work it, and timber for burning lime. However, looking over the whole field of North American achievement, architectural and non-architectural, composite and monolithic, the palm for boldness, magnitude of proportions and infinity of labour, must go to the sculptured mosaics of Yucatan. Maya architecture is the best remaining index of the art achievements of the American race. The construction of such buildings as the palace at Uxmal and the castillo at Chichen (Chichenitza) indicates a mastery in architectural design. There is lack of unity in plan and grouping, and an enormous waste of material as compared with available room. At Uxmal the mass of masonry is to chamber space about as forty to one. The builders were "ignorant of some of the most essential principles of construction, and are to be regarded as hardly more than novices in the art" (Holmes, *Archaeological Studies*, &c.). As for the marvels of Peru, the walls of the temple of the sun in Cuzco, with their circular form and curve inward, from the ground upward, are most imposing. Some of the gates without lintels are beautiful, and the geometric patterns in the walls extremely effective. The same objection to over-massiveness might not apply here as in Mexico, owing to volcanic activity.

Sociology.

Institutions in Europe and America have gathered abundant material for an intelligent comprehension of American Indian sociology. The British Association had a committee reporting during many years on the tribes of north-west Canada. The American Museum in New York has prepared a series of monographs on the tribes of the North Pacific coast, of northern Mexico, and of the Cordilleras of South America. The reports of the Bureau of American Ethnology in Washington cover the Eskimo, east and west, and all the tribes of the United States. In Mexico the former labours of Pimentel and Orozco y Berra are supplemented by those of Bandelier, Peñafiel, Herrera and Alfredo Chavero. Otto Stoll's studies in Guatemala, Berendt's in Central America, Ernst's in Venezuela, Im Thurn's in Guiana, those of Ehrenreich, von den Steinen, Meyer in Brazil, or of Bandelier, Bastian, Brühl, Middendorf, von Tschudi in Peru, afford the historian of comparative sociology ample groundwork for a comprehensive grasp of South American tribes. In all parts of the western hemisphere society was organized on cognate kinship, real or artificial, the unit being the clan. There were tribes where the basis of kinship was agnate, but these were the exceptions. The headship of the clan was sometimes hereditary, sometimes elective, but each clan had a totemic name, and the clans together constituted the tribe, the bond being not land, but blood. Women could adopt prisoners of war, in which case the latter became their younger sons. When a confederacy was organized under a council, intermarriage between tribes sometimes occurred; an artificial kinship thus arose, in which event the council established the rank of the tribes as elder and younger brother, grandfather, father and sons, rendering the relationship and its vocabulary most intricate, but necessary in a social system in which age was the predominant consideration and etiquette most exacting. (See Morgan, *Tables of Consanguinity*, Smithsonian Contributions, xvii.)

The Eskimo have a regular system of animal totem marks and corresponding gentes. Powell sets forth the laws of real and artificial kinship among the North American tribes, as well as tribal organization and government, the formation of confederacies, and the intricate rules of artificial kinship by which rank and courtesy were established. (Many papers in *Reports of Bur. Am. Ethnol.*) Bandelier declares that in Mexico existed neither state nor nation, nor political society of any kind, but tribes representing dialects, and autonomous in matters of government, and forming confederacies for the purposes of self-defence and conquest. The ancient Mexican tribe was composed of twenty autonomous kins. According to Brinton the social organization of ancient Peru was a government by a council of the gentes. The Inca was a war chief elected by the council to carry out its commands. Among the Caribs a like social order prevailed; indeed, their family system is identical with the totem system of North American Indians. Dominated by the rule of blood relationship, the Indians regulated all co-operative activities on this basis. Not only marriage, but speech and common industries, such as rowing a boat or chasing a buffalo, were under its sway. It obtrudes itself in fine art, behaviour, law-making, lore and religion. In larger or smaller numbers of cognate kindred, for shorter or longer periods of time, near or far from home, the aborigines developed their legislatures, courts, armies, secret societies and priesthoods.

Art of war.

In organization, engineering, strategy, offence and defence, the art of war was in the barbarous and the savage status or grade. One competent to judge asserts that peace, not war, was the normal intertribal habit. They held frequent intercourse, gave feasts and presents, and practised unbounded hospitality. Through this traffic objects travelled far from home, and now come forth out of the tombs to perplex archaeologists. Remembering the organization of the tribe everywhere prevalent, it is not difficult to understand that the army, or horde, that stands for the idea, was assembled on the clan basis. The number of men arrayed under one banner, the time during which they might cohere, the distances from home they could march, their ability to hold permanently what they had gained, together form an excellent metric scale of the culture grade in the several American provinces, and nowhere, even in the most favoured, is this mark high. With the Mexicans war was a passion, but warfare was little above the raid (Bandelier; Farrand). The lower tribes hunted their enemies as they hunted animals. In their war dances, which were only rehearsals, they disguised themselves as animals, and the pantomime was a mimic hunt. They had striking, slashing and piercing weapons held in the hand, fastened to a shaft or thong, hurled from the hand, from a sling, from an atlatl or throwing-stick, or shot from a bow. Their weapons were all individual, not one co-operative device of offence being known among them, although they understood fortification.

The term "slavery" is often applied to the aboriginal American tribes. The truth of this depends upon the definition of the word "slave." If it means the capture of men, and especially of women, and adoption into the tribe, this existed everywhere; but if subjection to a personal owner, who may compel service, sell or put to death the individual, slavery was far from universal. Nieboer finds it only on the North Pacific coast as far south as Oregon, among the Navajo and the Cibola pueblos, and in a few tribes of Middle and South America.

The thought life of the American aborigines is expressed in their practical knowledge and their lore. The fascination which hangs around the latter has well-nigh obscured the former. As in medicine theory is one thing and practice another, so among these savages must the two be carefully discriminated.

Lore.

Dorsey, again, draws a distinction between lore narratives, which can be rehearsed without fasting or prayer, and rituals which require the most rigid preparation. In each culture province the Indians studied the heavenly bodies. The Arctic peoples regulated their lives by the long day and night in the year; among the tribes in the arid region the place of sunrise was marked on the horizon for each day; the tropical Indians were not so observant, but they worshipped the sun-god above all. The Mayas had a calendar of 360 days, with intercalary days; this solar year was intersected by their sacred year of twenty weeks of thirteen days each, and these assembled in bewildering cycles. Their knowledge of the air and its properties was no less profound. Heat and cold, rain and drought, the winds in relation to the points of the compass, were nearest their wants and supplies, and were never out of their thoughts. In each province they had found the best springs, beds of clay, paint, soapstone, flinty rock, friable stone for sculpture and hard, tenacious stone for tools, and used ashes for salt. The vegetal kingdom was no less familiar to them. Edible plants, and those for dyes and medicines, were on their lists, as well as wood for tools, utensils and weapons, and fibres for textiles. They knew poisonous plants, and could eliminate noxious properties. The universal reliance on animal life stimulated the study of the animal kingdom. Everywhere there were names for a large number of species; industries and fine arts were developed through animal substances. Society was organized in most cases on animal clans, and religion was largely zoomorphic. The hunting tribes knew well the nature and habits of animals, their anatomy, their migrations, and could interpret their voices. Out of this practical knowledge, coupled with the belief in personeity, grew a folk-lore so vast that if it were written down the world would not contain the books.

Religion.

The religion of the American aborigines, so far as it can be made a subject of investigation, consisted (1) in what the tribes believed about spirits, or shades, and the spirit world—its organization, place, activities and relation to our world; and (2) in what they did in response to these beliefs. The former was their creeds, the latter their cults or worships. In these worships, social organization, religious dramas and paraphernalia, amusement and gambling, and private religion or fetichism, found place. In order to obtain an intelligent grasp of the religion of tribes in their several culture provinces, it must be understood: (1) That the form of belief called *animism* by Tylor (more correctly speaking, *personeity*), was universal; everything was somebody, alive, sentient, thoughtful, wilful. This personeity lifts the majority of earthly phenomena out of the merely physical world and places them in the spirit world. Theology and science are one. All is supernatural, *wakañ*. (2) That there existed more than one self or soul or shade in any one of these personalities, and these shades had the power not only to go away, but to transform their bodily tenements at will; a bird, by raising its head, could become a man; the latter, by going on all fours, could become a deer. (3) That the regulative side of the spirit world was the natural outcome of the clan social system and the tribal government in each tribe. Even one's personal name had reference to the world of ghosts. The affirmation that American aborigines believed in an all-pervading, omnipotent Spirit is entirely inconsistent with the very nature of the case. (4) Worship was everywhere dramatic. Only here and there among the higher tribes were bloody sacrifices in vogue, and prayers were in pantomime.

In the culture areas the environment gave specific characters to the religion. In the Arctic province the overpowering influence of meteorological phenomena manifested itself both in the doctrine of shades and in their shamanistic practices. The raven created the world. The Déné (Tinneh) myths resembled those of the Eskimo, and all the hunting tribes of eastern Canada and United States and the Mississippi valley have a mythology based upon their zootechny and their totemism. The religious conceptions of the fishing tribes on the Pacific coast between Mount St Elias and the Columbia river are worked out by Boas; the transformation from the hunting to the agricultural mode of life was accompanied by changes in belief and worship quite as radical. These have been carefully studied by Cushing, Stevenson and Fewkes. The pompous ceremonials of the civilized tribes of Mexico and the Cordilleras in South America, when analysed, reveal only a higher grade of the prevailing idea. Im Thurn says of the Carib: "All objects, animate and inanimate, seem exactly of the same nature, except that they differ in the accident of bodily form." These mythological ideas and symbols of the American aborigines were woven in their textiles, painted on their robes and furniture, burned into their pottery, drawn in sand mosaics on deserts, and perpetuated in the only sculptures worthy of the name, in wood and stone. They are inseparable from industry; language, social organization and custom wait upon them: they explain the universe in the savage mind.

Archaeology.

The archaeology of the western hemisphere should be divided as follows: (1) that of Indian activities; (2) the question of man's existence in a prior geological period. There is no dividing line between first-contact ethnology and pre-contact archaeology. Historians of this time, both north and south of Panama, described tools and products of activities similar to those taken from beneath the soil near by. The archaeologist recovers his specimens from waste places, cave deposits, abandoned villages, caches, shell-heaps, refuse-heaps, enclosures, mounds, hut rings, earthworks, garden beds, quarries and workshops, petroglyphs, trails, graves and cemeteries, cliff and cavate dwellings, ancient pueblos, ruined stone dwellings, forts and temples, canals or reservoirs. The relics found in these places are material records of language, industries, fine arts, social life, lore and religion.

Here and there in the Arctic province remains of old village sites have been examined, and collections brought away by whalers and exploring expeditions. Two facts are established—namely, that the Eskimo lived formerly farther south on the Atlantic coast, and that, aboriginally, they were not specially adept in carving and etching. The old apparatus of hunting and fishing is quite primitive. The Déné (Tinneh) province in Alaska and north-western Canada yields nothing to the spade. Algonquin-Iroquois Canada, thanks to the Geological Survey and the Department of Education in Ontario, has revealed old Indian camps, mounds and earthworks along the northern drainage of Lakes Erie and Ontario, and pottery in a curved line from Montreal to Lake of the Woods. Throughout eastern United States shell-heaps, quarries, workshops and camp sites are in abundance. The Sioux and the Muskhogee province is the mound area, which extends also into Canada along the Red river. The forms of these are earth-heaps, conical mounds, walls of earth, rectangular pyramids and effigies (Putnam). Thomas sums up the work of the Bureau of American Ethnology upon the structure, contents and distribution of these earth monuments, over a vast area from which adobe, building stone and stone-working material were absent. (See Hodge's *List of Pubs. of the Bur. Am. Ethnol.*) No writings have been recovered, the artisans shaping small objects in stone were specially gifted, the potters in only a few places approached those of the Pueblos, the fine art was poor, and relics found in the mounds do not indicate in their makers a grade of culture above that of the Indian tribes near by. The archaeology of the Pacific coast, from the Aleutian Islands, is written in shell-heaps, village sites, caves, and burial-places (Dall, Harlan I. Smith, Schumacher). The relics of bone, antler, stone, shell and copper are of yesterday. Even the Calaveras man is no exception, since his skull and his polished conical pestle, the latter made of stone more recent than the auriferous gravels, show him to have been of Digger Indian type. In Utah begin the ruins of the Pueblo culture. These cover Arizona and New Mexico, with extensions into Colorado on the north and Mexico on the south. The reports of work done in this province for several years past form a library of text and illustration. Cliff dwellings, cavate houses, pueblos and casas are all brought into a series without a break by Bandelier, Cushing, Fewkes, Holmes, Hough,

AMERICA

PLATE V.

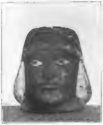

FIG. 1.—Reddish Brown Clay Vessel, in the form of a human head (portrait). Trujillo style. Chimboto, Peru. Inca culture

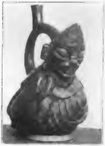

FIG. 2.—Red Clay Vessel, in the form of a demon shaped like a crab upon a mussel. Trujillo style. Chimboto, Peru. Inca culture.

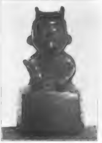

FIG. 3.—Black Clay Vessel, in the form of a human figure, with peculiar head-gear. Trujillo, Peru. Inca culture.

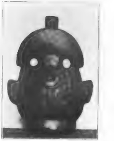

FIG. 4.—Black Clay Vessel, in the form of a human figure, with large head-gear and ornamentation of maize-cobs. Trujillo, Peru. Inca culture.

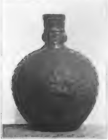

FIG. 5.—Red-Brown Clay Flask, with impressed relief representing a mythological scene. Supe, Peru.

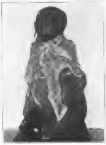

FIG. 6.—Female Mummy, with mantle of feathered mosaic; neckband, shawls, hair-net, head-wrap over tassels of parrot feathers. Peru. Inca culture.

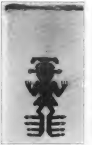

FIG. 7.—Textile Fabric, with stencilled human figure; colours, black, red-brown and yellow. Peru. Inca culture.

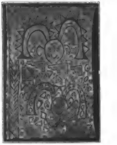

FIG. 8.—Coloured Textile Fabric, with picture writing. Peru.

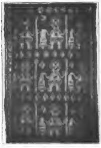

FIG. 9.—Textile Fabric in brown and yellowish white, with figures of birds and men holding staves and head trophies. Inca style. Peru.

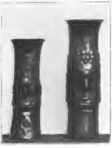

FIG. 10.—Two Gold Beakers, with human faces. Peru. Inca culture.

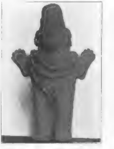

FIG. 11.—Human Clay Figure, with bead chain of mussel shells and of Venetian glass in the ears and on the neck; 1st period of Spanish conquest. Chancay, Peru.

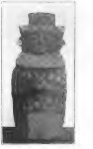

FIG. 12.—Black-Painted Clay Vessel, in form of a human figure holding a mussel. Chancay, Peru.

Mindeleff, Nordenskjöld, Powell and Stevenson. From Casa Grande, in Chihuahua, to Quemada, in Zacatecas, Carl S. Lumholtz found survivals of the cliff dwellers. Between Quemada and Copan, in Honduras, is an unbroken series of mural structures. The traditions agree with the monuments, whatever may be objected to assigning any one ruin to the Toltec, the Chichimec or the Nahuatl, that there are distinct varieties in ground-plan, motives, stone-craft, wall decorations and sculptures. Among these splendours in stone the following recent explorers must be the student's guide:—Bowditch, Charnay, Förstemann, F. T. Goodman, Gordon, Holmes, Maudslay, Mercer, Putnam, Sapper, Marshall H. Saville, Seler, Cyrus Thomas, Thompson. A list of the ruins, printed in the handbook on Mexico published by the Department of State in Washington, covers several pages. The special characteristics of each are to be seen partly in the skill and genius of their makers, and partly in the exigencies of the site and the available materials. A fascinating study in this connexion is that of the water-supply. The cenotes or underground reservoirs were the important factors in locating the ruins of northern Yucatan. From Honduras to Panama the urn burials, the pottery, the rude carved images and, above all, the grotesque jewellery, absorb the archaeologist's attention. (*Publications of Peabody Museum.*)

Beyond Chiriqui southward is El Dorado. Here also bewildering products of ancient metallurgy tax the imagination as to the processes involved, and questions of acculturation also interfere with true scientific results. The fact remains, however, that the curious metal-craft of the narrow strip along the Pacific from Mexico to Titicaca is the greatest of archaeological enigmas. Bandelier, Dorsey, Holmes, Seler and Uhle have taken up the questions anew. Beyond Colombia are Ecuador and Peru, where, in the widening of the continent, architecture, stone-working, pottery, metallurgy, textiles are again exalted. Among the Cordilleras in their western and interior drainages, over a space covering more than twenty degrees of latitude, the student comes again upon massive ruins. The materials on the coast were clay and gravel wrought into concrete, sun-dried bricks and pisé, or rammed work, cut stalks of plants formed with clay a kind of staff, and lintels were made by burying stems of caña brava (*Gynerium saccharoides*) in blocks of pisé. On the uplands structures were of stone laid up in a dozen ways. Walls for buildings, garden terraces and aqueducts were straight or sloping. Doorways were usually square, but corbelled archways and gateways surmounted with sculptures were not uncommon. Ornamentation was in carving and in colour, the latter far more effectively used than in Middle America. A glance at the exquisite textiles reveals at once the inspiration of mural decorations. The most prolific source of Peruvian relics is the sepulchres or huacas, the same materials being used in their construction as in building the houses. Here, owing to a dry climate, are the dead, clad and surrounded with food, vessels, tools and art products, as in life. The textiles and the pottery can only be mentioned; their quality and endless varieties astonish the technologist. In the Carib province there are no mural remains, but the pottery, with its excessive onlaying, recalls Mexico and the jewellers of Chiriqui. The polished stone work is superb, finding its climax in Porto Rico, which seems to have been the sacred island of the Caribs. For the coasts of South America the vast shell-heaps are the repositories of ancient history.

Palaeolithic man.

Since 1880 organized institutions of anthropology have taken the spade out of the hands of individual explorers in order to know the truth concerning Glacial or Pleistocene man. The geologist and the trained archaeologist are associated. In North America the sites have been examined by the Peabody Museum, the Bureau of American Ethnology, and others, with the result that only the Trenton gravels have any standing. The so-called palaeolithic implements are everywhere. The question is one of geology, simply to decide whether those recovered at Trenton are ancient. Putnam and George Frederick Wright maintain that they are ancient, Alex. Francis Chamberlain and Holmes that they are post-Glacial and comparatively recent (*Am. Anthrop.*, N.S. i. pp. 107, 614). Elsewhere in the United States fossilized bones, crania of a low order, association of human remains with those of fossil animals are not necessarily evidence of vast antiquity. In South America the shell-heaps, of enormous size, are supposed to show that the animals have undergone changes in size and that such vast masses require untold ages to accumulate. The first is a biological problem. As for the second, the elements of savage voracity and wastefulness, of uncertainty as to cubical contents on uneven surface, and of the number of mouths to fill, make it hazardous to construct a chronological table on a shell-heap. Hudson's village sites in Patagonia contain pottery, and that brings them all into the territory of Indian archaeology. Ameghino refers deposits in Patagonia, from which undoubted human bones and relics have been exhumed, to the Miocene. The question is of the age of the sediments from which these were taken. The bones of other associated animals, says John B. Hatcher, demonstrate the Pleistocene nature of the deposits, by which is not necessarily meant older Quaternary, for their horizons have not been differentiated and correlated in South America. Hatcher believes that "there is no good evidence in favour of a great antiquity for man in Patagonia." In a cave near Consuelo Cove, southern Patagonia, have been found fragments of the skin and bones of a large ground-sloth, *Grypotherium* (*Neomylodon*) *listai*, associated with human remains. Ameghino argues that this creature is still living, while Dr Moreno advances the theory that the animal has been extinct for a long period, and that it was domesticated by a people of great antiquity, who dwelt there prior to the Indians. Rodolfo Hauthal, Walter E. Roth and Dr R. Lehmann Nitsche review their work with the conclusion, not unanimously held by them, that man co-existed here with all the other animals whose remains were found during an inter-Glacial period. Arthur Smith Woodward sums up the question in *Proceedings of the Zoological Society of London*, closing with this sentence: "If we accept the confirmatory evidence afforded by Mr Spencer Moore, we can hardly refuse to believe that this ground-sloth was kept and fed by an early race of men." These are individual opinions, subject to revision by that court of appeals, the institutional judgment. (Summary in H. Hesketh Prichard, *Through the Heart of Patagonia* (1902), Appendix A.)

AUTHORITIES.—A valuable endowment of research in specimens, literature and pictures, deposited in libraries, museums and galleries since 1880, will keep ethnologists and archaeologists employed for many years to come. The scientific inquirer will find a mass of material in the papers and reports contributed to the numerous societies and institutions which are devoted to anthropological research. Museums of aboriginal culture are without number; in Washington the Smithsonian Institution, the National Museum, the Bureau of American Ethnology and the American Anthropologist issue publications on every division of the subject, lists of their publications and general bibliographies. Also the Peabody Museum, Cambridge; the American Museum of Natural History, New York; the Academy of Natural Sciences, Philadelphia; the Field Museum, Chicago; the California Academy and the California University, San Francisco; and the Canadian Institute, Toronto, publish monographs and lists. The most comprehensive work on North America is the *Handbook of American Indians* (prepared by the Bureau of American Ethnology, under W. H. Holmes, and edited by F. Webb Hodge).

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AMERICA ISLANDS, a name given to Christmas, Fanning, Palmyra and attendant islets, belonging to Great Britain, in the Central Pacific Ocean, between the equator and 6° N., and about 160° W. They are so named because frequented for their guano by traders from the United States. Christmas Island is probably the largest atoll in the Pacific (it is about 90 m. in circuit), and was discovered by Captain Cook in 1777. The islands were annexed by Great Britain in 1888 in view of the laying of the Pacific cable, of which Fanning Island is a station. Guano and mother-of-pearl shells are the principal articles of export; the population of the islands is about 300.

AMERICAN CIVIL WAR (1861–1865). 1. The Civil War between the northern and southern sections of the United States, which began with the bombardment of Fort Sumter on the 12th of April 1861, and came to an end, in the last days of April 1865, with the surrender of the Confederates, was in its scope one of the greatest struggles known to history. Its operations were spread over thousands of miles, vast numbers of men were employed, and both sides fought with an even more relentless determination than is usual when " armed nations " meet in battle. The duration of the war was due to the nature of the country and the enormous distances to be traversed, not to any want of energy, for the armies were in deadly earnest and their battles and combats (of which two thousand four hundred can be named) sterner than those of almost any war in modern history. The political history of the war, its antecedents and its consequences, are dealt with in the articles UNITED STATES (*History*) and CONFEDERATE STATES. For the purposes of the military narrative it is sufficient to say that eleven southern states seceded from the Union and formed the Confederate States of America. Jefferson Davis was chosen president of this confederacy, and an energetic government prepared to repel the expected attack of the " Union " states. The " resumption " by the seceding states of the coast defences (built on land ceded by the various states to the Federal government, and, it was argued, withdrawn therefore by the act of secession) brought on the war.

2. *Bombardment of Fort Sumter.*—South Carolina, finding other means of seizing or regaining Fort Sumter at Charleston ineffectual, ushered in the great struggle by the bombardment of the 12th of April 1861. Against overwhelming odds the United States troops held out until honour was satisfied; they then surrendered the ruins of the fort and were conveyed by warships to the north. At once the war spirit was aroused. President Lincoln called out 75,000 men. The few southern states which had not yet seceded, refused their contingents and promptly joined the " rebels," but there was no hesitation in the people of the North, and the state troops volunteered in far greater numbers than had been demanded. Nearly the whole of the nation had now definitely taken sides in the quarrel. The Confederacy consisted of eleven states (Virginia, North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas and Tennessee). All the remaining states and territories stood by the Union, except Missouri, Kentucky and Maryland, in which public opinion was divided. But the first operations of the war brought about the willing or unwilling adhesion of these border states to the Federal cause. Citizens of these states served on either side in the war. The small, but highly efficient, regular army stood by the president, though large numbers of the officers, amongst them many of the best in the service, left it when their states seceded. The navy likewise remained national, and of its officers very few went with their states, for the foreign relations of the navy tended to produce a sentiment wider than local. But the Federal armaments were not on such a scale as to enable the government to cope with a " nation in arms," and the first call for volunteers was followed by more and more, until in the end the Federals had more than a million men under arms. At first the troops on both sides were voluntarily enlisted, but the South quickly, the North later, put in force conscription acts. Reducing the figures to a three years' average, the North furnished about 45 % of her military population, the South not less than 90 % for that term. Even so the Confederacy was numerically, as in every other respect, far weaker, and rarely, after the second year, opposed equal numbers to the troops of the Union. Throughout the critical period of the war, that is, from the beginning of 1862 up to the day of Chattanooga, three distinct campaigns were always in progress. Virginia, separating the two hostile capitals, Richmond and Washington, was the theatre of the great campaigns of the east, where the flower of both armies fought. In the centre, the valleys of the Ohio, the Cumberland and the Tennessee were the battle-ground of large armies attacking and defending the south and south-eastern states of the Confederacy, while on and beyond the great waterway of the Mississippi was carried on the struggle for those interests, vital to either party, which depended on the mighty river and its affluents. Until the end of 1863 the events in these three regions remain distinct episodes; after that the whole theatre of war is comprised in the " anaconda policy," which concentrated irresistible masses of troops from all sides on the heroic remnants of the Confederacy. In Virginia and the east, Washington, situated on the outpost line of the Union, and separated by the " border " state of Maryland from Pennsylvania and the North, was for some time in great peril. Virginia, and with it the Federal navy yard at Norfolk and the arsenal at Harper's Ferry, was controlled by the rebels. Baltimore was the scene of a bloody riot as the first Northern regiment

(6th Mass.) passed through on its way to Washington on the 19th of April, and, until troops could be spared to protect the railway through Maryland, all reinforcements for the national capital had to be brought up to Annapolis by sea. When that state was reduced to order, the Potomac became the front, and, later, the base, of the Northern armies.

3. *Missouri and West Virginia.*—Missouri, at the other flank of the line, contained an even stronger Confederate element, and it was not without a severe struggle that the energy of Mr (afterwards General) F. P. Blair, and of Nathaniel Lyon, the Unionist military commander, prevailed over the party of secession. In Kentucky the Unionist victory was secured almost without a blow, and, even at the end of 1861, the Confederate outposts west of the Alleghenies lay no farther north than the line Columbus—Bowling Green—Cumberland Gap, though southern Missouri was still a contested ground. Between the Mississippi and the mountains the whole of the year was spent by both sides in preparing for the contest. In the east hostilities began in earnest in western Virginia. This part of the state, strongly Unionist, had striven to prevent secession, and soon became itself a state of the Union (1863). A force under General G. B. McClellan advanced from the Ohio in June and captured Philippi. This promptitude was not only dictated by the necessity of preserving West Virginia, but imposed by the necessity of holding the Baltimore & Ohio railway, which, as the great link between east and west, was essential to the Federal armies. A month later, an easy triumph was obtained by McClellan and Rosecrans against the Confederates of Virginia at Rich Mountain.

4. *First Bull Run.*—The opposing forces now in the field numbered 190,000 Unionists and half that number of Confederates; sixty-nine warships flew the Stars and Stripes and a number of improvised ironclads and gunboats the rival "Stars and Bars." On the 10th of June a Federal force was defeated at Big Bethel (near Fortress Monroe), and soon afterwards the main Virginian campaign began. On the Potomac the Unionist generals McDowell and Patterson commanded respectively the forces at Washington and Harper's Ferry, opposed by the Confederates under Generals J. E. Johnston and Beauregard at Winchester and at Manassas. The forces of these four commanders were raw but eager, and the people behind them clamoured for a decision. Much against his own judgment, Lieutenant-General Winfield Scott, the Federal general-in-chief, a veteran of the second war with England and of the war with Mexico, felt constrained to order an advance against Beauregard, while Patterson was to hold Johnston in check on the Shenandoah. On the 21st of July took place the first battle of Bull Run (*q.v.*) between McDowell and Beauregard, fought by the raw troops of both sides with an obstinacy that foreboded the desperate battles of subsequent campaigns. The arrival of Johnston on the previous evening and his lieutenant Kirby Smith at the crisis of the battle (for Patterson's part in the plan had completely failed), turned the scale, and the Federals, not yet disciplined to bear the strain of a great battle, broke and fled in wild rout. The equally raw Confederates were in no condition to pursue. A desultory duel between the forces of Rosecrans and Robert E. Lee in West Virginia, which ended in the withdrawal of the Confederates, and a few combats on the Potomac (Ball's Bluff or Leesburg, October 21; Dranesville, December 20), brought to a close the first campaign in the east.

5. *Close of the First Year.*—In the end Bull Run did more harm to the victors than to the conquered. The Southerners undeniably rested on their laurels, and enabled McClellan, who was now called to the chief military command at Washington, to raise, organize and train the famous Army of the Potomac, which, in defeat and victory, won its reputation as one of the finest armies of modern history. Johnston meanwhile was similarly employed in fashioning the equally famous Army of northern Virginia, which for three years carried the Confederacy on its bayonets. It was not until the people was stung by the humiliation of Bull Run that the unorganized enthusiasm of the North settled down into an invincible determination to crush the rebellion at all costs. The men of the South were not less in earnest, and the most highly individualized people in the world was thus found ready to accept a rigorous discipline as the only way to success. In the autumn, a spirited attempt was made by the Arkansas Confederates to reoccupy Missouri. Frémont, the Federal commander, proved quite unable to deal with this, and the gallant Lyon was defeated and killed at Wilson's Creek (August 10). Soon afterwards, after a steady resistance, the Unionist garrison of Lexington surrendered to Sterling Price. But the work of Blair and Lyon had not been in vain, and the mere menace of Frémont's advance sufficed to clear the state, while General John Pope, by vigorous action in the field and able civil administration, restored order and quiet in the northern part of the state. In the central theatre (Kentucky), the only event of importance was a daring reconnaissance of the Confederate fort at Columbus on the Mississippi by a small force under Brigadier-General U. S. Grant (action of Belmont, November 7).

6. *The Blockade.*—Meanwhile the Federal navy had settled down to its fourfold task of blockading the enemy's coast against the export of cotton and the import of war material, protecting the Union commerce afloat, hindering the creation of a Confederate navy and co-operating with the land forces. From the first months of the war the sea power of the Federals was practically unchallenged, and the whole length of the hostile coast-line was open to invasion. But the blockade of 3000 miles of coast was a far more formidable task, and international law required it to be effective in order to be respected. Nevertheless along the whole line some kind of surveillance was established long before the close of 1861, and, in proportion as the number of vessels available increased, the blockade became more and more stringent, until at last it was practically unbreakable at any point save by the fastest steamers working under unusually favourable conditions of wind and weather. As against the civilian enemy the navy strangled commerce; its military preponderance nipped in the bud every successive attempt of the Confederates to create a fleet (for each new vessel as it emerged from the estuary or harbour in which it had been built, was destroyed or driven back), while at any given point a secure base was available for the far-ranging operations of the Union armies. Two hundred and twelve warships or converted merchantmen were in commission on the 1st of January 1862. There had been several coastal successes in 1861, notably the occupation of Hatteras Inlet, North Carolina, by Commodore S. H. Stringham and General B. F. Butler (August 28–29, 1861), and the bombardment and capture of Forts Beauregard and Walker at Port Royal, South Carolina, by the fleet under Commodore S. F. duPont and the forces of General T. W. Sherman (November 7, 1861). Early in 1862 a large expedition under General A. E. Burnside and Commodore L. M. Goldsborough captured Roanoke Island, and the troops penetrated inland as far as Newbern (actions of February 8 and March 14). About the same time Fort Pulaski (the main defence of Savannah, Georgia) was invested and captured. But the greatest and most important enterprise was the capture of New Orleans (*q.v.*) by Flag-Officer D. G. Farragut and General Butler (April 18–25, 1862). This success opened up the lower Mississippi at the same time as the armies of the west began to move down that river under Grant, who was always accompanied by the gunboat flotilla which had been created on the upper waters in 1861. A slight campaign in New Mexico took place in February 1862, in which several brilliant tactical successes were won by the Texan forces, but no permanent foothold was secured by them.

7. *Fort Donelson.*—In the early months of 1862 preparations on a gigantic scale were made for the conquest of the South. McClellan and the Army of the Potomac faced Johnston, who with the Army of northern Virginia lay at Manassas, exercising and training his men with no less care than his opponent. Major-General D. C. Buell in Kentucky had likewise drilled his troops to a high state of efficiency and was preparing to move against the Confederate general Albert Sidney Johnston, whose reputation was that of being the foremost soldier on either side. Farther west the troops on both sides were by no means so well trained,

yet active operations began on the Tennessee. Here Fort Donelson on the Cumberland, Fort Henry on the Tennessee and Columbus on the Mississippi guarded the left of the Southern line, Sidney Johnston himself maintaining a precarious advanced position at Bowling Green, with his lieutenants, Zollicoffer and Crittenden, farther east at Mill Springs, and a small force under General Marshall in the mountains of eastern Kentucky. The last-named was soon defeated by General James A. Garfield at Prestonburg, and a few days later General G. H. Thomas won his first victory at Mill Springs (Logan's Cross Roads). Zollicoffer was killed and his army forced to make a disastrous retreat (January 19–20, 1862). The centre of Johnston's line (Forts Henry and Donelson) was next attacked by General Grant and Flag-Officer A. H. Foote. On the 6th of February Fort Henry fell to Foote's gunboat flotilla, and Grant then moved overland to Donelson. His troops were raw and possessed no decisive superiority in numbers, and sharp fighting took place when the garrison of Donelson tried to cut its way out. The attempt failed when almost on the point of success, and the Federals, under the excellent leadership of Generals C. F. Smith, Lew Wallace and McClernand, effected a lodgment in the works. The Confederate commanders proved themselves quite unequal to the crisis, and 15,000 men surrendered with the fort on the 16th of February.

8. *Island No. 10 and Pea Ridge.*—This very considerable success thrust back Johnston's whole line to New Madrid, Corinth and the Memphis & Charleston railway. The left flank, even after the evacuation of Columbus, was exposed, and the Missouri divisions under Pope quickly seized New Madrid. The adjoining river defences of Island No. 10 in the Mississippi proved more formidable. Foote's gunboats could, and did, run the gauntlet, but a canal had to be cut right round the batteries for the transports, before the land forces could cross the river and attack the works in rear; when this was accomplished, by the skill and energy of all concerned, the place with its garrison of 7000 men surrendered at once (April 8, 1862). Meanwhile, in the Missouri theatre, the Federal general Curtis, outnumbered and outmanœuvred by the forces of Price and Van Dorn, fought, and by his magnificent tenacity won, the battle of Pea Ridge (March 7–8), which put an end to the war in this quarter. On the whole, the first part of the western campaign was uniformly a brilliant success for the Federal arms. General H. W. Halleck, who was here in control of all the operations of the Federals, had meanwhile ordered Grant's force to ascend the Tennessee river and operate against Corinth; Buell's well-disciplined forces were to march overland from Nashville to join him, and General O. M. Mitchel with a division was sent straight southwards from the same place to cut the Memphis & Charleston line. The latter mission, brilliantly as it was executed, failed, through want of support, to secure a foothold. Had Halleck reinforced Mitchel, that officer might perhaps have forestalled the later victories of Grant and Sherman. As it was, the enterprise became a mere diversion.

9. *Shiloh.*—Meanwhile Grant was encamped at Pittsburg Landing on the Tennessee with an army of 45,000 men, and Buell with 37,000 men about two marches away. Early on the 6th of April A. S. Johnston and Beauregard completely surprised the camps of Grant's divisions. The battle of Shiloh (*q.v.*) was a savage scuffle between two half-disciplined hosts, contested with a fury rare even in this war. On the 6th the Unionists, scattered and unable to combine, were driven from point to point, and at nightfall barely held their ground on the banks of the river. The losses were enormous on both sides, Johnston himself being amongst the killed. The arrival of Buell enabled the Federals to take the offensive next morning along the whole line, and by sunset on the 7th, after another sanguinary battle, Beauregard was in full retreat. Some weeks afterwards, Halleck with the combined armies of Grant, Buell and Pope began the siege of Corinth, which Beauregard ultimately evacuated a month later. Thus the first campaign of the western armies, completed by the victory of the gunboat flotilla at Memphis (June 6), cleared the Mississippi as far down as Vicksburg, and compelled the Confederates to evacuate the Cumberland and a large portion of the Tennessee basins.

10. *The Peninsula.*—Many schemes were discussed between McClellan and President Lincoln before the Army of the Potomac finally took the offensive in Virginia. It was eventually decided that General Banks was to oppose "Stonewall" Jackson in the Shenandoah Valley, Frémont to hold western Virginia against the same general's enterprise, and McDowell with a strong corps to advance overland to meet McClellan, who, with the main army, was to proceed by sea to Fortress Monroe and thence to advance on Richmond. The James river, afterwards so much used for the Federal operations, was not yet clear, and it was here, in Hampton Roads, that the famous fight took place between the ironclads "Merrimac" (or "Virginia") and "Monitor" (March 8–9, 1862). McClellan's advance was opposed by a small force of Confederates under General Magruder, which, gradually reinforced, held the historic position of Yorktown for a whole month, and only evacuated it on the 3rd of May. Two days later McClellan's advanced troops fought a sharp combat at Williamsburg and the Army of the Potomac rendezvoused on the Chickahominy with its base at White House on the Pamunkey (May 7). J. E. Johnston had, long ere this, fallen back from Manassas towards Richmond, and the two armies were in touch when a serious check was given to McClellan by the brilliant successes of Jackson in the Shenandoah Valley.

11. *Jackson's Valley Campaign.*—The "Valley of Virginia," called also the "Granary of the Confederacy," was cut into long parallel strips by ridges and rivers, across which passages were rare, and along which the Confederates could, with little fear of interruption from the east, debouch into Maryland and approach Washington itself. Here Stonewall Jackson lay with a small force, and in front of him at the outlet of the valley was Banks, while Frémont threatened him from West Virginia. Jackson had already fought a winter campaign which ended in his defeat at the hands of General Shields at Kernstown (March 23). Banks's main army, early in May, lay far down the Valley at Strasburg and Front Royal, Frémont at the town of McDowell. Jackson's first blow fell on part of Frémont's corps, which was sharply attacked and driven into the mountains (McDowell, May 8). The victor quickly turned upon Banks, destroyed his garrison of Front Royal and nearly surrounded his main body; barely escaping, Banks was again defeated at Winchester and driven back to the Maryland border (May 23–25). These rapid successes paralysed the Federal offensive. McDowell, instead of marching to join McClellan, was ordered to the Valley to assist in "trapping Jackson," an operation which, at one critical moment very near success, ended in the defeat of Frémont at Cross Keys and of McDowell's advanced troops at Port Republic (June 8–9) and the escape of the daring Confederates with trifling loss. McClellan, deprived of McDowell's corps, felt himself reduced to impotence, and three Federal armies were vainly marching up and down the Valley when Johnston fell with all his forces upon the Army of the Potomac. The Federals lay on both sides of the Chickahominy river, and at this moment Johnston heard that McDowell's arrival need not be feared. The course of the battle of Seven Pines or Fair Oaks (*q.v.*) bore some resemblance to that of Shiloh; a sharp attack found the Unionists unprepared, and only after severe losses and many partial defeats could McClellan check the rebel advance. Here also fortune was against the Confederates. J. E. Johnston fell severely wounded, and in the end a properly connected and combined advance of the Army of the Potomac drove back his successor into the lines of Richmond (May 31–June 1).

12. *The Seven Days.*—Bad weather and skilful defence completely checked the assailants for another three weeks, and the situation was now materially altered. Jackson with the Valley troops had stealthily left Harrisonburg by rail on the 17th of June, and was now at Ashland in McClellan's rear. General Lee, who had succeeded Johnston in the command of the Army of northern Virginia, proposed to attack the Federals in their line of communication with White House, and passed most of his forces round to the aid of Jackson. The Seven Days' Battle (*q.v.*)

opened with the combat of Mechanicsville on the 26th of June, and the battle of Gaines' Mill on the 27th. Lee soon cut the communication with White House, but McClellan changed his base and retreated towards Harrison's Landing on the James river. It was some time before Lee realized this. In the end the Federals were sharply pursued, but McClellan had gained a long start and, fighting victoriously almost every day, at length placed himself in a secure position on the James, which was now patrolled by the Federal warships (June 26–July 1). But the second advance on Richmond was clearly a strategical failure.

13. *The Campaign of Perryville.*—After the capture of Corinth Halleck had suspended the Federal advance all along the line in the west, and many changes took place about this time. Halleck went to Washington as general-in-chief, Pope was transferred to Virginia, Grant, with his own Army of the Tennessee and Rosecrans's (lately Pope's) Army of the Mississippi, was entrusted with operations on the latter river, while Buell's Army of the Ohio was ordered to east Tennessee to relieve the inhabitants of that district, who, as Unionist sympathizers, were receiving harsh treatment from the Confederate and state authorities. Late in July Braxton Bragg, who had succeeded Beauregard in command of the Confederates, transferred his forces to the neighbourhood of Chattanooga. Tennessee was thenceforward to be the central theatre of war, and too late it was recognized that Mitchel should have been supported in the spring. The forces left south of Corinth were enough to occupy the attention of Grant and Rosecrans, and almost contemporaneously with Lee's advance on Washington (see below), Price and Bragg took the offensive against Grant and Buell respectively. The latter early in August lay near Murfreesboro, covering Nashville, but the Confederate general did not intend to threaten that place. The valleys and ridges of eastern Tennessee screened him as he rapidly marched on Louisville and Cincinnati. The whole of the Southern army in the west swung round on its left wing as the pivot, and Buell only just reached Louisville before his opponent. The Washington authorities, thoroughly dissatisfied, ordered him to turn over the command to General Thomas, but the latter magnanimously declined the offer, and Buell on the 8th of October fought the sanguinary and indecisive battle of Perryville, in consequence of which Bragg retired to Chattanooga.

14. *The Western Campaign.*—The Union leader was now ordered once more to east Tennessee, but he protested that want of supplies made such a move impossible. Rosecrans, the victor of Corinth and Iuka (see below), was thereupon ordered to replace him. Buell's failure to appreciate political considerations as a part of strategy justified his recall, but the value of his work, like that of McClellan, can hardly be measured by marches and victories. The disgraced general was not again employed, but the men of the Army of the Ohio retained throughout, as did those of the Army of the Potomac, the impress of their first general's discipline and training. Sterling Price in the meanwhile had been ordered forward against Grant and Rosecrans, and Van Dorn promised his assistance. Before the latter could come up, however, Rosecrans defeated Price at Iuka (September 19). The Confederates, not dismayed thereby, effected their junction and moved on Corinth, which was defended by Rosecrans and 23,000 Federal troops. Grant's other forces were split up into detachments, and when Van Dorn, boldly marching right round Rosecrans, descended upon Corinth from the north, Grant could hardly stir to help his subordinate. Rosecrans, however, won the battle of Corinth (October 3–4), though on the evening of the 3rd he had been in a perilous position. The Confederates fell back to the southward, escaping Grant once more, and thus ended the Confederate advance in the West.

15. *Pope's Campaign in Virginia.*—The Army of Virginia under Pope was composed of the troops lately chasing Jackson in the Valley—Frémont's (now Sigel's), Banks's and McDowell's corps. Halleck (at the Washington headquarters) began by withdrawing McClellan from the James to assist Pope in central Virginia; Lee, thus released from any fear for the safety of Richmond, turned swiftly upon Pope. That officer desired to concentrate his command on Gordonsville, but Jackson was before him at that place, and he fell back on Culpeper. On the 9th of August Banks and Jackson joined battle once more at Cedar Mountain (or Cedar Run); the Federals, though greatly inferior in numbers, attacked with much vigour. Banks was eventually beaten, but he had come very near to success, and Jackson soon retired across the Rapidan, where (the Army of the Potomac having now begun to leave the James) Lee joined him (August 17) with the corps of Longstreet. Pope now fell back behind the Rappahannock without showing fight. Here Halleck's orders bade him cover both Washington and Aquia Creek (whence the Army of the Potomac was to join him), orders almost impossible of execution, as any serious change of position necessarily uncovered one of these lines. The leading troops of the Army of the Potomac were now landed, and set out to join Pope's army, which faced Longstreet and Jackson on the Rappahannock between Bealton and Waterloo. On the 24th of August Lee ordered Jackson to march round Pope's right wing and descend on his rear through Thoroughfare Gap on Manassas and the old battle-ground of 1861. Pope was at this moment about to take the offensive, when a violent storm swelled the rivers and put an end to all movement. On the 26th of August the daring flank march of Jackson's corps ended at Manassas Station (see BULL RUN). Longstreet followed Jackson, and Lee's army was reunited on the battlefield. By the 1st of September the campaign of "Second Manassas" was over. Pope's army and such of the troops of the Army of the Potomac as had been involved in the catastrophe were driven, tired and disheartened, into the Washington lines. The Confederates were once more masters of eastern Virginia.

16. *Antietam.*—It was at this moment that Bragg was in the full tide of his temporary success in Tennessee and Kentucky, and, after his great victory of Second Bull Run, Lee naturally invaded Maryland, which, it was assumed, had not forgotten its Southern sympathies. But Lee received no real accession of strength, and when McClellan with all available forces moved out of Washington to encounter the Army of northern Virginia, the Confederates were still but a few marches from the point where they had crossed the Potomac. Lee had again divided his army. On the 13th of September Jackson was besieging 11,000 Federals in Harper's Ferry, Longstreet was at Hagerstown, Stuart's cavalry holding the passes of the South Mountain, while McClellan's whole army lay at Frederick. Here extraordinary good fortune put into the enemy's hands a copy of Lee's orders, from which it was clear that the Confederates were dangerously dispersed. Had McClellan moved at once he could have seized the passes without difficulty, as he was aware that he had only cavalry to oppose him. But the 13th was spent in idleness, and stubborn infantry now held the passes. A serious and costly action had to be fought before the way was cleared (battle of South Mountain, September 14). On the following day Harper's Ferry capitulated after a weak defence. Jackson thereupon swiftly rejoined Lee, leaving only a division to carry out the capitulation. On the 16th McClellan found Lee in position behind the Antietam Creek, and on the 17th was fought the sanguinary and obstinately contested battle of Antietam (*q.v.*) or Sharpsburg. At the price of enormous losses both sides escaped defeat in the field, but Lee's offensive was at an end and he retired into Virginia. Thenceforward the Confederacy was purely on the defensive. Only twice more did the forces of the South strike out (Gettysburg, 1863; Nashville, 1864), and then the offensive was more of a counter-attack than an advance.

17. *Vicksburg in 1862.*—The Confederate failures of Corinth, Perryville and Antietam were followed by a general advance by the Federals. It is about this time that Vicksburg becomes a place of importance. Farragut from New Orleans, and the gunboat flotilla from the upper waters, had engaged the batteries in June and July, but had returned to their respective stations, while a Federal force under General Williams, which had appeared before the fortress, retired to Baton Rouge. Early in August, Van Dorn, now in command of the place, sent a force to attack Williams, and on the 5th a hard-fought action took place at Baton Rouge, in which Williams was killed but his troops held

their own. At this time the minor fortress of Port Hudson was established to guard the rear of Vicksburg. In November Grant, with 57,000 men, began to move down from the north against General J. C. Pemberton, who has superseded the talented Van Dorn. A converging movement made by Grant from Grand Junction, W. T. Sherman from Memphis, and a force from Helena on the Arkansas side, failed, owing to Pemberton's prompt retirement to Oxford, Mississippi, and complications brought about by the intrigues of an able but intractable subordinate, McClernand, induced Grant to make a complete change of plan. Sherman was to proceed down the great river, and join the ships from the Gulf before Vicksburg, while Grant himself drove Pemberton southwards along the Mississippi Central railway. This double plan failed. Grant, as he pushed Pemberton before him to Granada, lengthened day by day his line of communication, and when Van Dorn, ever enterprising, raided the great Federal depot of Holly Springs the game was up. Grant retired hastily, for starvation was imminent, and Pemberton, thus freed, turned upon Sherman, and inflicted a severe defeat on that general at Chickasaw Bayou near Vicksburg (December 29). McClernand now assumed command, and on the 11th of January 1863 captured Fort Hindman near Arkansas Post. This was the solitary gain of the whole operation. Meanwhile Vicksburg was steadily becoming stronger and more formidable.

18. *Fredericksburg.*—McClellan, after the battle of the Antietam, paused for some time to reorganize his forces, some of which had barely recovered from the effects of Pope's unlucky campaign. He then slowly moved down the east side of the Blue Ridge, while Lee retired up the Valley on the west side of the same range. On the 6th of November the Army of the Potomac was at Warrenton, Lee at Culpeper, and Jackson in the Valley. When on the point of resuming the offensive, McClellan was suddenly superseded by Burnside, one of his corps commanders. Like Buell, McClellan had tempered the tools with which others were to strike; he was not again employed, and in his fall was involved his most brilliant subordinate, Fitz John Porter (*q.v.*). Burnside was by no means the equal of his predecessor, though a capable subordinate, and indeed only accepted the chief command with reluctance. He began his campaign by cancelling McClellan's operation, and, his own plan being to strike at Richmond from Fredericksburg, he moved the now augmented army to Falmouth opposite that place, hoping to surprise the crossing of the Rappahannock. Delays and neglect, not only at the front, but on the part of the headquarters staff at Washington, permitted Lee to seize the heights of the southern bank in time. When Burnside fought his battle of Fredericksburg (*q.v.*) an appalling reverse was the result, the more terrible as it was absolutely useless (December 13).

19. *Closing Operations of 1862.*—Chickasaw Bayou and Fredericksburg ended the Federal initiative in the west and the east; the Army of the Cumberland under Rosecrans alone could claim a victory. Buell's successor retained the positions about Nashville, whilst a new Army of the Ohio prepared to operate in east Tennessee. Bragg lay at Murfreesboro (see STONE RIVER), where Rosecrans attacked him on the 31st of December 1862. A very obstinate and bloody two days' battle ended in Bragg's retirement towards Chattanooga. During these campaigns the United States navy had not been idle. The part played by the gunboats on the upper Mississippi had been most conspicuous, as had been the operations of Farragut's heavier ships in the lower waters of the same river. The work of Du Pont and Goldsborough on the Atlantic coast has been alluded to above. Charleston was attacked without success in 1862, but from June to August 1863 it was besieged by General Gillmore and Admiral Dahlgren, and under great difficulties the Federals secured a lodgment, though it was not until Sherman appeared on the land side early in 1865 that the Confederate defence collapsed. Fort Fisher near Wilmington also underwent a memorable siege by land and sea. Certain incursions were from time to time made at different points along the whole sea-board. Minor operations moreover, especially in Arkansas and southern Missouri, were continually undertaken by both sides during 1862–1863, of which the battle of Prairie Grove, Arkansas (December 7, 1862), was the most notable incident. Meanwhile the blockade had become so stringent that few ordinary vessels could expect to break through, and a special type of steamer came into vogue for the purpose.

20. *Capture of Vicksburg.*—In 1863 the campaigns once more divided themselves accurately into those of east, centre and west. This year saw the greatest successes and the heaviest reverses of the Union army, Gettysburg and Vicksburg and Chattanooga against Chancellorsville and Chickamauga. Operations began in the west with the second advance upon Vicksburg. One corps of the Army of the Tennessee was detached to cover the Memphis & Charleston railway. Grant, with the other three under Sherman, McClernand and McPherson, moved by water to the neighbourhood of the fortress. Many weeks passed without any success to the Union arms. Vicksburg and its long line of fortifications stood on high bluffs, all else was swampy lowland and intricate waterways. As Sherman in 1862, so now Grant was unable to obtain any foothold on the high ground, and no effective attack was possible until this had been gained. At last, after many trials and failures, Grant took a daring step. The troops with their supplies marched round through a network of lakes and streams to a point south of Vicksburg; Admiral Porter's gunboats and the transports along with them "ran" the batteries. At Bruinsburg, beyond Pemberton's reach, a landing was made on the eastern bank and, without any base of supplies or line of retreat, Grant embarked upon a campaign which made him in the end master of the prize. On the 4th of July Pemberton surrendered the fortress and 37,000 men. Grant's endurance and daring had won what was perhaps the greatest success of the war. General Joseph Johnston with a small relieving army had appeared at Jackson, Mississippi, but had been held in check by General F. P. Blair and a force from the Army of the Tennessee; when Vicksburg surrendered a larger force was at once sent against him, whereupon he retired. In the meanwhile Banks had moved upstream from New Orleans, and laid siege to Port Hudson. Operations were pressed with vigour, and the place surrendered four days after Vicksburg. A Confederate attack on the post of Helena, Arkansas, was the last serious fight on the great river, and before the end of July the first merchant steamer from St Louis discharged her cargo at New Orleans.

21. *Chancellorsville and Gettysburg.*—In Virginia Burnside had made, in January 1863, an attempt to gain by manœuvre what he had missed in battle. The sudden swelling of rivers and downpour of rain stopped all movement at once, and the "Mud March" came to an end. A Federal general could retain his hold on the men after a reverse, but not after a farce: Burnside was replaced by General Joseph Hooker, who had a splendid reputation as a subordinate leader. The new commander displayed great energy in reorganizing the Army of the Potomac, the discipline of which had not come unscathed through a career of failure. Lee still held the battlefield of Fredericksburg and had not attempted the offensive, and in April he was much weakened by the detachment of Longstreet's corps to a minor theatre of operations. Hooker's operations began well, Lee was outmanœuvred and threatened in flank and rear, but the Federals were in the end involved in the confused and disastrous battle of Chancellorsville (*q.v.*). Stonewall Jackson was mortally wounded, but his men and those of Longstreet's who had remained with Lee defeated Hooker and forced him to retire again beyond the Rappahannock, though he had double Lee's force. But Hooker could at least make himself obeyed, and when Lee initiated his second invasion of the North a month after the battle of Chancellorsville, the Army of the Potomac was as resolute as ever. On the 9th of June the cavalry combat of Brandy Station made it clear to the Federal staff that Lee was about to use the Valley once more to screen an invasion of Maryland. Longstreet, A. P. Hill and Ewell (who were now Lee's corps commanders) were at one time scattered from Strasburg in the Valley to Fredericksburg, and Hooker earnestly begged to be allowed to attack them in detail. Success was certain, but the scheme was

vetoed by the Federal headquarters and government, whose first and ruling idea was to keep the Army of the Potomac between Lee and Washington. Hooker was thus compelled to follow Lee's movements. Ewell's men were raiding unchecked as far north as the Susquehanna, while Hooker was compelled to inactivity before the forces of Hill and Longstreet. The Federal general, within his limitations, acted prudently and skilfully. The Army of the Potomac crossed that river only one day later than Lee, and concentrated at Frederick. But Hooker was no longer trusted by the Washington authorities, and his dispositions were interfered with. Not allowed to control the operations of his own men, the unfortunate general resigned his command on the 28th. He was succeeded by General G. G. Meade, who, besides steadiness and ability, possessed the confidence of Lincoln and Halleck which Hooker had lacked. Meade was thus able to move promptly, Lee was compelled to meet him, and the Army of the Potomac began to take up its position on Pipe Creek, screened by Generals Reynolds and Buford at Gettysburg (*q.v.*). On the 1st of July the heads of Lee's columns engaged Buford's cavalry outposts, and the conflict began. All troops on both sides hurried to the unexpected battlefield, and after a great three days' battle, the Army of the Potomac emerged at last with a decisive victory. On the 4th, as Pemberton surrendered at Vicksburg, Lee drew off his shattered forces. One third of the Army of northern Virginia and one quarter of the Army of the Potomac remained on the field. Pursuit was not seriously undertaken, and the armies manœuvred back to the old battle-grounds of the Rapidan and the Rappahannock. A war of manœuvre followed, each side being reduced in turn by successive detachments sent to aid Rosecrans and Bragg in the struggle for Tennessee. In October Lee attempted a third Bull Run campaign on the same lines as the second, but Meade's steadiness foiled him, and he retired to the Rapidan again, where he in turn repulsed Meade's attempt to surprise him (Mine Run, November 26–28, 1863).

22. *Chickamauga.*—In the centre Rosecrans and Bragg spent the first six months of the year, as it were glaring at each other. Nothing was done by the main armies, but the far-ranging cavalry raids of the Confederates under J. H. Morgan and other leaders created much excitement, especially "Morgan's Raid" (June 27–July 26), through Indiana, Kentucky and Ohio, which states had hitherto little or no experience of the war on their own soil. At last the Army of the Cumberland advanced. Rosecrans manœuvred his opponent out of one position after another until Bragg was driven back into Chattanooga. These operations were very skilfully conducted by Rosecrans and his second-in-command, Thomas, and, at a trifling cost, advanced the Union outposts to the borders of Georgia. Burnside and the new Army of the Ohio had now cleared east Tennessee and occupied Knoxville (September 2), and meanwhile Rosecrans by a brilliant movement, in which he displayed no less daring in execution than skill in planning, once more manœuvred Bragg out of his position and occupied Chattanooga. But he had to fight to maintain his prize, and in the desperate battle of Chickamauga (*q.v.*) on the 19th and 20th of September, Bragg, reinforced by Longstreet from Virginia, won a complete victory. Thomas's defence won him the popular title of the "Rock of Chickamauga" and enabled Rosecrans to draw off his men, but the critical position of the Army of the Cumberland in Chattanooga aroused great alarm.

23. *Chattanooga.*—Grant was now given supreme command in the west, and the Army of the Tennessee (now under Sherman) and two corps from Virginia under Hooker were hurried by rail to Tennessee. In spite of his good record Rosecrans was deprived of his command. But Thomas, his successor, was one of the greatest soldiers of the war, and Grant's three generals, all men of great ability, set to work promptly. Hooker defeated Longstreet at Wauhatchie and revictualled Chattanooga (*q.v.*), and on the 23rd, 24th and 25th of November the three armies attacked Bragg's position. On the left Sherman made little progress; on the right, however, Hooker and the men from the Potomac army fought and won the extraordinary "Battle above the Clouds" on Lookout Mountain, and on the 25th the Confederate centre on Missionary Ridge was brilliantly stormed by Thomas and the Army of the Cumberland. Grant's triumph was decisive of the war in the west, and with Burnside's victory over Longstreet at Knoxville, the struggle for Tennessee was over. Vicksburg, Gettysburg and Chattanooga ended the crisis of the war, which had been at its worst for the Union in this year. Henceforth the South was fighting a hopeless battle.

24. *Plan of Campaign for 1864.*—Grant, now the foremost soldier in the Federal army, was on the 9th of March 1864 commissioned lieutenant-general and appointed general-in-chief. Halleck, Lincoln and Stanton, the intractable, if energetic, war secretary, now stood aside, and the efforts of the whole vast army were to be directed and co-ordinated by one supreme military authority. Sherman was to command in the west, Grant's headquarters accompanied Meade and the Army of the Potomac. The general plan was simple and comprehensive. Meade was to "hammer" Lee, and Sherman, at the head of the armies which had been engaged at Chattanooga and Knoxville, was to deal with the other great field army of Confederates under Johnston, and as far as possible gain ground for the Union in the south-east. Sherman's own plans went farther still, and included an eventual invasion of Virginia itself from the south, but this was not contemplated as part of the immediate programme. Butler with the new Army of the James was to move up that river towards Richmond and Petersburg. Subsidiary forces were to operate on the sea-board, in the Shenandoah Valley and elsewhere. At this time took place the Red River Expedition, which was intended for the subjugation of western Louisiana. The troops of General Banks and the war vessels under Admiral Porter moved up the Red river, and on the 16th of March 1864 reached Alexandria. Skirmishing constantly with the Confederates under Kirby Smith and Taylor, the Federals eventually on the 8th and 9th of April suffered serious reverses at Sabine Cross Roads and Pleasant Hill. Banks thereupon retreated, and, high water in the river having come to an end, the fleet was in the gravest danger of being cut off, until Colonel Bailey suggested, and rapidly carried out, the construction of a dam and weir over which the ships ran down to the lower waters. Eventually the various forces retired to the places whence they had come.

25. *The Wilderness Campaign.*— Virginia was now destined to be the scene of the bloodiest fighting of the whole war. Grant and Meade, reinforced by Burnside's IX. Corps to a strength of 120,000 men, crossed the Rapidan on the 4th of May with the intention of attacking Lee's inner flank, that nearer Richmond. With a bare 70,000 men the Confederate general struck at the flank of Grant's marching columns in that same Wilderness where Jackson had won his last battle twelve months before. The battle of the Wilderness (*q.v.*) went on for two days, with little advantage to either side. On his part Grant had lost 18,000 men. Lee had lost fewer, but could ill spare them, and Longstreet had been severely wounded (May 5–6). Grant, astonished perhaps, but here as always resolute, tried again to reach Lee's right wing, and on the 8th another desperate battle began at Spottsylvania (*q.v.*) Court House. The fighting on this field lasted ten days, at the end of which Grant had doubled his losses and was as far as ever from success. On the 21st of May, with extraordinary pertinacity, he sent Meade and Burnside once more against the inner flank of the Army of northern Virginia. The action of North Anna ended like the rest, though on this occasion the loss was small. A week later the Federals, again moving to their left, arrived upon the ground on which McClellan had fought two years before, and at Cold Harbor (Porter's battlefield of Gaines' Mill) the leading troops of the Army of the James joined the lieutenant-general. Meanwhile the minor armies had come to close quarters all along the line. The Army of the James moved towards Richmond on the same day on which the Army of the Potomac crossed the Rapidan. On the 16th of May Butler fought the indecisive battle of Drury's Bluff against Beauregard, in consequence of which he had to retire to Bermuda Hundred, whence most of his troops were sent to join Grant. At the same time the Union troops under Sigel in the Shenandoah Valley were defeated at New Market (May 15). General Hunter, who

replaced Sigel, won a combat at Piedmont, and marched on the 8th of June towards Lynchburg. The danger threatening this important point caused Lee to send thither General Early with the remnants of Jackson's old Valley troops. Hunter's assault (June 18) failed, and the Federals, unable to hold their ground, had to make a circuitous retreat to the Potomac by way of West Virginia.

26. *Cold Harbor.*—On the 3rd of June at Cold Harbor (*q.v.*) took place the last of Grant's "hammering" battles in the open fields. The attack of the Federals failed utterly; not even Fredericksburg was so disastrous a defeat. Six thousand men fell in one hour's fighting, and the total losses on this field, where skirmishing went on for many days, were 13,000. But Grant was as resolute as ever. His forces once more manœuvred against Lee's inner flank, still found no weak spot, and eventually arrived upon the James. The river was crossed, Lee as usual conforming to the movement, and on the 15th of June the Federals appeared before the works of Petersburg (*q.v.*). Here, and in the narrow neck of land between the Appomattox and the James, was the ganglion of the Confederacy, and the struggle for its possession was perhaps the greatest of modern history. A first assault made at once (June 15–18) failed with a loss of 8150 men. Two sharp combats followed on the 22nd of June and the 2nd of July, as Grant once more began to feel Lee's right. But the anniversary of Gettysburg saw Lee's works still intact, and 72,000 men of the Army of the Potomac and the Army of the James had fallen since the campaign had opened two months before. History has few examples to show comparable to this terrible campaign in Virginia. The ruthless determination of the superior leaders had been answered splendidly by the devotion of the troops, but the men of Chancellorsville and Gettysburg were mostly dead or wounded, and the recruits attracted by bounties or compelled by the "draft," which had at last been enforced in the North, proved far inferior soldiers to the gallant veterans whom they replaced.

27. *Petersburg.*—There was no formal siege of Lee's position. A vast network of fortifications covered the front of both armies, whose flank extended far to the south-west, Grant seeking to capture, Lee to defend, the Danville railway by which the Confederates received their supplies. Richmond, though no longer of paramount importance, was no less firmly held than Petersburg, and along the whole long line fighting went on with little interruption. On the 30th of July the Federal engineers exploded a mine under the hostile works, and Burnside's corps rushed to the assault. But the attempt ended in failure—the first defeat of the Army of the Potomac which could fairly be called discreditable. Still, Lee was losing men, few it is true, but most precious, since it was impossible to replace them, while the North poured unlimited numbers into the Federal camps. The policy of "attrition" upon which Grant had embarked, and which he was carrying through regardless of his losses, was having its effect. About this time Early, freed from the opposition of Hunter's forces, made a bold stroke upon Washington. Crossing the Potomac, he marched eastward, and, defeating a motley force (action of the Monocacy) which General Lew Wallace had collected to oppose him, appeared before the lines of Washington. The Federal capital was at the moment almost denuded of troops, and forces hastily despatched from the James only arrived just in time to save it. Thereupon the Confederates retired, narrowly escaping Hunter, and the brief campaign came to an end with an engagement at Kernstown. Early had been nearer to the immediate success than Lee had been in 1862 and 1863, but he had failed utterly to relax Grant's hold on Petersburg, which was becoming daily more crushing.

On the decisive theatre the Federals made their way, little by little and at a heavy cost, to the Weldon railway, and beyond it to the westward. Lee's lines were becoming dangerously extended, but he could not allow the enemy to cut him off from the west. On the 25th of August there was a battle at Reams Station, in which the Federals were forced back, and the famous II. Corps under Hancock was for the first time routed. But Grant was tireless, and five days later another battle was fought, at Peebles Farm, in which the lost ground was regained. Butler and the Army of the James at the same time won some successes in front of the Richmond works. One more attempt to outflank Lee to the westward was made by Grant without success, before winter came on, and the campaign closed with an expedition, under the direction of General Warren, which destroyed the Weldon line. Grant had not reached Lee's flank at any point, and his casualties from first to last had been unprecedentedly heavy, but "hammering" was steadily prevailing where skill and valour had failed.

28. *Sheridan's Valley Campaign.*—In the closing months of the year Grant's brilliant cavalry commander Sheridan had been put in command of an army to operate against Early in the Valley. The Federals in this quarter had hitherto suffered from want of unity in the command (*e.g.* Banks, Frémont and McDowell in 1862). The Army of the Shenandoah would not be thus handicapped, for Sheridan was a leader of exceptional character. The first encounter took place on the Opequan near Winchester. Early was defeated, but not routed (September 9), and another battle took place near Strasburg (Fisher's Hill) on the 22nd. Always disposing of superior numbers, Sheridan on this occasion won an important victory without much loss. A combat which took place, at Mount Jackson, during the pursuit, again ended successfully, and the triumphant Federals retired down the Valley, ruthlessly destroying everything which might be of the slightest value to the enemy. Early sharply followed them up, his men infuriated by the devastation of the "Granary of the Confederacy." At Cedar Creek (*q.v.*), during a momentary absence of the Federal commander, his camps were surprised by Early (October 19). The Army of the Shenandoah was routed and driven towards the Potomac. But the gallant stand of the old Potomac troops of the VI. Corps checked the Confederates. Sheridan arrived on the scene to find a new battle in progress. He was at his best at such a moment, and the rallied Federals under his command swept all before them. The victory was decisive, and, the country being now bare of supplies, the Army of the Shenandoah was sent to reinforce Grant, while the remnant of Early's forces also went to Petersburg. Sheridan's campaign was a famous episode of the war. It was conducted with skill, though, with twice the numbers of the enemy at his command, Sheridan's victory was a foregone conclusion. But he had at least shown that he possessed to an unusual degree the real attribute of a great captain—power over men.

29. *Sherman and Johnston.*—Meanwhile Sherman had fought his Atlanta campaign. General Johnston opposed him almost on the old Chickamauga battle-ground, where the Federal commander, after a brief campaign in Mississippi and Alabama, the result of which was to clear his right flank (February 3–March 6, 1864), collected his armies—the Army of the Tennessee under McPherson, the Army of the Cumberland under Thomas (Hooker's troops had now become part of this army) and the Army of the Ohio under Schofield. In the celebrated campaign of Atlanta the highest manœuvring skill was displayed by both the famous commanders. Whilst Grant, with his avowed object of crushing Lee's army, lost no opportunity of fighting a battle *coûte que coûte*, Sherman, intent rather on the conquest of territory, acted on different lines. Johnston, than whom there was no better soldier in the Confederate service when a careful defence was required, disposed of sensibly inferior forces, and it was to be expected that the 18th-century methods of making war by manœuvring and by combats, not battles, would receive a modern illustration in Georgia. Operations began early in May 1864, and five days of manœuvring and skirmishing about Resaca and Rocky Face ended in Johnston's retirement to Resaca. A fortnight later the same manœuvres, combined with constant "tapping" at the Confederate defences, caused him to fall back again. At Adairsville the same process was gone through, and Johnston retired to Cassville, where he offered battle. Sherman was far too wary to be drawn into an action under unfavourable conditions. If each general had been able to obtain a great battle upon his own terms, each would have fought most willingly, for neither desired a useless prolongation of the war. As it was, both declined to risk a

decision. Johnston's inferiority in numbers was now becoming lessened as Sherman had to detach more and more troops to his ever-lengthening communications with Chattanooga. Another manœuvre brought about a heavy combat near Dallas (Pickett's Mills and New Hope Church, May 25–27). After a time Johnston fell back, and on the 6th of June the Federals appeared before Marietta (*q.v.*). Hitherto neither leader had offered a weak spot to his opponent, though the constant skirmishing had caused a loss of 9000 men to Sherman and about two-thirds of that number to the Confederates. At this moment Sherman suddenly changed his policy and sent his troops straight against the hostile entrenchments. The neighbourhood of Marietta witnessed for the next fortnight very heavy fighting, notably at Pine Mountain on the 14th and Kenesaw on the 27th, both actions being frontal assaults gallantly pushed home and as gallantly repulsed. Sherman acted thus in order to teach his own men and the enemy that he was not "afraid," and the lesson was not valueless. He then resumed his manœuvring, which was now facilitated by improved weather and better roads.

30. *Atlanta.*—Johnston in due time evacuated the Marietta lines. On the 7th of July his fortifications on the Chattahoochee river were turned, and he fell back into the Atlanta (*q.v.*) position, which was carefully prepared, like all the others, beforehand. Here Johnston was deprived of his command. His campaign had not been unsuccessful, for Sherman had never succeeded in taking him at a disadvantage, but the whole of the South, including President Davis and his chief of staff General Bragg, clamoured for a more "energetic" policy, and General J. B. Hood was put in command on the understanding that he should "fight." The new general, whose bold and skilful leading had been conspicuous on most of the Virginia battlefields, promptly did so. At first successful, the Confederates had in the end to retire. A few days after this battle (called Peach Tree Creek) took place the battle of Atlanta, which was fiercely contested by the veterans of both sides, and in which McPherson, one of the best generals in the Union army, was killed. Still, Hood was again beaten. The Army of the Tennessee, under its new commander General O. O. Howard, fought and won the battle of Ezra Church on the 28th of July, and, Atlanta being now nearly surrounded, Hood was compelled to adopt the Fabian methods of his predecessor, and fell back to the southward. An attack on the Army of the Ohio near Jonesboro concluded the Atlanta campaign, which left Sherman in control of Atlanta, but hampered by the necessity of preserving his communications with Chattanooga and weakened by a total loss of 30,000 men. In this celebrated campaign the American generals rivalled if they did not excel the exploits of Marlborough, Eugene and Villars, under allied conditions.

31. *The March to the Sea.*—Although General Canby, with a Federal force in the south, had been ordered to capture Mobile early in the year—after which he was to operate towards Atlanta—Mobile still flew the Confederate flag, and Hood, about to resume the offensive, was thus able to base himself on Montgomery in order to attack Sherman in flank and rear. But the Federal commander was not to be shaken off from his prize. He held firmly to Atlanta, clearing the city of non-combatants and in other ways making ready for a stubborn defence. Thomas and the Army of the Cumberland were sent back to guard Tennessee. A heavy attack on the post of Allatoona (to the garrison of which Sherman sent the famous message, "Hold the fort, for I am coming") was repulsed (October 5). The main armies quickly regained contact, each edging away north-westwards towards the Tennessee and coming into contact at Gaylesville, Alabama, and again at Decatur. General Slocum with Hooker's old Potomac troops garrisoned Atlanta, and every important post along the railway to Chattanooga was held in force. Sherman had now resolved to execute his plan of a march through Georgia to the sea and thence through the Carolinas towards Virginia, destroying everything of military value *en route*. With the provisos that if Lee turned upon Sherman, Grant must follow him up sharply, and that Thomas could be left to deal with Hood (both of which could be, and were, done), the scheme might well be decisive of the war. Preparations were carefully made. Fifty thousand picked men were to march through Georgia with Sherman, and Thomas was to be reinforced by all other forces available. There was no force to oppose the "March to the Sea." Hood was far away on the Tennessee, which he crossed on the 29th of October at Tuscumbia, making for Nashville. Want of supplies checked the Confederates after a few marches, while Schofield was pressing forward to meet them at Pulaski and Thomas was gathering, at Nashville, a motley army drawn from all parts of the west. It was at this same time that Sherman broke up his railway communication, destroying Atlanta as a place of arms, and set out on his adventurous expedition. There was little in his path. Skirmishes at Macon and Milledgeville alone varied the daily routine of railway-breaking and supply-finding, in which a belt of country 60 m. wide was absolutely cleared. On the 10th of December the army, thoroughly invigorated by its march, appeared before the defences of Savannah. On the 13th of December a division stormed Fort McAllister, and communication was opened with the Federal fleet. The march concluded with the occupation of Savannah on the 20th.

32. *Nashville.*—Hood, at a loss to divine Sherman's purpose, hastened on into Tennessee amidst weather which would have stopped most troops. Schofield met him on the Duck river, while Thomas was shaping his army in rear. Hood manœuvred Schofield out of his lines and pushed on once more. At Franklin Schofield had to accept battle, and thirteen distinct assaults on his works were made, all pushed with extraordinary fury and lasting far into the night. Thomas ordered his lieutenant to retire on Nashville, Hood following him up, impressing recruits, transports and supplies, and generally repeating the scenes of Bragg's march of 1862. The civil authorities and the lieutenant-general also urgently demanded that Thomas should advance. Constancy of purpose was the salient feature of Thomas's military character. He would not fight till he was ready. But this last great counter-stroke of the Confederacy alarmed the whole North. So great was the tension that Grant finally sent General J. A. Logan to take command. But before Logan arrived, Thomas had on the 15th and 16th of December fought and won the battle of Nashville (*q.v.*), the most crushing victory of the whole war. Hood's army was absolutely ruined. Only a remnant of it reassembled beyond the Tennessee.

33. *The Carolinas.*—From Savannah, Sherman started on his final march through the Carolinas. Columbia, his first objective, was reached on the 17th of February 1865. As usual, all that could be of possible value to the enemy was destroyed and, by some accident, the town itself was burned. Sherman, like Sheridan, was much criticized for his methods of reducing opposition, but it does not seem that his "bummers" were guilty of wanton cruelty and destructiveness, at least in general, though the cavalry naturally gave more ground for the accusation than the main body of the army. And the methods of the Confederates had on occasion been somewhat similar. The Confederate general Hardee managed to gather some force (chiefly from the evacuated coast towns) wherewith to oppose the onward progress of the Federals. As commander-in-chief, Lee now reappointed Johnston to command, and the latter soon attacked and very nearly defeated his old opponent at Bentonville (March 19–20). But the "bummers" were no mere marauders, but picked men from the armies that had won Vicksburg and Chattanooga, and, though surrounded, held their ground stoutly and successfully. Advancing once more, they were joined at Goldsboro by the forces lately besieging Fort Fisher (see below), and nearly 90,000 men marched northward towards Virginia, pushing Johnston's weak army before them. Meanwhile the bulk of the forces at Nashville had been sent to the north-east to close Lee's escape to the mountains, and in March the final campaign had opened at Petersburg.

34. *The Final Campaign.*—At last Lee's men had lost heart in the unequal struggle. Sheridan raided the upper James and destroyed all supplies. Grant lay in front of the Army of northern Virginia with 125,000 men, and when active operations

began Lee had no resource but to try and escape to the south-west in order to join Johnston. The western movement was covered by a furious sortie from the lines of Petersburg, which was repulsed with heavy loss. Grant felt that this was a mere feint to screen some other move, and instantly carried the Army of the Potomac to the westward, leaving a bare screen of troops in his lines. On the 29th of March the movement began, followed in rapid succession by the combats of White Oak Road and Dinwiddie Court House and Sheridan's great victory of Five Forks. At the same time the VI. Corps at last carried the Petersburg lines by storm. Thereupon Lee and Longstreet evacuated the Petersburg and Richmond lines and began their retreat. Their men were practically starving, though their rearguard showed a brave front. The remnant of Ewell's corps was cut off at Sailor's Creek, and when Sheridan got ahead of the Confederates while Grant furiously pressed them in the rear, surrender was inevitable (April 8). On the 9th the gallant remnant of the Army of northern Virginia laid down its arms at Appomattox Court House, and the Confederacy came to an end. Johnston surrendered to Sherman at Durham Station on the 26th, and soon afterwards all the remaining Confederate soldiers followed their example. So ended the gigantic struggle, as to the conduct of which it is only necessary to quote, with a more general application, the *envoi* of a Federal historian, "It has not seemed necessary to me to attempt a eulogy of the Army of the Potomac or the Army of northern Virginia." The general terms of surrender were that the Confederates should give up all material, and sign a parole not to take up arms again. There were no manifestations of triumph or exultation on the part of the victors, the lot of the vanquished was made as easy as possible, and after a short time the armies melted into the mass of the people without disturbance or disorder. A general amnesty proclaimed by the president of the United States on the 29th of May was the formal ending of the Civil War.

35. *Character of the War.*—No undisciplined levies could have fought as did the armies on both sides. Grave faults the men had, from the regular's point of view. They required humouring, and their march discipline was very elastic. But in battle the "thinking bayonets" resolutely obeyed orders, even though it were to attack a Marye's Hill, or a "Bloody Angle," for they had undertaken their task and would carry it through unflinchingly. So much may be said of both armies. The great advantage of the Confederate—an advantage which he had in a less degree as against the hardier and country-bred Federal of the west—was that he was a hunter and rider born and bred, an excellent shot, and still not infrequently settled his quarrels by the duel. The town-bred soldier of the eastern states was a thoughtful citizen who was determined to do his duty, but he had far less natural aptitude for war than his enemy from the Carolinas or his comrade from Illinois or Kansas. At the same time the more varied conditions of urban life made him more adaptable to changes of climate and of occupation than the "Southron." Irish brigades served on both sides and shot each other to pieces as at Fredericksburg. They had the reputation of being excellent soldiers. The German divisions, on the other hand, were rarely as good as the rest. The leading of these men was in the hands, as a rule, of regular or ex-regular officers, who made many mistakes in their handling of large masses, but had been taught at West Point and on the Indian frontier to command men in danger, and administer them in camp. The volunteer officers rarely led more than a division. When given high command at once they usually failed, but the best of them rose gradually to the superior ranks; Logan, for instance, became an army commander, Sickles, Terry and others corps commanders. Cleburne, one of the best division commanders of the South, had been a corporal in the British army. Meagher, the leader of the "Irish brigade" at Fredericksburg, was the young orator of the "United Irishmen." But Lee, the Johnstons, McClellan, Grant and Sherman had all served in the old army. Most of them were young men in 1861. Stuart was twenty-eight, Sheridan thirty, Grant and Jackson under forty, while some of the subordinate generals were actually fresh from West Point.

36. *Strategy and Tactics.*—The roughness of much of the country gave a peculiar tone to the strategy of the combatants. Roads were untrustworthy, rivers swelled suddenly, advance and retreat were conditioned and compelled, especially in the case of the ill-equipped Confederates, by the exigencies of food supply. Long forward strides of the Napoleonic type were rarely attempted; "changes of base" were indeed made across country, and over considerable distances, as by Sherman in 1864, but ordinarily either the base and the objective were connected by rail or water, or else every forward step was, after the manner of Marlborough's time, organized as a separate campaign. Hence field fortifications played an unusually prominent part, time and material being available as a rule for works of solid construction. In isolated instances of more rapid campaigning—*e.g.* Antietam and Gettysburg—they were of subordinate importance. The attack and defence of these entrenchments led to tactical phenomena of unusual interest. Cavalry could not bring about the decision in such country, and sought a field for its restless activity elsewhere. Artillery had fallen, technically, far behind the infantry arm, and in face of long-range rifle fire could not annihilate the hostile line with case-shot fire as in the days of Napoleon. In a battle such as Chancellorsville or the Wilderness guns were almost valueless, since there was little open space in which they might be used. It thus fell to the infantry to attack and defend with its own weapons, and the defence was, locally, almost inexpugnable behind its tall breastworks. One line of works could be stormed, but there were almost always two or three retrenchments behind. The attacking infantry, who found it necessary to cross a fire-swept zone 1000 yds. broad, had to be used resolutely in masses, line following line, and each carrying forward the wrecks of its predecessor. Partial attacks were invariably costly failures. The use of masses was never put in practice more sternly than by Grant in 1864. At the same time, as has been said, the cavalry arm found plenty of work. The horses were not trained for European shock-tactics, nor did the country offer charging room, and though mêlées of mounted men engaging with sword and pistol were not infrequent, the usual method of fighting was dismounted fire action, which was practised with uncommon skill by the troopers on both sides. The far-ranging strategic "raid" was a notable feature of the war; freely employed by both sides, it was sometimes harmful, more usually profitable, especially to the South, by reason of the captures in material, the information acquired and the alarm and confusion created. These raids, and the more ordinary screening work, were never executed more brilliantly than by Lee's great cavalry general, "Jeb" Stuart, in Virginia, but the Federal generals, Pleasonton and Sheridan, did excellent work in the east, as also Wheeler and Forrest on the Confederate, Wilson and Grierson on the Federal, side in the west. The technical services, in which the mechanical skill and ingenuity of the American had full play, developed remarkable efficiency. Whether it was desired to build a railway bridge, disable a locomotive or cut a canal, the engineers were always ready with some happy expedient. On one occasion an *infantry* division of 8000 men repaired 102 miles of railway and built 182 bridges in 40 days, forging their own tools and using local resources. Many novelties, too, such as the field telegraph, balloons and signalling, were employed.

37. *The Union and Confederate Navies.*—The naval war had been likewise fruitful of lessons for the future. Though wooden ships were still largely employed, the ironclad even then had begun to take a commanding place, and the sailing ship at last disappeared from naval warfare. Mines, torpedoes and submarines were all employed, and with the "Monitor" may fairly be said to have begun the application of mechanical science to the uses of naval war. The Federal navy was enormously expanded. Three hundred and thirteen steamers were brought into the service. Sloops of an excellent type were built for work on the high seas, of which the celebrated "Kearsarge" was one. Gunboats were constructed so fast that they were called "ninety-day gunboats." Special reversible paddle steamers (called double-enders) were designed for service in the inlets and estuaries, and sixty-six ironclads were built and employed during the four

years. Mississippi river steamers were armed with heavy guns and protected by armour, boiler-plates, cotton bales, &c., and some fast cruisers were constructed for ocean work, one of them actually reaching the high speed of 17·75 m. per hour. The existing Federal navy of 1861 already included some large and powerful modern vessels, such as the "Minnesota" and "Powhatan." To oppose them the Confederates, limited as they were for means, managed to construct various ironclads, and to improvise a considerable fleet of minor vessels, and, though a fighting navy never assembled under a Confederate flag-officer, the Southern warships found another more damaging and more profitable scope for their activity. It has been said that the blockade of the Confederate coast became in the end practically impenetrable, and that every attempt of the Confederate naval forces to break out was checked at once by crushing numerical preponderance. The exciting and profitable occupation of blockade-running led to countless small fights off the various harbours, and sometimes the United States navy had to fight a more serious action when some new "rebel" ironclad emerged from her harbour, inlet or sound.

38. *Fort Fisher.*—Many of the greater combats in which the navy was engaged on the coast and inland have been referred to above, and the fighting before Charleston, New Orleans, Mobile and Vicksburg is described in separate articles. One of the heaviest of the battles was fought at Fort Fisher in 1864. This place guarded the approaches to Wilmington, North Carolina. Troops under Butler and a large fleet under Admiral Porter were destined for this enterprise. An incendiary vessel was exploded close to the works without effect on the 23rd–24th of December, and the ships engaged on the 24th. The next day the troops were disembarked, only to be called off after a partial assault. Butler then withdrew, and Porter was informed on the 31st that "a competent force properly commanded" would be sent out. On the 8th of January 1865 General Terry arrived with the land forces, and the armada arrived off Fisher on the 12th. On the 13th, 6000 men were landed, covered by the guns of the fleet, and, after Porter had subjected the works to a terrific bombardment, Fisher was brilliantly carried by storm on the 15th. Reinforcements arriving, the whole force then marched inland to meet Sherman.

39. *Other Naval Actions.*—Apart from this, and other actions referred to, two incidents of the coast war call for notice—the career of the "Albemarle" and the duel between the "Atlanta" and the "Weehawken." The ironclad ram "Albemarle," built at Edwards' Ferry on the Roanoke river, had done considerable damage to the Federal vessels which, since Burnside's expedition to Newberne, had cruised in Albemarle Sound, and in 1864 a force of double-enders and gunboats, under Captain Melancton Smith, U.S.N., was given the special task of destroying the rebel ram. A naval battle was fought on the 5th of May 1864, in which the double-ender "Sassacus" most gallantly rammed the "Albemarle" and was disabled alongside her, and Smith's vessel and others, unarmoured as they were, fought the ram at close quarters. After this the ironclad retired upstream, where she was eventually destroyed in the most daring manner by a boat's crew under Lieutenant W. B. Cushing. Making his way up the Roanoke as far as Plymouth he there sank the ironclad at her wharf by exploding a spar-torpedo (October 27). On the 17th of June 1863 after a brief action the monitor "Weehawken" captured the Confederate ironclad "Atlanta" in Wassaw Sound, South Carolina. This duel resembled in its attendant circumstances the famous fight of the "Chesapeake" and the "Shannon." Captain John Rodgers, like Broke, was one of the best officers, and the "Weehawken," like the "Shannon," was known as one of the smartest ships in the service. Five heavy accurate shots from the Federal's turret guns crushed the enemy in a few minutes.

40. *The Commerce-Destroyers.*—Letters of marque were issued to Confederate privateers as early as April 1861, and Federal commerce at once began to suffer. When, however, surveillance became blockade, prizes could only with difficulty be brought into port, and, since the parties interested gained nothing by burning merchantmen, privateering soon died out, and was replaced by commerce-destroying pure and simple, carried out by commissioned vessels of the Confederate navy. Captain Raphael Semmes of the C.S.S. "Sumter" made a successful cruise on the high seas, and before she was abandoned at Gibraltar had made seventeen prizes. Unable to build at home, the Confederates sought warships abroad, evading the obligations of neutrality by various ingenious expedients. The "Florida" (built at Liverpool in 1861–1862) crossed the Atlantic, refitted at Mobile, escaped the blockaders, and fulfilled the instructions which, as her captain said, "left much to the discretion but more to the torch." She was captured by the U.S.S. "Wachusett" in the neutral harbour of Bahia (October 7, 1862). The most successful of the foreign-built cruisers was the famous "Alabama," commanded by Semmes and built at Liverpool. In the course of her career she burned or brought into port seventy prizes, fought and sank the U.S.S. "Hatteras" off Galveston, and was finally sunk by the U.S.S. "Kearsarge," Captain Winslow, off Cherbourg (June 19, 1864). The career of another promising cruiser, the "Nashville," was summarily ended by the Federal monitor "Montauk" (February 28, 1863). The "Shenandoah" was burning Union whalers in the Bering Sea when the war came to an end. None of the various "rams" built abroad for the "rebel" government ever came into action. The difficulties of coaling and the obligations of neutrality hampered these commerce-destroyers as much as the Federal vessels that were chasing them, but, in spite of drawbacks, the *guerre de course* was the most successful warlike operation undertaken by the Confederacy. The mercantile marine of the United States was almost driven off the high seas by the terror of these destructive cruisers.

41. *Cost of the War.*—The total loss of life in the Union forces during the four years of war was 359,528, and of the many thousands discharged from the services as disabled or otherwise unfit, a large number died in consequence of injuries or disease incurred in the army. The estimate of 500,000 in all may be taken as approximately correct. The same number is given as that of the Southern losses, which of course fell upon a much smaller population. The war expenditure of the Federal government has been estimated at $3,400,000,000; the very large sums devoted to the pensions of widows, disabled men, &c., are not included in this amount (Dodge). In 1879 an estimate made of all Federal war expenses up to that date, including pension charges, interest on loans, &c., showed a total of $6,190,000,000 (Dewey, *Financial History of the United States*).

BIBLIOGRAPHY.—The United States government's *Official Records of the Union and Confederate Armies* (70 vols., most of which are divided into two or three "parts," and atlas, 1880–1900) include every important official document of either side that it was possible to obtain in the course of many years' work. A similar but less voluminous work is the *Records of the Union and Confederate Navies* (1894–); *The Rebellion Record* (1862–1868), edited by F. W. Moore, a contemporary collection, has been superseded to a great extent by the official records, but is still valuable as a collection of unofficial documents of all kinds. *Battles and Leaders of the Civil War* (1887–1889) is a series of papers, covering the whole war, written by the prominent commanders of both sides. The sixteen volumes of the *Campaigns of the Civil War* (1881–1882) and the *Navy in the Civil War* (1883) (written by various authors) are of very unequal merit, but several of the volumes are indispensable to the study of the Civil War. Of general works the following are the best:—Comte de Paris, *History of the Civil War in America*, translated from the French (1875–1888); Horace Greeley, *The American Conflict* (1864–1866); J. Scheibert, *Der Bürgerkrieg i. d. Nordam. Freistaaten* (Berlin, 1874); Wood and Edmonds, *Civil War in the United States* (London, 1905); T. A. Dodge, *Bird's Eye View of our Civil War* (revised edition, 1887); E. A. Pollard, *A Southern History of the War* (1866). The contemporary accounts mentioned should be studied with caution. Of critical works, J. C. Ropes, *The Story of the Civil War* (1894–1898); G. F. R. Henderson, *Stonewall Jackson and the American Civil War* (London, 1898) and *The Science of War*, chapters viii. and ix. (London, 1905); C. C. Chesney, *Essays in Military Biography* (1874); Freytag-Loringhoven, *Studien über Kriegführung, 1861–1865* (Berlin, 1901–1903), are the most important. Publications of the Military Historical Society of Massachusetts (vols. i.-x., 1881 onwards) also comprise critical accounts of nearly all the important campaigns. A critical account of the Virginian operations and the Chickamauga campaign is Gen. E. P. Alexander's *Military Memoirs of a Confederate* (1906). C. R. Cooper, *Chronological and Alphabetical Record of the Great Civil War* (Milwaukee, 1904) may be mentioned as a work of reference.

A fairly complete bibliography will be found in J. N. Larned, *Literature of American History* (Boston, 1902), and useful lists in Ropes, *op. cit.*, and in the *Cambridge Modern History*, vol. vii. p. 812. For biographies, memoirs and general works, see the lists appended to the various biographical articles and to the articles UNITED STATES and CONFEDERATE STATES. (C. F. A.)

AMERICAN LAW. The laws of the various states and territories of the United States rest at bottom on the same foundation as those of England, namely, the English common law as it existed at the beginning of the 17th century. (See ENGLISH LAW.) The only exceptions worth noting are to be found in the state of Louisiana, the territory of New Mexico, and the acquisitions following the Spanish war of 1898. Those derive most of their law from France or Spain, and thus remotely from the principles of Roman jurisprudence. A part also, but comparatively a small part, of the law of Texas, Missouri, Arizona and the Pacific states comes from similar sources. The United States as a whole has no common law, except so far as its courts have followed the rules of English common-law procedure in determining their own. Most of the positive law of the United States comes from the several states. It is the right of each state to regulate at its pleasure the general relations of persons within its territory to each other, as well as all rights to property subject to its jurisdiction. Each state has also its own system of adjective law. The trial courts of the United States of original jurisdiction follow in general the practice of the state in which they sit as to procedure in cases of common-law character. As to that in equity, or what means the same thing, chancery causes, they follow in general the practice of the English court of chancery as it existed towards the close of the 18th century, when the original Judiciary Act of the United States was adopted. The public statutes of the United States are to be found in the *Revised Statutes* of 1873, and in the succeeding volumes of the *Statutes at Large*, enacted by each Congress. Those of each state and territory are printed annually or biennially as they are enacted by each legislature, and are commonly revised every fifteen or twenty years, the revision taking the place of all former public statutes, and being entitled *Revised Statutes*, *General Statutes*, or *Public Laws*. The private or special laws of each state, so far as such legislation is permitted by its constitution, are in some states published separately, and made the subject of similar compilations or revisions; in others they are printed with the public session laws. American courts are often given power by statute to make rules of procedure which have the force of laws. Municipal subdivisions of a state generally have authority from the legislature to make ordinances or by-laws on certain subjects, having the character of a local law, with appropriate sanctions, commonly by fine or forfeiture.

The XIVth Amendment.

Law in the United States has been greatly affected by the results of the Civil War. During its course (1861–1865) the powers of the president of the United States may be said to have been re-defined by the courts. It was its first civil war, and thus for the first time the exercise of the military authority of the United States within a state which had not sought its aid became frequent and necessary. Next followed the amendments of the Constitution of the United States having for their special purpose the securing beyond question of the permanent abolition of slavery and the civil and political rights of the coloured race. At the outset the Supreme Court of the United States was inclined to treat them as having a very limited operation in other directions. One of the provisions of the XIVth Amendment is that no state shall deny to any person within its jurisdiction the equal protection of the laws. The benefit of this guarantee was claimed by the butchers of New Orleans, in contending against a monopoly in respect of the slaughter of cattle granted by the state of Louisiana to a single corporation. Their suit was dismissed by the Supreme Court in 1873, with the expression of a doubt whether any action of a state not directed by way of discrimination against the negroes as a class, or on account of their race, would ever be held to come within the purview of the provision in question.[1] The chief justice and three of his associates dissented from the judgment, holding that the XIVth Amendment did protect the citizens of the United States against the deprivation of their common rights by state legislation.[2] Public sentiment supported the view of the minority, and it was not long before changes in the *personnel* of the court, occurring in common course, led it to the same conclusions. The protection of the XIVth Amendment is now invoked before it more frequently than is that afforded by any other article of the Constitution. In one of its recent terms twenty-one cases of this nature were decided.[3] Very few of them related to the negro. Since the decision in the Slaughter-House Cases, the controversies as to the constitutional rights of the negro have been comparatively infrequent, but there has been a great and steadily increasing number in all the courts in the country, involving questions of discrimination in favour of or against particular individuals, or of changes affecting the rights of parties in the accustomed forms of judicial procedure.

Down to 1868, when this amendment was adopted, it was, as to most matters, for the state alone to settle the civil rights and immunities of those subject to its jurisdiction. If they were to be free from arbitrary arrests, secure in liberty and property, equal in privilege and entitled to an impartial administration, it was because the constitution of the state so declared. Now they have the guarantee of the United States that the state shall never recede from these obligations. This has readjusted and reset the whole system of the American law of personal rights.[4]

The Supreme Court of the United States has used the great power thus confided to it with moderation. Its general rules of decision are well stated in these words of Mr Justice Brown, found in one of its recent opinions:—

> "In passing upon the validity of legislation, attacked as contrary to the XIVth Amendment, it has not failed to recognize the fact that the law is, to a certain extent, a progressive science; that in some of the states methods of procedure, which at the time the constitution was adopted were deemed essential to the protection and safety of the people or to the liberty of the citizen, have been found to be no longer necessary; that restrictions which had formerly been laid upon the conduct of individuals, or of classes of individuals, had proved detrimental to their interests; while, upon the other hand, certain other classes of persons, particularly those engaged in dangerous or unhealthful employments, have been found to be in need of additional protection. Even before the adoption of the constitution, much had been done toward mitigating the severity of the common law, particularly in the administration of its criminal branch. The number of capital crimes, in this country at least, had been largely decreased. Trial by ordeal and by battle had never existed here, and had fallen into disuse in England. The earlier practice of the common law, which denied the benefit of witnesses to a person accused of felony, had been abolished by statute, though, so far as it deprived him of the assistance of counsel and compulsory process for the attendance of his witnesses, it had not been changed in England. But, to the credit of her American colonies, let it be said that so oppressive a doctrine had never obtained a foothold there. The 19th century originated legal reforms of no less importance. The whole fabric of special pleading, once thought to be necessary to the elimination of the real issue between the parties, has crumbled to pieces. The ancient tenures of real estate have been largely swept away, and land is now transferred almost as easily and cheaply as personal property. Married women have been emancipated from the control of their husbands, and placed upon a practical equality with them with respect to the acquisition, possession and transmission of property. Imprisonment for debt has been abolished. Exemptions from executions have been largely added to, and in most of the states homesteads are rendered incapable of seizure and sale upon forced process. Witnesses are no longer incompetent by reason of interest, even though they be parties to the litigation. Indictments have been simplified, and an indictment for the most serious of crimes is now the simplest of all. In several of the states grand juries, formerly the only safeguard against a malicious prosecution, have been largely abolished, and in others the rule of unanimity, so far as applied to civil cases, has given way to verdicts rendered by a three-fourths majority. This case does not call for an expression of opinion as to the wisdom of these changes, or their validity under the XIVth Amendment, although the substitution of prosecution by information in lieu of indictment was recognized as valid in *Hurtado* v. *California*, 110 U.S. 516. They are mentioned only for the purpose of calling attention to the probability that other changes of no less importance may be made in the future, and that while the cardinal principles of justice are immutable, the methods by which justice

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[1] The Slaughter-House Cases, 16 Wallace's Reports, 36, 81.

[2] *Ibid.* 89, 111, 129.

[3] *Guthrie on the Fourteenth Amendment*, 27.

[4] Baldwin's *Modern Political Institutions*, 111, 112.

> is administered are subject to constant fluctuation, and that the Constitution of the United States, which is necessarily and to a large extent inflexible and exceedingly difficult of amendment, should not be so construed as to deprive the states of the power to amend their laws so as to make them conform to the wishes of the citizens as they may deem best for the public welfare without bringing them into conflict with the supreme law of the land. Of course, it is impossible to forecast the character or extent of these changes, but in view of the fact that from the day Magna Carta was signed to the present moment, amendments to the structure of the law have been made with increasing frequency, it is impossible to suppose that they will not continue, and the law be forced to adapt itself to new conditions of society, and particularly to the new relations between employers and employees, as they arise."[1]

The Civil War deeply affected also the course of judicial decision in the southern states. During its progress it engaged the attention of a very large part of the population, and the business of the courts necessarily was greatly lessened. Upon its close political power passed, for a time, into new hands, and many from the northern and western states took prominent positions both at the bar and on the bench. The very basis of society was changed by the abolition of slavery. New state constitutions were adopted, inspired or dictated by the ideas of the North. The transport system was greatly extended, and commerce by land took to a large extent the place formerly filled by commerce by navigation. Manufacturing came in to supplement agricultural industry. Cities grew and assumed a new importance. Northern capital sought investment in every state. It was a natural consequence of all these things that the jurisprudence of the South should come to lose whatever had been its distinctive character. The unification of the nation inevitably tended to unify its law.

The Bar Association.

An important contribution towards this result was made by the organization of the American Bar Association in 1878. Of the fourteen signers of the call for the preliminary conference, five were from the southern states. Its declared objects were "to advance the science of jurisprudence, promote the administration of justice and uniformity of legislation throughout the Union, uphold the honour of the profession of the law, and encourage cordial intercourse among the members of the American Bar."

Law schools.

Largely through its efforts, the American law schools have taken on a new character. The course of study has been both broadened and prolonged, and the attendance of students has increased in full proportion to the additions to the facilities for obtaining a more thorough training in the profession. When the association commenced its labours, those studying law in the offices of practising lawyers very largely outnumbered those found in the law school. The proportion is now reversed. During the year 1900, for instance, the state board of law examiners in New York examined 899 applicants for admission to the bar of that state. Of these all but 157 had received their legal education wholly or in part at a law school.[2] In 1878 few law schools had adopted any system of examination for those desiring to enter them. Such a requirement for admission is now common. In only one school were opportunities then afforded for advanced studies by graduate students with a view to attaining the doctorate in law. Courses of this description are now offered by several of the university schools.

Reports.

A more scientific character has thus been taken on by American law. It is noticeable both in legal text-books and in the opinions of the courts of last resort. In the latter precision of statement and method in discussion are invited by the uniform practice of preparing written opinions. The original practice of reading these from the bench has been generally discontinued. They are simply handed down to an official reporter for publication, which is done at the expense of the government by which the court is commissioned. With the judicial reports of each state the lawyers of that state are required to be familiar; and this is rendered possible, even in the larger ones, by state digests, prepared every few years by private enterprise. Outside of the state their circulation is comparatively limited, though sets of all are generally found in each state library, and of many in the Bar libraries at the principal county seats. The private libraries of lawyers in large practice also often contain the reports of adjoining and sometimes those of distant states as well as those of their own and of the Supreme Court of the United States. The decisions of one state, however, are now best known in others through unofficial reports. One large publishing concern prints every case decided in the courts of last resort. They are published in several distinct series, those, for instance, coming from the northern Atlantic states being grouped together as the *Atlantic Reporter*, and those from the states on the Pacific coast as the *Pacific Reporter*. Another house has published a compilation professing to give all the leading American cases from the first to the latest volume of reports. Another makes a similar selection from the decisions of each year as they appear, and publishes them with critical annotations. There are also annual digests of a national character, comprehending substantially all American cases and the leading English cases reported during the preceding year.

These various publications are widely diffused, and so the American lawyer is enabled, in preparing for the argument of any cause involving questions of difficulty, to inform himself with ease of such precedents as may apply. A court in Texas is thus as likely to be made acquainted with a decision in Maine or Oregon as with one in any nearer state, and in the development of American law all American courts are brought in close touch with each other.

English and American law.

This tendency has been advanced by the steady growth of codification. That is beginning also to serve to bring English and American law nearer together in certain directions. A Negotiable Instruments Act, promoted by the American Bar Association, and prepared by a conference of commissioners appointed by the several states to concert measures of uniform legislation, has been adopted in the leading commercial states. It is founded upon the English "Chalmers's Act," and the English decisions giving a construction to that have become of special importance. The acts of parliament known as the Employers' Liability Act and the Railway and Canal Traffic Act have also served as the foundation of similar legislation in the United States, and with the same result. Modern English decisions are, however, cited less frequently in American courts than the older ones; and the older ones themselves are cited far less frequently than they once were. In the development of their legislation, England and the United States have been in general harmony so far as matters of large commercial importance are concerned, but as to many others they have since 1850 drawn apart. Statutes, at one point or another, probably now affect the disposition of most litigated causes in both countries. Their application, therefore, must serve more or less to obscure or displace general principles, which might otherwise control the decision and make it a source of authority in foreign tribunals. The movement of the judicial mind in the United States, and also its modes and form of expression, have a different measure from that which characterizes what comes from the English bench. American judges are so numerous, and (except as to the Supreme Court of the United States) the extent of their territorial jurisdiction so limited, that they can give more time to the careful investigation of points of difficulty, and also to the methodical statement of their conclusions. Whatever they decide upon appeal being announced in writing, and destined to form part of the permanent published records of the state, they are expected and endeavour to study their words and frame opinions not only sound in law but unobjectionable as literary compositions.

The choice of American judges, particularly in the older states, has been not uninfluenced by these considerations. Marshall, Bushrod Washington, Story, Kent, Ware, Bradley, and many of their contemporaries and successors, were put upon the bench in part because of their legal scholarship and their power of felicitous expression. Hence the better American opinions have more elaboration and finish than many which come from the English courts, and are more readily accepted as authorities by American judges. But the great multiplication of reports has so widened the field of citation as in effect to reduce it. Each of the larger and older states has now a settled body of legal precedent of its own, beyond which its judges in most cases do not look. If a prior decision applies, it is controlling. If there be none, they prefer to decide the case, if possible, on principle rather than authority.

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[1] *Holden* v. *Hardy*, 169 United States Reports, 336, 385-387.

[2] *Columbia Law Review*, i. 99.

While the state courts are bound to accept the construction placed upon the Constitution and laws of the United States by the Supreme Court of the United States, and thus uniformity of decision is secured in that regard, the courts of the United States, on the other hand, are as a rule obliged to accept in all other particulars the construction placed by the courts of each state on its constitution and laws. This often gives a seeming incongruity to the decisions of the Supreme Court of the United States. A point in a case coming up from one judicial circuit may be determined in a way wholly different from that followed in a previous judgment in a cause turning upon the same point, but appealed from another circuit, because of a departure from the common law in one state which has not been made in another. In view of this, a doctrine originally proposed by Mr Justice Story in 1842[1] has not been infrequently invoked of late years, which rests upon the assumed existence of a distinctive federal jurisprudence of paramount authority as to certain matters of general concern, as for example those intimately affecting commerce between the states or with foreign nations. The consequence is that a case involving such questions may be differently adjudged, according as it is brought in a state or in a federal court.[2]

The divergences now most noticeable between English and American law are in respect of public control over personal liberty and private property, criminal procedure and the scope of the powers of municipal corporations.

Under the constitutional provision that no one shall be deprived of life, liberty or property without due process of law, American courts frequently declare void statutes which in England would be within the acknowledged powers of parliament. These provisions are liberally expounded in favour of the individual, and liberty is held to include liberty of contract as well as of person. Criminal procedure is hedged about with more refinements and safeguards to the accused than are found in England, and on the other hand, prosecutions are more certain to follow the offence, because they are universally brought by a public officer at public expense. The artificiality of the proceedings is fostered by a general right of appeal on points of law to the court of last resort. It is in criminal causes involving questions of common-law liability and procedure [3] that English law-books and reports are now most frequently cited. American municipal corporations are confined within much narrower limits than those of England, and their powers more strictly construed.

Trial by jury.

Trial by jury in civil causes seems to be declining in public esteem. The expenses necessarily incident to it are naturally increasing, and the delays are greater also from a general tendency, especially in cities, where most judicial business is transacted, to reduce the number of hours a day during which the court is in session. The requirement of unanimity is dispensed with in a few states, and it has been thus left without what many deem one of its essential features. The judge interposes his authority to direct and expedite the progress of the trial less frequently and less peremptorily than in England. A jury is waived more often than formerly, and there is a growing conviction that, with a capable and independent judiciary, justice can be looked for more confidently from one man than from thirteen.

The United States entered on the work of simplifying the forms of pleading earlier than England, but has not carried it so far. Demurrers have not been abandoned, and in some states little has been done except to replace one system of formality by another hardly less rigid. The general plan has been to codify the laws of pleading by statute. In a few states they have proceeded more nearly in accordance with the principles of the English Judicature Act, and left details to be worked out by the judges, through rules of court.[4]

The legislature and the courts.

Most of the state constitutions assume that the powers of government can be divided into three distinct departments, executive, legislative and judicial; and direct such a distribution. In thus ignoring the administrative functions of the state, they have left a difficult question for the courts, upon which the legislature often seeks in part to cast them. The general tendency has been to construe, in such circumstances, the judicial power broadly, and hold that it may thus be extended over much which is rather to be called quasi-judicial.[5] A distinction is taken between entrusting jurisdiction of this character to the courts, and imposing it upon them. Where the statute can be construed as simply permissive, the authority may be exercised as a matter of grace, when it would be peremptorily declined, were the meaning of the legislature that it must be accepted.[6] The courts, for similar reasons, have generally declined (in the absence of any constitutional requirement to that effect) to advise the legislature, at its request, whether a proposed statute, if enacted, would be valid. While its validity, were it to be enacted, might become the subject of a judicial decision, it is thought for that reason, if for no other, to be improper to prejudge the point, without a hearing of parties interested. The constitutions of several states provide for such a proceeding, and in these the Supreme Court is not infrequently called upon in this way, and gives responses which are always considered decisive of legislative action, but would not be treated as conclusive in any subsequent litigation that might arise.

Police power of states.

The general trend of opinion in the Supreme Court of the United States since 1870, upon questions other than those arising under the XIVth Amendment, has been towards recognizing the police power of the several states as entitled to a broad scope. Even, for instance, in such a matter as the regulation of commerce between different states, it has been upheld as justifying a prohibition against running any goods trains on a Sunday, and a requirement that all railway cars must be heated by steam.[7] In the "Granger Cases,"[8] the right of the state to fix the rate of charges for the use of a grain elevator for railway purposes, and for general railway services of transportation, was supported, and although the second of these was afterwards overruled,[9] the principle upon which it was originally rested was not shaken.

On the other hand, reasons of practical convenience have necessarily favoured the substantial obliteration of state lines as to the enforcement of statutory private rights. Massachusetts in 1840, six years before the passage of Lord Campbell's Act, provided a remedy by indictment for the negligent killing of a man by a railway company, a pecuniary penalty being fixed which the state was to collect for the benefit of his family. In most of the other states by later statutes a similar result has been reached through a civil action brought by the executor or administrator as an agent of the law. In some, however, the state must be the plaintiff; in others the widow, if any there be. The accident resulting in death often occurs in a state where the man who was killed does not reside, or in which the railway company does not have its principal seat. It may therefore be desirable to sue in one state for an injury in another. Notwithstanding such an action is unknown to the common law, and rests solely on a local statute, the American courts uniformly hold that, when civil in form, it can be brought under such statutes in any state the public policy of which is not clearly opposed to such a remedy. In like manner, the responsibilities of stockholders and directors of a moneyed corporation, under the laws of the state from which the charter is derived, are enforced in any other states in which they may be found. Thus a double liability of stockholders to creditors, in case of the insolvency of the company, or a full liability to creditors of directors who have made false reports or certificates regarding its financial condition, is treated as of a contractual nature, and not penal in the international sense of that term.[1] As a judgment of one state has equal force in another, so far as the principle of *res adjudicata* is concerned, the orders of a court in a state to which a corporation owes its charter, made in proceedings for winding it up, may be enforced to a large extent in any other. The shareholders are regarded as parties by representation to the winding-up proceedings, and so bound by decrees which are incidental to it.[2]

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[1] *Swift* v. *Tyson*, 16 Peters' Reports, 1, 19.

[2] See *Forepaugh* v. *Delaware, Lackawanna & Western Railroad Company*, 128 Pennsylvania State Reports, 267; *Faulkner* v. *Hart*, 82 New York Reports, 313; and *Lake Shore & Michigan Southern Railway Company* v. *Prentice*, 147 United States Reports, 101.

[3] See, as examples, *Commonwealth* v. *Rubin*, 165 Massachusetts Reports, 453, in which Holmes, C.J., traces the rule that, if a man abuse an authority given him by the law, he becomes a trespasser *ab initio*, back to the Year Books; and *Commonwealth* v. *Cleary*, 172 Massachusetts Reports, 175, in which the same judge refers to Glanville and Fleta as authority for the proposition that the admission in evidence, in cases of rape, of complaints made by the woman soon after the commission of the offence is a perverted survival of the old rule that she could not bring an appeal unless she had made prompt hue and cry.

[4] This has been carried furthest in Connecticut. See *Botsford* v. *Wallace*, 72 Connecticut Reports, 195.

[5] Norwalk Street Railway Company's Appeal, 69 Connecticut Reports, 576; 38 *Atlantic Reporter*, 708.

[6] *Zanesville* v. *Zanesville Telephone Company*, 63 Ohio State Reports, 442; 59 *North-Eastern Reporter*, 109.

[7] *New York Railroad* v. *New York*, 165 United States Reports, 628.

[8] *Munn* v. *Illinois*, 94 United States Reports, 113; *Chicago Railroad Company* v. *Iowa*, ibid. 155.

[9] *Wabash Railway Company* v. *Illinois*, 118 United States Reports, 557; *Reagan* v. *Farmers' Loan and Trust Company*, 154 United States Reports, 362.

The provisions of the United States law on different subjects and the literature concerning them are given in the separate articles. See the bibliography to the article LAW; also Cooley on *The Constitutional Limitations which rest upon the Legislative Power of the States of the American Union;* Andrews on *American Law;* and Russell on *The Police Power of the State, and Decisions thereon as illustrating the Development and Value of Case Law.* (S. E. B.)

AMERICAN LITERATURE. The earliest books which are commonly described as the beginnings of American literature were written by men born and bred in England; they were published there; they were, in fact, an undivided part of English literature, belonging to the province of exploration and geographical description and entirely similar in matter and style to other works of voyagers and colonizers that illustrate the expansion of England. They contain the materials of history in a form of good Elizabethan narrative, always vigorous in language, often vivid and picturesque. John Smith (1579–1631) wrote the first of these, *A True Relation of such Occurrences and Accidents of Note as hath happened in Virginia* (1608), and he later added other accounts of the country to the north. William Strachey, a Virginian official of whom little is known biographically, described (1610) the shipwreck of Sir Thomas Gates on the Bermudas, which is believed to have yielded Shakespeare suggestions for *The Tempest.* Colonel Henry Norwood (d. 1689), hitherto unidentified, of Leckhampton, Gloucestershire, a person eminent for loyalty in the reign of Charles I. and distinguished in the civil wars, later governor of Tangiers and a member of parliament for Gloucester, wrote an account of his voyage to Virginia as an adventurer, in 1649. These are characteristic works of the earliest period, and illustrate variously the literature of exploration which exists in numerous examples and is preserved for historical reasons. The settlement of the colonies was, in general, attended by such narratives of adventure or by accounts of the state of the country or by documentary record of events. Thus George Alsop (b. 1638) wrote the *Character of the Province of Maryland* (1666), and Daniel Denton a *Brief Description of New York* (1670), and in Virginia the progress of affairs was dealt with by William Stith (1689–1755), Robert Beverly (f. 1700), and William Byrd (1674–1744). Each settlement in turn, as it came into prominence or provoked curiosity, found its geographer and annalist, and here and there sporadic pens essayed some practical topic. The product, however, is now an indistinguishable mass, and titles and authors alike are found only in antiquarian lore. The distribution of literary activity was very uneven along the sea-board; it was naturally greatest in the more thriving and important colonies, and bore some relation to their commercial prosperity and political activity and to the closeness of the connexion with the home culture of England. From the beginning New England, owing to the character of its people and its ecclesiastical rule, was the chief seat of the early literature, and held a position apart from the other colonies as a community characterized by an intellectual life. There the first printing press was set up, the first college founded, and an abundant literature was produced.

Beginnings.

The characteristic fact in the Puritan colonies is that literature there was in the hands of its leading citizens and was a chief concern in their minds. There were books of exploration and description as in the other colonies, such as William Wood's (d. 1639) *New England's Prospect* (1634), and John Josselin's *New England's Rarities* (1672), and tales of adventure in the wilderness and on the sea, most commonly described as "remarkable providences," in the vigorous Elizabethan narrative; but besides all this the magistracy and the clergy normally set themselves to the labour of history, controversy and counsel, and especially to the care of religion. The governors, beginning with William Bradford (1590–1657) of Plymouth, and John Winthrop (1588–1649) of Massachusetts Bay, wrote the annals of their times, and the line of historians was continued by Winslow, Nathaniel Morton, Prince, Hubbard and Hutchinson. The clergy, headed by John Cotton (1585–1652), Thomas Hooker (1586?–1647), Nathaniel Ward (1579?–1652), Roger Williams (1600–1683), Richard Mather (1596–1669), John Eliot (1604–1690), produced sermons, platforms, catechisms, theological dissertations, tracts of all sorts, and their line also was continued by Shepard, Norton, Wise, the later Mathers and scores of other ministers. The older clergy were not inferior in power or learning to the leaders of their own communion in England, and they commanded the same prose that characterizes the Puritan tracts of the mother country; nor did the kind of writing deteriorate in their successors. This body of divines in successive generations gave to early New England literature its overwhelming ecclesiastical character; it was in the main a church literature, and its secular books also were controlled and coloured by the Puritan spirit. The pervasiveness of religion is well illustrated by the three books which formed through the entire colonial period the most popular domestic reading of the Puritan home. These were *The Bay Psalm Book* (1640), which was the first book published in America; Michael Wigglesworth's (1631–1705) *Day of Doom* (1662), a doggerel poem; and the *New England Primer* (*c.* 1690), called "the Little Bible." The sole voice heard in opposition was Thomas Morton's satirical *New English Canaan* (1637), whose author was sent out of the colony for the scandal of Merrymount, but satire itself remained religious in Ward's *Simple Cobbler of Agawam* (1647). Poetry was represented in Anne Bradstreet's (1612–1672) *The Tenth Muse lately sprung up in America* (1650), and was continued by a succession of doggerel writers, mostly ministers or schoolmasters, Noyes, Oakes, Folger, Tompson, Byles and others. The world of books also included a good proportion of Indian war narratives and treatises relating to the aborigines. The close of the 17th century shows literature, however, still unchanged in its main position as the special concern of the leaders of the state. It is Chief-Justice Samuel Sewall's (1652–1730) *Diary* (which remained in manuscript until 1878) that affords the most intimate view of the culture and habits of the community; and he was known to his contemporaries by several publications, one of which, *The Selling of Joseph* (1700), was the first American anti-slavery tract.

The literature of the first century, exemplified by these few titles, is considerable in bulk, and like colonial literature elsewhere is preserved for historical reasons. In general, it records the political progress and social conditions of the Puritan state, and the contents of the Puritan mind. The development of the original settlement took place without any violent check. Though the colony was continually recruited by fresh immigration, the original 20,000 who

Puritanism.

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[1] *Huntington* v. *Attrill,* 146 United States Reports, 657.

[2] *Great Western Telegraph Company* v. *Purdy,* 162 United States Reports, 329; *Fish* v. *Smith,* 73 Connecticut Reports, 377; 47 *Atlantic Reporter,* 710.

arrived before 1640 had established the principles of the state, and their will and ideas remained dominant after the Restoration as before. It was a theocratic state controlled by the clergy, and yet containing the principle of liberty. The second and third generations born on the soil, nevertheless, showed some decadence; notwithstanding the effort to provide against intellectual isolation and mental poverty by the foundation of Harvard College, they felt the effects of their situation across the sea and on the borders of a wilderness. The people were a hard-faring folk and engaged in a material struggle to establish the plantations and develop commerce on the sea; their other life was in religion soberly practised and intensely felt. They were a people of one book, in the true sense,—the Bible; it was the organ of their mental life as well as of their spiritual feelings. For them, it was in the place of the higher literature. But long resident there in the strip between the sea and the forest, cut off from the world and consigned to hard labour and to spiritual ardours, they developed a fanatical temper; their religious life hardened and darkened; intolerance and superstition grew. Time, nevertheless, ripened new changes, and the colony was to be brought back from its religious seclusion into the normal paths of modern development. The sign was contained, perhaps, most clearly in the change effected in the new charter granted by King William which made property the basis of the franchise in place of church-membership, and thus set the state upon an economic instead of a religious foundation. It is rather by men than by books that these times are remembered, but it is by the men who were writers of books. In general, the career of the three Mathers coincides with the history of the older Puritanism, and their personal characteristics reflect its stages as their writings contain its successive traits. Richard Mather, the emigrant, had been joint author in the composition of *The Bay Psalm Book*, and served the colony among the first of its leaders. It was in his son, Increase Mather (1639–1723), that the theocracy, properly speaking, culminated. He was not only a divine, president of Harvard College and a prolific writer; but he was dominant in the state, the chief man of affairs. It was he who, sent to represent the colony in England, received from King William the new charter. His son, Cotton Mather (1663–1728), succeeded to his father's distinction; but the changed condition is reflected in his non-participation in affairs; he was a man of the study and led there a narrower life than his father's had been. He was, nevertheless, the most broadly characteristic figure of the Puritan of his time. He was able and learned, abnormally laborious, leaving over 400 titles attributed to him; and at the same time he was an ascetic and visionary. The work by which he is best remembered, the *Magnalia Christi Americana, or the Ecclesiastical History of New England from its First Planting in the Year 1620, unto the Year of our Lord 1698* (1702), is the chief historical monument of the period, and the most considerable literary work done in America up to that time. It is encyclopaedic in scope, and contains an immense accumulation of materials relating to life and events in the colony. There the New England of the 17th century is displayed. His numerous other works still further amplify the period, and taken all together his writings best illustrate the contents of Puritanism in New England. The power of the clergy was waning, but even in the political sphere it was far from extinction, and it continued under its scheme of church government to guard jealously the principles of liberty. In John Wise's (1652–1725) *Vindication of the Government of New England Churches* (1717) a precursor of the Revolution is felt. It was in another sphere, however, that Puritanism in New England was to reach its height, intellectually and spiritually alike, in the brilliant personality of Jonathan Edwards (1703–1758), its last great product. He was free of affairs, and lived essentially the private life of a thinker. He displayed in youth extraordinary precocity and varied intellectual curiosity, and showed at the same early time a temperament of spirtual sensitiveness and religious ideality which suggests the youth of a poet rather than of a logician. It was not without a struggle that he embraced sincerely the Calvinistic scheme of divine rule, but he was able to reconcile the doctrine in its most fearful forms with the serenity and warmth of his own spirit; for his soul at all times seems as lucid as his mind, and his affections were singularly tender and refined. He served as minister to the church at Northampton; and, driven from that post, he was for eight years a missionary to the Indians at Stockbridge; finally he was made president of Princeton College, where after a few weeks' incumbency he died. The works upon which his fame is founded are *Treatise concerning the Religious Affections* (1746), *On the Freedom of the Will* (1754), *Treatise on Original Sin* (1758). They exhibit extraordinary reasoning powers and place him among the most eminent theologians. He contributed by his preaching great inspiring force to the revival, known as "the Great Awakening," which swept over the dry and formal Puritanism of the age and was its last great flame. In him New England idealism had come to the birth. He illustrates, better than all others, the power of Puritanism as a spiritual force; and in him only did that power reach intellectual expression in a memorable way for the larger world. The ecclesiastical literature of Puritanism, abundant as it was, produced no other work of power; nor did the Puritan patronage of literature prove fruitful in other fields. If Puritanism was thus infertile, it nevertheless prepared the soil. It impressed upon New England the stamp of the mind; the entire community was by its means intellectually as well as morally bred; and to its training and the predisposition it established in the genius of the people may be ascribed the respect for the book which has always characterized that section, the serious temper and elevation of its later literature and the spiritual quality of the imagination which is so marked a quality of its authors.

Franklin.

The secularization of life in New England, which went on concurrently with the decline of the clergy in social power, was incidental to colonial growth. The practical force of the people had always been strong; material prosperity increased and a powerful class of merchants grew up; public questions multiplied in variety and gained in importance. The affairs of the world had definitely obtained the upper hand. The new spirit found its representative in the great figure of Benjamin Franklin (1706–1790), who, born in Boston, early emigrated to Philadelphia, an act which in itself may be thought to forecast the transfer of the centre of interest to the west and south and specifically to that city where the congress was to sit. Franklin was a printer, and the books he circulated are an index to the uses of reading in his generation. Practical works, such as almanacs, were plentiful, and it is characteristic that Franklin's name is, in literature, first associated with *Poor Richard's Almanack* (1732). The literature of the 18th century outside of New England continued to be constituted of works of exploration, description, colonial affairs, with some sprinkling of crude science and doctrines of wealth; but it yields no distinguished names or remembered titles. Franklin's character subsumes the spirit of it. In him thrift and benevolence were main constituents; scientific curiosity of a useful sort and invention distinguished him; after he had secured a competence, public interests filled his mature years. In him was the focus of the federating impulses of the time, and as the representative of the colonies in England and during the Revolution in France, he was in his proper place as the greatest citizen of his country. He was, first of men, broadly interested in all the colonies, and in his mind the future began to be comprehended in its true perspective and scale; and for these reasons to him properly belongs the title of "the first American." The type of his character set forth in the *Autobiography* (1817) was profoundly American and prophetic of the plain people's ideal of success in a democracy. It is by his character and career rather than by his works or even by his great public services that he is remembered; he is a type of the citizen-man. Older than his companions, and plain while they were of an aristocratic stamp, he greatens over them in the popular mind as age greatens over youth; but it was these companions who were to lay the foundations of the political literature of America. With the increasing political life lawyers as a class had naturally come into prominence as spokesmen and debaters. A young generation of orators sprang up, of whom James Otis (1725–1783) in the north, and Patrick Henry (1736–1799) in the south, were the most brilliant; and a group of statesmen, of whom the most notable were Thomas Jefferson (1743–1826), James Madison (1751–1836), and Alexander Hamilton (1757–1804), held the political direction of the times; in the speeches and state-papers of these orators and statesmen and their fellows the political literature of the colonies came to hold the first place. The chief memorials of this literature are *The Declaration of Independence* (1776), *The Federalist* (1788), a treatise on the principles of free government, and Washington's *Addresses* (1789–1793–1796). Thus politics became, in succession to exploration and religion, the most important literary element in the latter half of the 18th century.

18th-century poetry and fiction.

The more refined forms of literature also began to receive intelligent attention towards the close of the period. The Revolution in passing struck out some sparks of balladry and song, but the inspiration of the spirit of nationality was first felt in poetry by Philip Freneau (1752–1832), whose *Poems* (1786) marked the best poetical achievement up to his time. Patriotism was also a ruling motive in the works of the three poets associated with Yale College, John Trumbull (1750–1831), Timothy Dwight (1752–1817), and Joel Barlow (1754–1812), authors respectively of *McFingal* (1782), a Hudibrastic satire of the Revolution, *The Conquest of Canaan* (1785), an epic, and *The Vision of Columbus* (1787), later remade into *The Columbiad*, also an epic. These poets gathered about them a less talented company, and all were denominated in common the "Hartford Wits," by which name rather than by their works they are remembered. The national hymn, "Hail Columbia," was composed by Joseph Hopkinson (1770–1842) in 1798. Fiction, in turn, was first cultivated by Charles Brockden Brown (1771–1810), a Philadelphian, who wrote six romantic novels (1798–1801) after the style of Godwin, but set in the conditions of the new world and mixing local description and observation with the material of mystery and terror. Fiction had been earlier attempted by Mrs Susanna Haswell Rowson, whose *Charlotte Temple* (1790) is remembered, and contemporaneously by Mrs Hannah Webster Foster in *The Coquette* (1797) and by Royall Tyler (1758–1826) in *The Algerian Captive* (1799); but to Brown properly belongs the title of the first American novelist, nor are his works without invention and intensity and a certain distinction that secure for them permanent remembrance. The drama formally began its career on a regular stage and with an established company, in 1786 at New York, with the acting of Royall Tyler's comedy *The Contrast*; but the earliest American play was Thomas Godfrey's (1736–1763) tragedy, *The Prince of Parthia*, acted in Philadelphia in 1767. William Dunlap (1766–1839) is, however, credited with being the father of the American theatre on the New York stage, where his plays were produced. One other earlier book deserves mention, John Woolman's (1720–1772) *Journal* (1775), an autobiography with much charm. With these various attempts the 18th century was brought to an end. In 200 years no literary classic had been produced in America.

The new nation.

The new nation, which with the 19th century began its integral career, still retained the great disparities which originally existed between the diverse colonies. Political unity, the simplest of the social unities, had been achieved; "a more perfect union," in the language of the founders, had been formed; but even in the political sphere the new state bore in its bosom disuniting forces which again and again threatened to rive it apart until they were dissipated in the Civil War; and in the other spheres of its existence, intellectually, morally, socially, its unity was far from being accomplished. The expansion of its territory over the continental area brought new local diversity and prolonged the contrasts of border conditions with those of the long-settled communities. This state of affairs was reflected in the capital fact that there was no metropolitan centre in which the tradition and forces of the nation were concentrated. Washington was a centre of political administration; but that was all. The nation grew slowly, indeed, into consciousness of its own existence; but it was without united history, without national traditions of civilization and culture, and it was committed to the untried idea of democracy. It was founded in a new faith; yet at the moment that it proclaimed the equality of men, its own social structure and habit north and south contradicted the declaration, not merely by the fact of slavery, but by the life of its classes. The south long remained oligarchic; in the north aristocracy slowly melted away. The coincidence of an economic opportunity with a philosophic principle is the secret of the career of American democracy in its first century. The vast resources of an undeveloped country gave this opportunity to the individual, while the nation was pledged by its fundamental idea to material prosperity for the masses, popular education and the common welfare, as the supreme test of government. In this labour, subduing the new world to agriculture, trade and manufactures, the forces of the nation were spent, under the complication of maintaining the will of the people as the directing power; the subjugation of the soil and experience in popular government are the main facts of American history. In the course of this task the practice of the fine arts was hardly more than an incident. When anyone thinks of Greece, he thinks first of her arts; when anyone thinks of America, he thinks of her arts last. Literature, in the sense of the printed word, has had a great career in America; as the vehicle of use, books, journals, literary communication, educational works and libraries have filled the land; nowhere has the power of the printed word ever been so great, nowhere has the man of literary genius ever had so broad an opportunity to affect the minds of men contemporaneously. But, in the artistic sense, literature, at most, has been locally illustrated by a few eminent names.

The most obvious fact with regard to this literature is that—to adopt a convenient word—it has been regional. It has flourished in parts of the country, very distinctly marked, and is in each case affected by its environment and local culture; if it incorporates national elements at times, it seems to graft them on its own stock. The growth of literature in these favoured soils was slow and humble. There was no outburst of genius, no sudden movement, no renaissance; but very gradually a step was taken in advance of the last generation, as that had advanced upon its forefathers. The first books of true excellence were experiments; they seem almost accidents. The cities of Boston, New York and Philadelphia were lettered communities; they possessed imported books, professional classes, men of education and taste. The tradition of literature was strong, especially in New England; there were readers used to the polite letters of the past. It was, however, in the main the past of Puritanism, both in England and at home, and of the 18th century in general, on which they were bred, with a touch ever growing stronger of the new European romanticism. All the philosophic ideas of the 18th century were current. What was most lacking was a standard self-applied by original writers; and in the absence of a great national centre of standards and traditions, and amid the poverty of such small local centres as the writers were bred in, they sought what they desired, not in England, not in any one country nor in any one literature, but in the solidarity of literature itself, in the republic of letters, the world-state itself,—the master-works of all European lands; they became either actual pilgrims on foreign soil or pilgrims of the mind in fireside travels. The foreign influences that thus entered into American literature are obvious and make a large part of its history; but the fact here brought out is that European literature and experience stood to American writers in lieu of a national centre; it was there that both standard and tradition were found.

Early 19th-century classics.

American literature first began to exist for the larger world in the persons of Washington Irving (1785–1859) and James Fenimore Cooper (1789–1851). Their recognition was almost contemporaneous. *The Sketch Book* (1819) was the first American book to win a great reputation in England, and *The Spy* (1821) was the first to obtain a similar vogue on the continent. The fame of both authors is associated with New York, and that city took the first place as the centre of the literature of the period. It was not that New York was more intellectual than other parts of the country; but it was a highly prosperous community, where a mercantile society flourished and consequently a certain degree of culture obtained. The first American literature was not the product of a raw democracy nor of the new nationality in any sense; there was nothing sudden or vehement in its generation; but, as always, it was the product of older elements in the society where it arose and flourished under the conditions of precedent culture. The family of Irving were in trade. Cooper's father was in the law. A third writer, William Cullen Bryant (1794–1878), is associated with them, and though he announced his poetic talent precociously by *Thanatopsis* (1807), his *Poems* (1832), immediately republished in London, were the basis of his true fame. Born in Massachusetts, he lived his long life in New York, and was there a distinguished citizen. His father was a physician. All three men were not supremely endowed; they do not show the passion of genius for its work which marks the great writers; they were, like most American writers, men with the literary temperament, characteristically gentlemen, who essayed literature with varying power. If the quality of this early literature is to be appreciated truly, the fact of its provenance from a society whose cultivation was simple and normal, a provincial bourgeois society of a prosperous democracy, must be borne in mind. It came, not from the people, but from the best classes developed under preceding conditions.

Irving.

Irving all his life was in the eyes of his countrymen, whatever their pride might be in him, more a travelled gentleman than one of themselves. He had come home to end his days at Sunnyside by the Hudson, but he had won his fame in foreign fields. In his youth the beginnings of his literary work were most humble—light contributions to the press. He was of a most social nature, warm, refined, humorous, a man belonging to the town. He was not seriously disposed, idled much, and surprised his fellow-citizens suddenly by a grotesque *History of New York* (1809), an extravaganza satirizing the Dutch element of the province. He discovered in writing this work his talent for humour and also one part of his literary theme, the Dutch tradition; but he did not so convince himself of his powers as to continue, and it was only after the failure of his commercial interests that, being thrown on himself for support, he published in London ten years later, at the age of thirty-six, the volume of sketches which by its success committed him to a literary career. In that work he found himself; sentiment and distinction of style characterized it, and these were his main traits. He remained abroad, always favoured in society and living in diplomatic posts in Spain and England, for seventeen years, and he later spent four years in Spain as minister. Spain gave him a larger opportunity than England for the cultivation of romantic sentiment, and he found there his best themes in Moorish legend and history. On his return to America he added to his subjects the exploration of the west; and he wrote, besides, biographies of Goldsmith and Washington. He was, as it turned out, a voluminous writer; yet his books successively seem the accident of his situation. The excellence of his work lies rather in the treatment than the substance; primarily, there is the pellucid style, which he drew from his love of Goldsmith, and the charm of his personality shown in his romantic interest, his pathos and humour ever growing in delicacy, and his familiar touch with humanity. He made his name American mainly by creating the legend of the Hudson, and he alone has linked his memory locally with his country so that it hangs over the landscape and blends with it for ever; he owned his nativity, too, by his pictures of the prairie and the fur-trade and by his life of Washington, who had laid his hand upon his head; but he had spent half his life abroad, in the temperamental enjoyment of the romantic suggestion of the old world, and by his writings he gave this expansion of sympathy and sentiment to his countrymen. If his temperament was native-born and his literary taste home-bred, and if his affections gave a legend to the countryside and his feelings expanded with the view of prairie and wilderness, and if he sought to honour with his pen the historic associations and memory of the land which had honoured him, it was, nevertheless, the trans-Atlantic touch that had loosed his genius and mainly fed it, and this fact was prophetic of the immediate course of American literature and the most significant in his career.

Cooper.

Cooper's initiation into literature was similar to that of Irving. He had received, perhaps, something more of scanty formal education, since he attended Yale College for a season, but he early took to the sea and was a midshipman. He was thirty years old before he began to write, and it was almost an accident that after the failure of his first novel he finished *The Spy*, so deterring was the prejudice that no American book could succeed. He was, however, a man of great energy of life, great force of will; it was his nature to persist. The way once opened, he wrote voluminously and with great unevenness. His literary defects, both of surface and construction, are patent. It was not by style nor by any detail of plot or character that he excelled; but whatever imperfections there might be, his work was alive; it had body, motion, fire. He chose his subjects from aspects of life familiar to him in the woods or on the sea or from patriotic memories near to him in the fields of the Revolution. He thus established a vital connexion with his own country, and in so far he is the most national by his themes of any of the American writers. What he gave was the scene of the new world, both in the forest and by the fires of the Revolution and on the swift and daring American ships; but it was especially by his power to give the sense of the primitive wilderness and the ocean weather, and adventure there, that he won success. In France, where he was popular, this came as an echo out of the real world of the west to the dream of nature that had lately grown up in French literature; and, besides, of all the springs of interest native to men in every land adventure in the wild is, perhaps, the easiest to touch, the quickest and most inflaming to respond. Cooper stood for a true element in American experience and conditions, for the romance in the mere presence of primeval things of nature newly found by man and opening to his coming; this was an imaginative moment, and Cooper seized it by his imagination. He especially did so in the Indian elements of his tale, and gave permanent ideality to the Indian type. The trait of loftiness which he thus incorporated belongs with the impression of the virgin forest and prairie, the breadth, the silence and the music of universal nature. The distinction of his work is to open so great a scene worthily, to give it human dignity in rough and primitive characters seen in the simplicity of their being, and to fill it with peril, resourcefulness and hardihood. It is the only brave picture of life in the broad from an American pen. Scott, in inventing the romantic treatment of history in fiction, was the leader of the historical novel; but Cooper, except in so far as he employed the form, was not in a true sense an imitator of Scott; he did not create, nor think, nor feel, in Scott's way, and he came far short of the deep human power of Scott's genius. He was not great in character; but he was great in adventure, manly spirit and the atmosphere of the natural world, an Odysseyan writer, who caught the moment of the American planting in vivid and characteristic traits.

Bryant.

This same spirit, but limited to nature in her most elemental forms and having the simplest generic relations to human life, characterizes Bryant. He, too, had slender academic training, and came from the same social origins as Irving and Cooper; but, owing to his extraordinary boyish precocity, the family influences upon him and the kind of home he was bred in are more clearly seen. He framed his art in his boyhood on the model of 18th-century verse, and though he felt the liberalizing influences of Wordsworth later there always remained in his verse a sense of form that suggests a severer school than that of his English contemporaries. He lived the life of a journalist and public man in New York, but the poet in him was a man apart and he jealously guarded his talent in seclusion. Though he was at times abroad, he resembled Cooper in being unaffected by foreign residence; he remained home-bred. He wrote a considerable quantity of verse; but it is by a quality in it rather than by its contents that his poetry is recalled, and this quality exists most highly in the few pieces that are well known. To no verse is the phrase "native wood-notes wild" more properly applied. His poetry gives this deep impression of privacy; high, clear, brief in voice, and yet, as it were, as of something hidden in the sky or grove or brook, or as if the rock spoke, it is nature in her haunts; it is the voice of the peak, the forests, the cataracts, the smile of the blue gentian, the distant rosy flight of the water-fowl,—with no human element less simple than piety, death or the secular changes of time. It is, too, an expression of something so purely American that it seems that it must be as uncomprehended by one not familiar with the scene as the beauty of Greece or Italian glows; it is poetry locked in its own land. This presence of the pure, the pristine, the virginal in the verse, this luminousness, spaciousness, serenity in the land, this immemorialness of natural things, is the body and spirit of the true wild, such as Bryant's eyes had seen it and as it had possessed his soul. In no other American poet is there this nearness to original awe in the presence of nature; nowhere is nature so slightly humanized, so cosmically felt, and yet poetized. Poetry of this sort must be small in amount; a few hundred lines contain it all; but they alone shrine the original grandeur, not so much of the American landscape, as of wild nature when first felt in the primitive American world.

American romanticism thus began with these three writers, who gave it characterization after all by only a few simple traits. There was in it no profound passion nor philosophy nor revolt; especially there was no morbidness. It was sprung from a new soil. The breath of the early American world was in Bryant's poetry; he had freed from the landscape a Druidical nature-worship of singular purity, simple and grand, unbound by any conventional formulas of thought or feeling but deeply spiritual. The new life of the land filled the scene of Cooper; prairie, forest and sea, Indians, backwoodsmen and sailors, the human struggle of all kinds, gave it diversity and detail; but its life was the American spirit, the epic action of a people taking primitive possession, battling with its various foes, making its world. Irving, more brooding and reminiscent, gave legend to the landscape, transformed rudeness with humour and brought elements of picturesqueness into play; and in him, in whom the new race was more mature, was first shown that nostalgia for the past, which is everywhere a romantic trait but was peculiarly strong under American conditions. He was consequently more free in imagination than the others, and first dealt with other than American subjects, emancipating literature from provinciality of theme, while the modes of his romantic treatment, the way he felt about his subjects, still owed much to his American birth. In all this literature by the three writers there was little complexity, and there was no strangeness in their personalities. Irving was more genially human, Cooper more vitally intense; Bryant was the more careful artist in the severe limits of his art, which was simple and plain. Simplicity and plainness characterize all three; they were, in truth, simple American gentlemen, of the breeding and tastes that a plain democracy produced as its best, who, giving themselves to literature for a career, developed a native romanticism, which, however obvious and uncomplicated with philosophy, passion or moods, represented the first stage of American life with freshness of power, an element of ideal loftiness and much literary charm.

General progress.

Though Irving, Cooper and Bryant were associated with New York, there was something sporadic in their germination. They have no common source; they stood apart; and their work neither overlapped nor blended, but remained self-isolated. None of them can be said to have founded a school, but Irving left a literary tradition and Cooper had followers in the field of historical fiction. The literary product up to the middle of the century presents generally from its early years the appearance of an indistinguishable mass, as in colonial days, in which neither titles nor authors are eminent. The association of American literature with the periodical press is, perhaps, the most important trait to be observed. New York and Philadelphia were book-markets, and local presses had long been at work issuing many reprints. Magazines in various degrees of importance sprang up in succession to the earlier imitations of English 18th-century periodicals, which abounded at the beginning of the century; and as time went on these were accompanied by a host of annuals of the English *Keepsake* variety. Philadelphia was especially distinguished by an early fertility in magazines, which later reached a great circulation, as in the case of *Godey's* and *Graham's*; the *Knickerbocker* became prominent in New York from 1833, when it was founded; Richmond had in *The Southern Literary Messenger* the chief patron of southern writers from 1834, and there were abortive ventures still farther south in Charleston. These various periodicals and like publications were the literary arena, the place of ambition for young and old, for known and unknown, and there literary fame and what little money came of its pursuit were found. Minor poetry flourished in it; sketches, tales, essays, every sort of writing in prose multiplied there. A change in the atmosphere of letters is also to be noted. The 18th century was fairly left behind. The Philadelphian reprint of Galignani's Paris edition of Keats, Shelley and Coleridge had brought in the new romantic poetry with wide effect; and Disraeli, Bulwer and, later, Dickens are felt in the prose; in verse, especially by women, Mrs Hemans and Mrs Browning ruled the moment. The product was large. In poetry it was displayed on the most comprehensive scale in Rufus Wilmot Griswold's (1815–1857) collections of American verse, made in the middle of the century. Mrs Lydia Sigourney (1791–1865), a prolific writer, and Mrs Maria Gowan Brooks (1795–1845), known as Southey's "Maria del Occidente," a more ambitious aspirant, the "Davidson sisters" (1808–1825: 1823–1838), and Alice (1820–1871) and Phoebe Cary (1824–1871) illustrate the work of the women; and Richard Henry Wilde (1789–1847), George Pope Morris (1802–1864), Charles Fenno Hoffman (1806–1884) and Willis Gaylord Clark (1810–1841) may serve for that of men. In this verse, and in the abundant prose as well, the sentimentality of the period is strongly marked; it continued to the times of the Civil War. Two poets of a better type, Joseph Rodman Drake (1795–1820), distinguished by delicacy of fancy, and Fitz-Greene Halleck (1790–1867), who showed ardour and a real power of phrase, are remembered from an earlier time for their brotherhood in verse, but Drake died young and Halleck was soon sterilized, so that the talents of both proved abortive. The characteristic figure that really exemplifies this secondary literature at its best is Nathaniel Parker Willis (1806–1867) who, though born in Portland, Maine, was the chief *littérateur* of the Knickerbocker period. He wrote abundantly in both verse and prose, and was the first of the journalist type of authors, a social adventurer with facile powers of literary entertainment, a man of the town and immensely popular. He was the sentimentalist by profession, and his work, transitory as it proved, was typical of a large share of the taste, talent and ambition of the contemporary crowd of writers. Neighbouring him in time and place are the authors of various stripe, known as "the Literati," whom Poe described in his critical papers, which, in connexion with Griswold's collections mentioned above, are the principal current source of information concerning the bulk of American literature in that period.

Poe.

This world of the magazines, the Literati and sentimentalism, was the true *milieu* of Edgar Allan Poe (1809–1849). Born in Boston, his mother a pleasing English actress and his father a dissipated stage-struck youth of a Baltimore family, left an orphan in childhood, he was reared in the Virginian home of John Allan, a merchant of Scottish extraction; he received there the stamp of southern character. He was all his life characteristically a southerner, with southern ideals of character and conduct, southern manners towards both men and women and southern passions. He showed precocity in verse, but made his real *début* in prose as editor of *The Southern Literary Messenger* at Richmond in 1835. He was by his talents committed to a literary career, and being usually without definite means of support he followed the literary market, first to Philadelphia and later to New York. He was continuously associated with magazines as editor, reviewer or contributor; they were his means of sustenance; and, whether as cause or effect, this mode of life fell in with the nature of his mind, which was a contemporary mind. He was perhaps better acquainted with contemporary work in literature than any of his associates; he took his first cues from Disraeli and Bulwer and Moore, and he was earliest to recognize Tennyson and Mrs Browning; his principal reading was always in the magazines. He was, however, more than a man of literary temperament like Irving and Cooper; he was a child of genius. As in their case, there was something sporadic in his appearance on the scene. He had no American origins, but only American conditions of life. In fact he bore little relation to his period, and so far as he was influenced, it was for the worse; he transcended the period, essentially, in all his creative work. He chose for a form of expression the sketch, tale or short story, and he developed it in various ways. From the start there was a melodramatic element in him, itself a southern trait and developed by the literary influence of Disraeli and Bulwer on his mind. He took the tale of mystery as his special province; and receiving it as a mystery that was to be explained, after the recent masters of it, he saw its fruitful lines of development in the fact that science had succeeded to superstition as the source of wonder, and also in the use of ratiocination as a mode of disentanglement in the detective story. Brilliant as his success was in these lines, his great power lay in the tale of psychological states as a mode of impressing the mind with the thrill of terror, the thrall of fascination, the sense of mystery. It is by his tales in these several sorts that he won, more slowly than Irving or Cooper and effectually only after his death, continental reputation; at present no American author is so securely settled in the recognition of the world at large, and he owes this, similarly to Cooper, to the power of mystery over the human mind universally; that is, he owes it to his theme, seconded by a marvellous power to develop it by the methods of art. He thus added new traits to American romanticism, but as in the case of Irving's Spanish studies there is no American element in the theme; he is detached from his local world, and works in the sphere of universal human nature, nor in his treatment is there any trace of his American birth. He is a world author more purely than any other American writer. Though it is on his tales that his continental reputation necessarily rests, his temperament is more subtly expressed in his verse, in which that *fond* of which his tales are the logical and intelligible growth gives out images and rhythms, the issue of morbid states, which affect the mind rather as a form of music than of thought. Emotion was, in art, his constant aim, though it might be only so simple a thing as the emotion of colour as in his landscape studies; and in his verse, by an unconscious integration and flow of elements within him it must be thought, he obtained emotional effects by images which have no intellectual value, and which float in rhythms so as to act musically on the mind and arouse pure moods of feeling absolutely free of any other contents. Such poems must be an enigma to most men, but others are accessible to them, and derive from them an original and unique pleasure; they belong outside of the intellectual sphere. It is by virtue of this musical quality and immediacy that his poetry is characterized by genius; in proportion as it has meaning of an intelligible sort it begins to fade and lower; so far as "Lenore" and "Annie" and "Annabel Lee" are human, they are feeble ghosts of that sentimentality which was so rife in Poe's time and so maudlin in his own personal relations; and except for a half-dozen pieces, in which his quality of rhythmical fascination is supreme, his verse as a whole is inferior to the point of being commonplace. Small as the quantity of his true verse is, it more sustains his peculiar genius in American eyes than does his prose; and this is because it is so unique. He stands absolutely alone as a poet with none like him; in his tales, as an artist, he is hardly less solitary, but he has some ties of connexion or likeness with the other masters of mystery. Poe lived in poverty and died in misery; but without him romanticism in America would lose its most romantic figure, and American literature the artist who, most of all its writers, had the passion of genius for its work.

Poe left even less trace of himself in the work of others than did Irving, Cooper and Bryant. He stands in succession to them, and closed the period so far as it contributed to American romanticism anything distinguished, original or permanent. The ways already opened had, however, been trod, and most notably in fiction. The treatment of manners and customs, essentially in Irving's vein, was pleasingly cultivated in Maryland by John Pendleton Kennedy (1795–1870) in *Swallow Barn* (1832) and similar tales of Old Dominion life. In Virginia, Beverly Tucker (1784–1851) in *The Partisan Leader* (1836), noticeable for its prophecy of secession, and John Esten Cooke (1830–1886) in *The Virginia Comedians* (1854), also won a passing reputation. The champion in the south, however, was William Gilmore Simms (1806–1870), born in Charleston, a voluminous writer of both prose and verse, who undertook to depict, on the same scale as Cooper and in his manner, the settlement of the southern territory and its Indian and revolutionary history; but of his many novels, of which the characteristic examples are *The Yemassee* (1835), *The Partisan* (1835) and *Beauchampe* (1842), none attained literary distinction. The sea-novel was developed by Herman Melville (1819–1891) in *Typee* (1846) and its successors, but these tales, in spite of their being highly commended by lovers of adventure, have taken no more hold than the work of Simms. Single novels of wide popularity appeared from time to time, of which a typical instance was *The Wide, Wide World* (1850) by Susan Warner (1819–1885). The grade of excellence was best illustrated, perhaps, for the best current fiction which was not to be incorporated in literature, by the novels of Catharine Maria Sedgwick (1789–1867), of a western Massachusetts family, in *Hope Leslie* (1827) and its successors. The distinct Knickerbocker strain was best preserved by James Kirke Paulding (1778–1860) among the direct imitators of Irving; but the better part of the Irving tradition, its sentiment, social grace and literary flavour, was not noticeable until it awoke in George William Curtis (1824–1892), born a New Englander but, like Bryant, a journalist and public man of New York, whose novels, notes of travel and casual brief social essays brought that urbane style to an end, as in Donald Grant Mitchell (born 1822) the school of sentiment, descended from the same source, died not unbecomingly in the *Reveries of a Bachelor* (1850) and *Dream Life* (1851). Two poets, just subsequent to Poe, George Henry Boker (1823–1890) and Thomas Buchanan Read (1822–1872), won a certain distinction, the former especially in the drama, in the Philadelphia group. The single popular songs, "The Star-Spangled Banner" (1813), by Francis Scott Key (1779–1843) of Maryland, "America" (1832) by Samuel Francis Smith (1808–1895) of Massachusetts, and "Home, Sweet Home" (1823) by John Howard Payne (1792–1852) of New York, may also be appropriately recorded here. The last distinct literary personality to emerge from the miscellany of talent in the middle of the century, in the middle Atlantic states, was James Bayard Taylor (1825–1878), who, characteristically a journalist, gained reputation by his travels, poems and novels, but in spite of brilliant versatility and a high ambition failed to obtain permanent distinction. His translation of *Faust* (1870) is his chief title to remembrance; but the later cultivation of the oriental motive in American lyrical poetry owes something to his example.

New England scholarship.

In New England, which succeeded to New York as the chief source of literature of high distinction, the progress of culture in the post-Revolutionary period was as normal and gradual as elsewhere in the country; there was no violence of development, no sudden break, but the growth of knowledge and taste went slowly on in conjunction with the softening of the Puritan foundation of thought, belief and practice. What most distinguished literature in New England from that to the west and south was its connexion with religion and scholarship, neither of which elements was strong in the literature that has been described. The neighbourhood of Harvard College to Boston was a powerful influence in the field of knowledge and critical culture. The most significant fact in respect to scholarship, however, was the residence abroad of George Ticknor (1791–1871), author of *The History of Spanish Literature* (1849), of Edward Everett (1794–1865), the orator, and of George Bancroft (1800–1891), author of the *History of the United States* (1834–1874), who as young men brought back new ideals of learning. The social connexion of Boston, not only with

England but with the continent, was more constant, varied and intimate than fell to the fortune of any other city, and owing to the serious temper of the community the intellectual commerce with the outer world through books was more profound. Coleridge was early deeply influential on the thought of the cultivated class, and to him Carlyle, who found his first sincere welcome and effectual power there, succeeded. The influence of both combined to introduce, and to secure attention for, German writers. Translation, as time went on, followed, and German thought was also further sustained and advanced in the community by Frederick Henry Hedge (1805–1890), a philosophical theologian, who conducted a propaganda of German ideas. The activity of the group about him is significantly marked by the issue of the series of *Specimens of Foreign Standard Literature* (1838), edited by George Ripley (1802–1880), the critic, which was the first of its kind in America. French ideas, as time went on, were also current, and the field of research extended to the Orient, the writings of which were brought forward especially in connexion with the Transcendental Movement to which all these foreign studies contributed. In New England, in other words, a close, serious and vital connexion was made, for the first time, with the philosophic thought of the world and with its tradition even in the remote past. Unitarianism, which was the form in which the old Puritanism dissolved in the cultivated class, came in with the beginning of the century, and found its representative in the gentle character, refined intelligence and liberal humanity of William Ellery Channing (1780–1842), who has remained its chief apostle. It was the expression of a moral maturing and intellectual enlightenment that took place with as little disturbance as ever marked religious evolution in any community. The people at large remained evangelical, but they also felt in a less degree the softening and liberalizing tendency; nevertheless it was mainly in the field of Unitarianism that literature flourished, as was natural, and Transcendentalism was a phenomenon that grew out of Unitarianism, being indeed the excess of the movement of enlightenment and the extreme limit of intuitionalism, individualism and private judgment. These two factors, religion and scholarship, gave to New England literature its serious stamp and academic quality; but the preparatory stage being longer, it was slower to emerge than the literature of the rest of the country.

The first stirrings of romanticism in New England were felt, as in the country to the south, by men of literary temperament in a sympathetic enjoyment and feeble imitation of the contemporary English romantic school of fiction exemplified by Mrs Radcliffe, Lewis and Godwin. Washington Allston (1779–1843), the painter, born in South Carolina but by education and adoption a citizen of Cambridge, showed the taste in *Monaldi* (1841), and Richard Henry Dana (1787–1879) in *Paul Felton* (1833); in his poem of the same date, "The Buccaneer," the pseudo-Byronic element, which belongs to the conception of character and passion in this school of fiction, appears. These elder writers illustrate rather the stage of imaginative culture at the period, and show by their other works also—Allston by his poems "The Sylphs of the Seasons" (1813), and Dana by his abortive periodical *The Idle Man* (1821) issued at New York—their essential sympathy with the literary conditions reigning before the time of Irving. They both were post-Revolutionary, and advanced American culture in other fields rather than imagination, Allston in art and Dana in criticism, as editor of *The North American Review*, which was founded in 1815, and was long the chief organ of serious thought and critical learning, influential in the dissemination of ideas and in the maintenance of the intellectual life. The influence of their personality in the community, like that of Channing, with whom they were closely connected, was of more importance than any of their works.

The definite moment of the appearance of New England in literature in the true sense was marked by Ralph Waldo Emerson's (1803–1882) *Nature* (1836), Nathaniel Hawthorne's (1804–1864) *Twice-Told Tales* (1837) and Henry Wadsworth Longfellow's (1807–1882) *Voices of the Night* (1839). Of this group of men Longfellow is the most national figure, and from the point of view of literary history the most significant by virtue of what he contributed to American romanticism in the large. He felt the conscious desire of the people for an American literature, and he obeyed it in the choice of his subjects. He took national themes, and his work is in this respect the counterpart in poetry to that of Cooper in prose. In *Hiawatha* (1855) he poetized the Indian life; and, though the scene and figures of the poem are no more localized than the happy hunting-grounds, the ideal of the life of the aborigines in the wilderness is given with freshness and primitive charm and with effect on the imagination. It is the sole survivor of many poetic attempts to naturalize the Indian in literature, and will remain the classic Indian poem. In *Evangeline* (1847), *The Courtship of Miles Standish* (1858) and *The New England Tragedies* (1868), he depicted colonial life. As he thus embodied national tradition in one portion of his work, he rendered national character in another, and with more spontaneity, in those domestic poems of childhood and the affections, simple moods of the heart in the common lot, which most endeared him as the poet of the household. These are American poems as truly as his historical verse, though they are also universal for the English race. In another large portion of his work he brought back from the romantic tradition of Europe, after Irving's manner, motives which he treated for their pure poetic quality, detached from anything American, and he also translated much foreign verse from the north and the south of Europe, including Dante's *Divine Comedy* (1867). He has, more than any other single writer, reunited America with the poetic past of Europe, particularly in its romance. The same serenity of disposition that marked Irving and Bryant characterized his life; and his art, more varied than Bryant's or Irving's, has the same refinement, being simple and so limpid as to deceive the reader into an oblivion of its quality and sometimes into an unwitting disparagement of what seems so plain and natural as to be commonplace. In Longfellow, as in Irving, one is struck by that quietude, which is so prevailing a characteristic of American literature, and which proceeds from its steady and even flow from sources that never knew any disturbance or perturbation. The life, the art, the moods are all calm; deep passion is absent.

Emerson: Hawthorne: Longfellow.

Hawthorne was endowed with a soul of more intense brooding, but he remained within the circle of this peace. He developed in solitude exquisite grace of language, and in other respects was an artist, the mate of Poe in the tale and exceeding Poe in significance since he used symbolism for effects of truth. He, like Longfellow, embodied the national tradition, in this case the Puritan past; but he seized the subject, not in its historical aspects and diversity of character and event, but psychologically in its moral passion in *The Scarlet Letter* (1850), and less abstractly, more picturesquely, more humanly, in its blood tradition, in *The House of the Seven Gables*. In his earlier work, as an artist, he shows the paucity of the materials in the environment, especially in his tales; but when his residence in Italy and England gave into his hands larger opportunity, he did not succeed so well in welding Italy with America in *The Marble Faun* (1860), or England with America in his experimental attempts at the work which he left uncompleted, as he had done in the Puritan romances. He had, however, added a new domain to American romanticism; and, most of all these writers, he blended moral truth with fiction; he, indeed, spiritualized romance, and without loss of human reality,—a rare thing in any literature. Both Longfellow and Hawthorne were happy in reconciling their art with their country: both, not less than Poe, were universal artists, but they incorporated the national past in their art and were thereby more profoundly American.

Emerson, whose work lay in the religious sphere, not unlike Jonathan Edwards at an earlier time of climax but in a different way, marked the issue of Puritanism in pure idealism, and was more contemporaneously associated with life in the times than were the purely imaginative writers. He was the central figure of Transcendentalism, and apart from his specific teachings stood for the American spirit, disengaged from authority, independent, personal, responsible only to himself. He reached a revolutionary extreme, but he had not arrived at it by revolutionary means; without storm or stress, with characteristic peacefulness, he came to the great denials, and without much concerning himself with them turned to his own affirmations of spiritual reality, methods of life and personal results. Serenity was his peculiar trait; amid all the agitation about him he was entirely unmoved, lived calmly and wrote with placid power, concentrating into the slowly-wrought sentences of his *Essays* (1841–1875) the spiritual essence and moral metal of a life lived to God, to himself and to his fellow-men. He, more than any other single writer, reunited American thought with the philosophy of the world; more than all others, he opened the ways of liberalism, wherever they may lead. He was an emancipator of the mind. In his *Poems* (1847–1867), though the abstract and the concrete often find themselves awkward mates, his philosophic ideas are put forth under forms of imagination and his personal life is expressed with nobility; his poetic originality, though so different in kind, is as unique as Poe's, and reaches a height of imaginative faculty not elsewhere found in American verse. His poetry belongs more peculiarly to universal art, so pure in general is its philosophic content and so free from any temporal trait is the style; but it is as distinguished for the laconic expression of American ideas, minted with one blow, as his prose is for the constant breathing of the American spirit. It is the less possible to define the American traits in Emerson, because they constituted the man. He was as purely an American type as Lincoln. The grain of the man is in his work also; and the best that his prose and verse contain is his personal force. In him alone is genius felt as power; in the others it impresses one primarily as culture, modes of artistic faculty, phases of temperament. In this, too, he brings to mind Jonathan Edwards, the other climax of the religious spirit in New England; in Edwards it was intellectual power, in Emerson it was moral power; in both it was indigenous, power springing from what was most profound in the historic life of the community.

Whittier: Holmes: Lowell.

Three other names, John Greenleaf Whittier (1807–1892), Oliver Wendell Holmes (1809–1894), James Russell Lowell (1819–1891), complete the group of the greater writers of New England. Holmes was a more local figure, by his humour and wit and his mental acuteness a Yankee and having the flavour of race, but neither in his verse nor his novels reaching a high degree of excellence and best known by *The Autocrat of the Breakfast Table* (1858), which is the Yankee prose classic. His contemporary reputation was largely social and owed much to the length of his life, but his actual hold on literature already seems slight and his work of little permanent value. Whittier stands somewhat apart as the poet of the soil and also because of his Quakerism; he was first eminent as the poet of the anti-slavery movement, to which he contributed much stirring verse, and later secured a broader fame by *Snowbound* (1866) and his religious poems of simple piety, welcome to every faith; he was also a balladist of local legends. In general he is the voice of the plain people without the medium of academic culture, and his verse though of low flight is near to their life and faith. Lowell first won distinction by *The Biglow Papers* (1848), which with the second series (1886) is the Yankee classic in verse, and is second only to his patriotic odes in maintaining his poetic reputation; his other verse, variously romantic in theme and feeling, and latterly more kindred to English classic style, shows little originality and was never popularly received; it is rather the fruit of great talent working in close literary sympathy with other poets whom from time to time he valued. His prose consists in the main of literary studies in criticism, a field in which he held the first rank. Together with Holmes and Whittier he gives greater body, diversity and illustration to the literature of New England; but in the work of none of these is there the initiative or the presence of single genius that characterize Emerson, Hawthorne and Longfellow. Lowell was a scholar with academic ties, a patriot above party, master of prose and verse highly developed and finished, and at times of a lofty strain owing to his moral enthusiasm; Whittier was a Quaker priest, vigorous in a great cause of humanity, with fluent power to express in poetry the life of the farm, the roadside and the legends that were like folklore in the memory of the settlement; Holmes was a town wit and master of occasional verse, with notes here and there of a higher strain in single rare poems.

Transcendentalism.

The secondary literature that accompanied the work of these writers was abundant. It was largely the product of Transcendentalism and much of it gathered about Emerson. In *The Dial* (1840), the organ of Transcendentalism, he introduced to the public his young friend, Henry David Thoreau (1817–1862), author of *Walden* (1854) and the father of the nature-writers, who as a hermit-type has had some European vogue and shows an increasing hold as an exception among men, but whose work has little literary distinction; and together with him, his companion, William Ellery Channing (1818-1901), a poet who has significance only in the transcendentalist group. With them should be named Emerson's coeval, Amos Bronson Alcott (1799–1888), the patriarch of the so-called Concord philosophers, better esteemed for his powers of monologue than as a writer in either prose or verse. Emerson's associate-editor in *The Dial* was Sarah Margaret Fuller, afterwards Marchioness d'Ossoli (1810–1850), a woman of extraordinary qualities and much usefulness, who is best remembered by her *Woman in the Nineteenth Century* (1844), but contributed no permanent work to literature. She was a leading figure at Brook Farm, the socialistic community founded by members of the group, and especially by Ripley, who like her afterwards emigrated to New York and together with her began a distinguished critical career in connexion with *The New York Tribune*. Transcendentalism produced also its peculiar poet in Jones Very (1813–1881), whose *Poems* (1839) have original quality though slight merit, and its novelist in Sylvester Judd (1813–1853), whose *Margaret* (1845) is a unique work in American fiction. Other transcendentalist poets were Christopher Pearse Cranch (1813–1892), and Charles Timothy Brooks (1813–1883), who translated *Faust* (1856), besides a score of minor names. Outside of this group Thomas William Parsons (1819–1892), who translated Dante's *Inferno* (1843), was a poet of greater distinction, but his product was slight. The prose of the movement, though abundant, yielded nothing that is remembered.

History.

Oratory.

Fiction.

The literary life of Boston was, however, by no means confined within this circle of thought. It was most distinguished in the field of history, where indeed the writers rivalled the imaginative authors in public fame. They were, besides George Bancroft already mentioned, John Gorham Palfrey (1796–1881), author of *The History of New England* (1858), William Hickling Prescott (1796–1859), whose field was Spanish and Spanish-American history, John Lothrop Motley (1814–1877), whose attention was given to Dutch history, and Jared Sparks (1789–1866), whose work lay in biography. In the writings of Prescott and Motley the romanticism of the period is clearly felt, and they attained the highest distinction in the literary school of history of the period. Oratory also flourished in Daniel Webster (1782–1852), Edward Everett (1794–1865), Rufus Choate (1799–1859), Wendell Phillips (1811–1884), Charles Sumner (1811–1874), and Robert Charles Winthrop (1809–1894), the last survivor of a long line of fiery or classic oratory in which New England was especially distinguished and had rivalry only from Henry Clay (1777–1852) of Virginia, and John Caldwell Calhoun (1782–1850) of South Carolina. The church also produced two powerful speakers in Theodore Parker (1810–1860), the protagonist of the liberals in Boston, and Henry Ward Beecher (1813–1887), who sustained a liberal form of New England congregationalism in Brooklyn, New York, where he made Plymouth Church a national pulpit. The single memorable novel of the period was Mrs Harriet Beecher Stowe's (1811–1896) *Uncle Tom's Cabin* (1852), which had a world-wide vogue; it is the chief contribution of the anti-slavery movement to American literature and stands for plantation life in the old south. Another female writer, Mrs Lydia Maria Child (1802–1880), remembered by her *Philothea* (1836), deserves mention in the line of notable American women who served their generation in literary ways and by devotion to public causes. Criticism was served excellently by Edwin Percy Whipple (1819-

Scholarship.

1885), and less eminently by Henry Theodore Tuckerman (1813–1871), who emigrated to New York; but scholarship in general flourished under the protection of Harvard College, where Ticknor, Longfellow and Lowell maintained a high ideal of literary knowledge and judgment in the chair they successively filled, and were accompanied in English by Francis James Child (1825–1896), whose *English and Scottish Ballads*, first issued in 1858, was brought to its final and monumental form in 1892. Cornelius Conway Felton (1807–1862), president of Harvard College, stood for Greek culture, but the classical influence was little in evidence. Elsewhere in New England George Perkins Marsh (1801–1882) of Vermont, long minister to Italy, and William Dwight Whitney (1827–1894) of Yale, were linguistic scholars of high distinction. The development of the colleges into universities was already prophesied in the presence and work of these men. Outside of New England scholarship had been illustrated in New York by Charles Anthon (1797–1867), the classical editor, by the Duyckincks, Evert Augustus (1816–1878) and George Long (1823–1863), editors of the *Cyclopaedia of American Literature* (1855), and by Giulian Crommelin Verplanck (1786–1870), editor of *Shakespeare* (1846).

Characteristics of New England literature.

New England thus, standing somewhat apart, produced a characteristic literature, more deeply rooted in the community than was the case elsewhere; and this literature, blending with what was produced to the south and west, became a predominant share of what has been nationally accepted as standard American literature. It is also the more profound and scholarly share; and if quantity as well as quality be counted, and, as is proper, Bryant be included as the product of Puritan culture, it is the more artistic share. American standard literature, so constituted, belongs to romanticism, and is a phase of the romanticism which was then the general mood of literature; but it is a native product, with traits of its own and inward development from local conditions, not only apparent by its themes, but by its distinct evolution. Though it owed much to contact with Europe through its travelled scholars and its intellectual commerce by means of translations and imported books, and often dealt with matter detached from America both in prose and poetry, it was essentially self-contained. It was, in a marked way, free from the passions whose source was the French Revolution and its after-throes from 1789 to 1848; it is by this fact that it differs most from European romanticism. Just as the Puritan Rebellion in England left the colonies untouched to their own development, the political revolutions in Europe left the new nation unaffected to its normal evolution. There was never any revolution, in the French sense, in America, whether social, political, religious or literary; its great historical changes, such as the termination of English rule, the passing away of Puritanism, the abolition of slavery with the consequent destruction of the old South, were in a true sense conservative changes, normal phases of new life. In literature this state of things is reflected in the absence in it of any disturbance, its serenity of mood, its air of quiet studies. It is shown especially in its lack of passion. The only ardours displayed by its writers are moral, patriotic or religious, and in none of them is there any sense of conflict. The life which they knew was wholesome, regular, still free from urban corruption, the experience of a plain, prosperous and law-abiding people. None of these writers, though like Hawthorne they might deal with sin or like Poe with horror and a lover's despair at death, struck any tragic note. No tragedy was written, no love-poetry, no novel of passion. No literature is so maiden-pure. It is by refinement rather than power that it is most distinguished, by taste and cultivation, by conscientiousness in art, in poetic and stylistic craft; it is romance retrospectively seen in the national past, or conjured out of foreign lands by reminiscent imagination, or symbolically created out of fantasy; and this is supplemented by poetry of the domestic affections, the simple sorrows, all "that has been and may be again" in daily human lives, and by prose similarly related to a well-ordered life. If it is undistinguished by any work of supreme genius, it reflects broadly and happily and in enduring forms the national tradition and character of the land in its dawning century.

The original impulse of this literature had spent its force by 1861—that is, before the Civil War. The greater writers had, in general, already done their characteristic work, and though the survivors continued to produce till toward the close of the century, their works contained no new element and were at most mellow fruits of age. The war itself, like the Revolution, left little trace in literature beyond a few popular songs and those occasional poems which the older poets wrote in the course of the conflict. Their attitude toward it and (with the exception of Whittier and Lowell) toward the anti-slavery movement which led up to it was rather that of citizens than of poets, though in the verse of Longfellow and Emerson there is the noble stamp of the hour, the impress of liberty, bravery and sorrow. Lowell is the exception; he found in the *Commemoration Ode* (1865) his loftiest subject and most enduring fame. The work began to fall into new hands, and a literature since the war grew up, which was, however, especially in poetry, a continuation of romanticism and contained its declining force. It was contributed to from all parts of the older country, and also from the west, and a generation has now added its completed work to the sum. No author, in this late period, has received the national welcome to the same degree as the men of the elder time; none has had such personal distinction, eminence or public affection; and none has found such honourable favour abroad, either in England or on the continent. Poetry has felt the presence of the art of Tennyson, which has maintained an extreme sensitiveness among the poets to artistic requirements of both material and technique; and it also has taken colour from the later English schools. It has, however, yielded its pre-eminent position to prose. The novel has displaced romance as the highest form of fiction, and the essay has succeeded the review as the form of criticism. The older colleges have grown into universities, and public libraries have multiplied throughout the north and west. The literature of information, meant for the popularization of knowledge of all kinds, has been put forth in great quantity, and the annual increase in the production of books keeps pace with the general growth of the country. Literature of distinction, however, makes but a small part of this large mass.

Later writers.

In poetry the literary tradition was continued in Boston by Thomas Bailey Aldrich (1836–1907), essentially a stylist in verse, brief, definite, delicate, who carried the lighter graces of the art, refinement, wit, polish, to a high point of excellence. His artistic consanguinity is with Herrick and Landor, and he takes motive and colour for his verse from every land, as his predecessors had done, but with effects less rich. He divided attention between drama and lyric, but as his dramas look strictly to the stage, it is on the lyrics that his reputation rests. He was master also of an excellent prose and wrote novels, sketches of travel, and especially stories, strongly marked by humour, surprise and literary distinction. In New York, Edmund Clarence Stedman (1833–1908) became the chief representative of the literary profession. He was both poet and critic, and won reputation in the former and the first rank in the latter field. His *Victorian Poets* (1875) and *Poets of America* (1885), followed by comprehensive anthologies (1894–1900), together with *The Nature and Elements of Poetry* (1892), are the principal critical work of his generation, and indeed the sole work that is eminent. His verse, less practised as time went on, was well wrought and often distinguished by flashes of spirited song and balladry. With him is associated his elder friend, Richard Henry Stoddard (1825–1903), who made his appearance before the Civil War, and whose verse belongs in general character to the style of that earlier period and is as rapidly forgotten. Both Stedman and Stoddard were of New England birth, as was also the third to be mentioned, William Winter (born 1836), better known as the lifelong dramatic critic of the metropolis. The last of the New York poets of established reputation, Richard Watson Gilder (b. 1844 in New Jersey; d. 1909), was at first affiliated with the school of Rossetti, and his work in general, *Five Books of Song* (1894), strongly marked by artistic susceptibility, is in a high degree refined and delicate. In the country at large popular success, in England as well as in America, was won by Charles Godfrey Leland (1824–1903), in *Hans Breitmann's Ballads* (1871), humorous poems in the Pennsylvania Dutch dialect. Born in Philadelphia, he spent the greater part of his mature life abroad and wrote numerous works on diverse topics, but his reputation is chiefly connected with his books on gypsy life and lore. Another foreign resident who deserves mention was William Wetmore Story (1819–1895), the sculptor, of Massachusetts, connected with the Boston group, whose verse and prose gave him the rank of a *littérateur*. The South again entered into literature with the work of Sidney Lanier (1842–1881), in succession to Henry Timrod (1829–1867) and Paul Hamilton Hayne (1830–1886), who find a place rather by the affection in which they are held at the South than by positive merit. Lanier showed originality and a true poetic gift, but his talents were little effectual. From the West humorous poetry was produced by Francis Bret Harte (1839–1902), born in Albany, in *The Heathen Chinee* (1870) and similar verse, but he is better remembered as the artistic narrator of western mining life in his numerous stories and novels. Verse of a similar kind also first brought into literary notice John Hay (1838–1905), in *Pike County Ballads* (1871), who also wrote in prose; but his reputation was rather won as a statesman in the closing years of his life. Minor poets of less distinction but with a vein superior to that of the earlier period, more excellent in workmanship and more coloured with imagination and mood, arose in all parts, of whom the most notable are Julia Ward Howe (born 1819), in Boston, the venerable friend of many good causes, Henry Howard Brownell (1820–1872) of Rhode Island, author of the most vigorous and realistic poetry of the Civil War, *War Lyrics* (1866), Edward Rowland Sill (1841–1887), born in Connecticut but associated with California, Henry Van Dyke (born 1852), in New York, better known by his prose in tale and essay, Silas Weir Mitchell (born 1830), in Philadelphia, whose repute as a novelist has overshadowed his admirable verse, Eugene Field (1850–1895) of Chicago, James Whitcomb Riley (born 1853) of Indiana, both distinguished for their humorous and childhood verse, and Joaquin Miller (born 1841) of Oregon, whose first work, *Songs of the Sierras* (1871), had in it much of the spirit of the wild land, the colour of the desert, the free, adventurous character of the filibuster, all strangely mixed with pseudo-Byronic passions.

Whitman.

Apart from all these, whether minor or major poets, stands Walt Whitman (1819–1892), whose *Leaves of Grass* (1855) first appeared before the war, but whose fame is associated rather with its successive editions and its companion volumes, and definitely dated, perhaps, from 1867. He received attention in England, as did Miller, on an assumption that his works expressed the new and original America, the unknown democracy, and he has had some vogue in Germany mainly owing to his naturalism. His own countrymen, however, steadily refuse to accept him as representative of themselves, and his naturalism is uninteresting to them, while on the other hand a group apparently increasing in critical authority treat his work as significant. It is, in general, only by those few fine lyrics which have found a place in all anthologies of American verse that he is well known and highly valued in his own land.

The later novel.

The chief field of literary activity has been found in the novel, and nowhere has the change been so marked as here. The romantic treatment of the novel practically disappeared, and in its place came the realistic or analytic treatment, rendering manners by minute strokes of observation or dissecting motives psychologically. This amounted to a substitution of the French art of fiction, in some of its forms, for the English tradition of broad ideality and historical picturesqueness. The protagonist of the reform was William Dean Howells (born 1837), a cultivated literary scholar, and a various writer of essays, travel sketches, poetry and plays, editor of many magazines and books, whose career in letters has been more laborious and miscellaneous than any other contemporary, but whose main work has been the long series of novels that he has put forth almost annually throughout the period. He not only wrote fiction, but he endeavoured to make known to Americans fiction as it was practised in other lands, Russia, Italy, Spain, and to bring the art that was dearest to him into line with the standard of the European world. He was an apostle of the realistic school, and directed his teaching to the advocacy of the novel of observation, which records life in its conditions and attempts to realize what is in the daily lives and experience of man rather than what belongs to adventure, imagination or the dreaming part of life. Of his works, *The Lady of the Aroostook* (1879), *The Rise of Silas Lapham* (1885), *A Hazard of New Fortunes* (1889), are characteristic examples. He won a popular vogue, and if it is now less than it was, it is because after a score of years tastes and fashions change. The conscientiousness of his art continues the tradition of American writers in that respect, and he is master of an affable style. His work, including all its phases, is the most important body of work done in his generation. Henry James (born 1843), who mainly resided abroad, is his compeer, and in a similar way has followed French initiative. He also has been a various writer of criticism and travel and the occasional essay; but his equally long series of novels sustains his reputation. He has developed the psychological treatment of fiction, and of his work *The Portrait of a Lady* (1881), *The Princess Casamassima* (1886) and *The Tragic Muse* (1890) are characteristic. He has had less vogue owing to both matter and style, but in certain respects his power, more intellectual than that of Howells, has greater artistic elements, while the society with which he deals is more complex. He is really a cosmopolitan writer and has no other connexion with America than the accident of birth. A third novelist, also a foreign resident, Francis Marion Crawford (1854–1909), falls into the same category. A prolific novelist, in the beaten track of story-telling, he has always a story to tell and excellent narrative power. The work regarded as most important from his hand is *Saracinesca* (1887) and its sequels; but his subjects are cosmopolitan, his talent is personal, and he has no effectual connexion with his own country. The romantic tradition of the older time was continued by Lew Wallace (1827–1905) of Indiana, a distinguished general and diplomat, in his Mexican tale, *The Fair God* (1873), and his oriental romances, *Ben Hur* (1880), one of the most widely circulated of American books, and *The Prince of India* (1893). A mode of the novel which was wholly unique was practised by Francis Richard Stockton (1834–1902) in his droll tales, of which *Rudder Grange* (1879) is the best known.

The principal minor product of the novel lay in the provincial tale. The new methods easily lent themselves to the portraiture of local conditions, types and colour. Every part of the country had its writers who recorded its traits in this way. For New England Mrs Harriet Beecher Stowe described the older life in *Old Town Folks* (1869), and was succeeded by Sarah Orne Jewett (1849–1909) and Mary Eleanor Wilkins (born 1862). The West was notably treated by Edward Eggleston (1837–1902) in *The Hoosier School Master* (1871), Mary Hallock Foote (born 1847) in *Led-Horse Claim* (1883) and Hamlin Garland (born 1860) in *Main Travelled Roads* (1891). The South was represented by Mary Noailles Murfree [" Charles Egbert Craddock "] (born 1850) in *In the Tennessee Mountains* (1884) and its successors, by Thomas Nelson Page (born 1853) in *Marse Chan* (1887) and other tales of the reconstruction in Virginia, and with most literary grace by George Washington Cable (born 1844), whose novels of Louisiana are remarkable for their poetic charm. The list is sufficiently illustrative of the general movement, which made what was called the dialect novel supreme for the season. This was succeeded by a revival of the historical novel in local fields, of which Winston Churchill (born 1871) in *Richard Carvel* (1899) is the leading exponent, and together with it the sword and dagger tale of the Dumas type, the special contemporary plot invented by Anthony Hope, and romance in its utmost forms of adventure and extravagance, came in like a flood at the close of the Spanish War. There were during the period from 1870 to 1900 many other writers of fiction, who often proceeded in conventional and time-honoured ways to tell their tale, but none of them is especially significant for the general view or as showing any tendencies of an original sort. The pietistic novel, for example, was produced with immense popularity by Edward Payson Roe (1838–1888), who shared the same vogue as Josiah Gilbert Holland (1819–1881), and both fell heir to the same audience which in the earlier period had welcomed *The Wide, Wide World* with the same broad acceptance.

Essayists.

The essay, and the miscellaneous work which may be classed with it, was cultivated with most distinction by Thomas Wentworth Higginson (born 1823), one of the Boston group, a writer of the greatest versatility, as in his life he followed many employments, from that of preaching in a Unitarian pulpit to that of commanding a negro regiment in the Civil War. He has written good verse and excellent prose, and his familiar style, often brilliant with life and wit, especially becomes the social essay or reminiscent paper in which he excelled, and gives agreeableness to his writings in every form. *Atlantic Essays* (1871) is a characteristic book; and, in general, in his volumes is to be found a valuable fund of reminiscence about the literature and the times of his long life, not elsewhere so abundant or entertaining. Charles Dudley Warner (1829–1900) of Hartford, also in close touch in the later years with the Boston group, was more gifted with gentle humour and of a literary temperament that made the social essay his natural expression. He won popularity by *My Summer in a Garden* (1870), and was the author of many volumes of travel and several novels, but the familiar essay, lighted with humour and touched with a reminiscence of the Irving quality in sentiment, was his distinctive work. The long life of Edward Everett Hale (1822–1909), minister at Boston, was fruitful in many miscellaneous volumes, including fiction of note, *The Man Without a Country* (1868), but the most useful writing from his pen falls into prose resembling the essay in its form and manner of address, though cousin, too, to the sermon. John Burroughs (b. 1837) of New York carried on in essay form the nature tradition of Thoreau, touched with Emersonianism in the thought, and after his example books of mingled observation, sentiment and literary quality, with an out-of-door atmosphere, have multiplied.

Humour.

American humour often cultivates a form akin to the essay, but it also falls into the mould of the tale or scene from life. In the period before the Civil War, to sum up the whole subject in this place, it had the traits which it has since maintained, as its local tang, of burlesque, extravaganza, violence, but it recorded better an actual state of manners and scene of life in raw aspects. Its noteworthy writers were Seba Smith (1792–1868) of Maine, author of the *Letters of Major Jack Downing*, which began to appear in the press in 1830; Augustus Baldwin Longstreet of Georgia in *Georgia Scenes* (1835); William Tappan Thompson (1812–1882), born in Ohio but associated with the South by descent and residence, in *Major Jones' Courtship* (1840), a Georgian publication; Joseph G. Baldwin (1815–1864) in *Flush Times in Alabama and Mississippi* (1853); and Benjamin Penhallow Shillaber (1814–1890) in *Life and Sayings of Mrs Partington* (1854). A fresh form, attended by whimsicality, appears in George Horatio Derby's (1823–1861) *Phoenixiana* (1855). In the war-times Robert Henry Newell (1836–1901) and David Ross Locke (1833–1888), respectively known as "Orpheus C. Kerr" and "Petroleum V. Nasby" cultivated grotesque orthography in a characteristic vein of wit; and with more quaintness and drollery Henry Wheeler Shaw (1818–1885) and Charles Farrar Browne (1834–1867), known as "Josh Billings" and "Artemus Ward," won immense popularity which extended to England. These latter writers were men of Northern birth, but of Western and wandering journalistic experience as a rule. Their works make up a body of what is known as "American humour," a characteristic native product of social conditions and home talent. One poet, John Godfrey Saxe (1816–1887) of Vermont, attempted something similar in literary verse after the style of Tom Hood. The heir to this tradition of farce, drollery and joke was Samuel Langhorne Clemens (1835–1910), known as "Mark Twain," born in Missouri, who raised it to an extraordinary height of success and won world-wide reputation as a great and original humorist. His works, however, include a broader compass of fiction, greater humanity and reality, and ally him to the masters of humorous creation. Joel Chandler Harris (1848–1908) of Georgia introduced a new variety in *Nights with Uncle Remus* (1883), which is literary negro folklore, and Finley Peter Dunne (born 1857) of Chicago, the creator of "Mr Dooley," continues the older American style in its original traits.

History.

History was represented in this period with a distinction not inferior to that of the elder group by Francis Parkman (1823–1863) of Boston, who, however, really belongs with the preceding age by his affiliations; his series of histories fell after the Civil War by their dates of publication, but they began with *History of the Conspiracy of Pontiac* (1851); he was the contemporary of Lowell and differed from the other members of the elder group, who survived, only by the fact of the later maturing of his work. He was not less eminent than Motley and Prescott and his history is of a more modern type. In the next generation the field of American history was cultivated by many scholars, and a large part of local history and of national biography was for the first time recorded. James Ford Rhodes's (1848) *History of the United States* (1892) holds standard rank; the various writings of John Fiske (1842–1901), distinguished also as a philosophical writer, in the colonial and revolutionary periods are valued both for scholarship and for excellent literary style; and Theodore Roosevelt's (born 1858) *The Winning of the West* (1889) and his several biographical studies deserve mention by their merit as well as for his eminent position. The historians, however, have seldom sought literary excellence, and their works belong rather to learning than to literature. The same statement is true of the scholarship of the universities in general, where the spirit of literary study has changed. In the department of scholarship little requires mention beyond Horace Howard Furness's (born 1833) lifelong work on his *Variorum Edition of Shakespeare*, the Shakespearian labours of Henry Norman Hudson (1814–1886) and Richard Grant White (1821–1885), the Chaucerian studies of Thomas Raynesford Lounsbury (born 1838) of Yale, and the translations of Dante (1867, 1892) by Charles Eliot Norton (1827–1908) of Harvard.

Modern Ideas.

The period has been one of great literary activity, effort and ambition, but it affects one by its mass rather than its details; it presents few eminent names. The romantic motives fixed in early colonizing history as a taking possession of the land by a race of Puritans, pioneers, river-voyagers, backwoodsmen, argonauts, have been exhausted; and no new motives have been found. The national tradition has been absorbed and incorporated, so far as literature was able to accomplish this. The national character on the other hand has been expressed rather in local types, the colour of isolated communities and provincial conditions for their picturesque value and human truth, and in commonplace characters of average life; but no broadly ideal types of the old English tradition have been created, and the great scene of life has not been staged after the manner of the imaginative masters of the past. There has been no product of ideas since Emerson; he was, indeed, the sole author who received and fertilized ideas as such, and he has had no successor. America is, in truth, perhaps intellectually more remote from Europe than in its earlier days. The contact of its romanticism with that of Europe was, as has been seen, imperfect, but its touch with the later developments and reactions of the movement in Europe is far more imperfect. With Tolstoy, Ibsen, d'Annunzio, Zola, Nietzsche, Maeterlinck, Sudermann, the American people can have no effectual touch; their social tradition and culture make them impenetrable to the present ideas of Europe as they are current in literary forms. Nor has anything been developed from within that is fertile in literature. The political unity of the nation is achieved, but it is not an integral people in other respects. It has not the unity of England or France or even of the general European mind; it rather contains such disparate elements as characterize the Roman or the Turkish empire. It is cleft by political tradition and in social moral conviction, north and south, and by intellectual strata of culture east and west; it is still a people in the making. Its literature has been regional, as was said, centred in New England, New York, Philadelphia, contributed to sporadically from the

South, growing up in Western districts like Indiana or germinating in Louisville in Kentucky, abundant in California, but always much dependent on the culture of its localities; it blends to some extent in the mind of the national reading public, but not very perfectly. The universities have not, on the whole, been its sources or fosterers, and they are now filled with research, useful for learning but impotent for literature. The intellectual life is now rather to be found in social, political and natural science than elsewhere; the imaginative life is feeble, and when felt is crude; the poetic pulse is imperceptible.

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AMERICAN WAR OF INDEPENDENCE (1775–1781). This war, by which the United States definitely separated themselves from the British connexion, began with the affair of Lexington in Massachusetts, on the 19th of April 1775, and was virtually ended by the capitulation of Cornwallis at Yorktown, Virginia, on the 19th of October 1781. In this article the progress of the war itself is alone considered, its political side being treated under UNITED STATES: *History*. From a military standpoint as well as politically it was a conspicuous and instructive conflict,—conspicuous, or even unique, as being the most famous struggle in history where colonial dependencies defeated their powerful parent state, and instructive as presenting exceptional conditions and consequent errors in the attempt to break down the revolt. The reasons for Great Britain's failure appear in the progress of the war, which assumed two distinct stages, operations in the north followed by operations in the south. In point of time and energy military activity was about equally divided between these two fields. As the naval operations in connexion with the war have a European interest as well, they are dealt with in a separate section.

Land operations.

To strike at the rebellion first in the north was natural and inevitable. To King George and his ministry, Massachusetts was the hotbed of disloyalty, the head and front of opposition to their colonial policy, and there coercion should begin. It was also a convenient point for a prompt display of authority, as the town of Boston was the headquarters of General Gage, recently appointed royal governor of Massachusetts and commander of the king's troops in North America. He had with him four regiments of regulars, the initial force with which to overawe the restless and defiant population in his vicinity. While Gage is to be credited with advising his government that not less than 20,000 men would be necessary for the work in hand, he proceeded at once to suppress demonstrations around Boston. His principal expedition brought about the skirmish of the 19th of April 1775 (see LEXINGTON), in which a detachment sent to seize some military stores collected at Concord suffered heavily at Lexington, Concord and other places, at the hands of the surrounding militia. This encounter roused the New England colonies, and in a few days some 16,000 of their townsmen marched in small bands upon Boston to protest against and resist further similar incursions; and in this irregular body we have the nucleus of the colonial forces which carried the war through. A noteworthy incident of the Concord affair, and characteristic of the attitude which the provincials had maintained and continued to maintain for another year, was the official representation to the king by the Massachusetts people that the regulars were the first to fire upon them, and that they returned the fire and fought through the day in strict defence of their rights and homes as Englishmen. They repeated their professions of loyalty to his majesty and the principles of the English Constitution. Conscious, nevertheless, that a struggle impended, they instantly sent word to all the other colonies, whose whig elements sympathetically responded to the alarm. The war had opened.

Bunker Hill.

The home government extended its precautions and preparations. General (Sir) William Howe, who succeeded Gage in the chief command in October, and Generals (Sir) Henry Clinton and John Burgoyne were sent out at once with reinforcements. Cornwallis followed a year later. These four generals were identified with the conduct of the principal operations on the side of the British. The force at Boston was increased to 10,000 men. The American Congress at Philadelphia, acting for all the thirteen colonies, voted general defensive measures, called out troops and appointed George Washington of Virginia commander-in-chief. Before he reached the camp forming around Boston, a second and more important collision took place. On the 17th of June 1775 occurred the battle of Bunker Hill (*q.v.*), in which, although victorious, the British suffered heavily, losing one-third of their force in storming the hastily constructed lines of the "rebels." The latter's most serious loss was that of General Joseph Warren, one of the prominent leaders of the revolutionary movement in Massachusetts. In moral effect the battle proved anything but a defeat to the Americans, who now drew a cordon of works around Boston, hemming Howe's army in a contracted, and, as it proved, untenable, position. On the 3rd of July Washington took command of the American army at Cambridge and proceeded with what is known as the "siege of Boston," which was marked by no special incident, and closed with the evacuation of the town by the British on the 17th of March 1776, Howe sailing away to Halifax, Nova Scotia. While the main interest centred at this point, the year 1775 was marked by two enterprises elsewhere. Fort Ticonderoga, the key to the passage of Lakes George and Champlain to Canada, was surprised and taken on the 10th of May by a small band under Colonel Ethan Allen, while Colonel Benedict Arnold headed an expedition through the Maine woods to effect the capture of Quebec, where Sir Guy Carleton commanded. Arnold joined General Richard Montgomery, who was already near the city, and the combined force assaulted Quebec on the 31st of December, only to meet with complete defeat. Montgomery was killed and many of his men taken prisoners. Demonstrations against Canada were soon discontinued, Arnold drawing off the remnant of his army in May 1776.

The events of 1775, though favourable to America, were but a prelude to the real struggle to come. For the campaign of 1776 both sides made extensive preparations. To the home government the purely military problem, although assuming larger dimensions and more difficulties, still seemed to admit of a simple solution, namely, to strike hard where the rebellion was most active and capable of the longest resistance. Defeated there, it would quickly dissipate in all quarters. As much more than one-half of the population and resources of the colonists lay north of Chesapeake Bay—New England alone having an estimated population of over 700,000 persons—it was only a question as to what point in this area should be made the future base of operations. Largely upon the representations of Howe, Burgoyne and others, it was determined to shift the field from Boston to New York city, from there to hold the line of the Hudson river in co-operation with a force to move down from Canada under Carleton and Burgoyne, and thus effectually to isolate New England.

Long Island.

Fort Washington.

Upon this plan the new campaign opened in June 1776. Howe, heavily reinforced from home, sailed on the 10th from Halifax to New York and on the 5th of July encamped on Staten Island. Washington, anticipating this move, had already marched from Boston and fortified the city. His left flank was thrown across the East river beyond the village of Brooklyn, while his front and right on the harbour and North or Hudson river were open to a combined naval and military attack. The position proved untenable. Howe drove Washington out of it, and forced the abandonment of the whole of Manhattan Island by three well-directed movements upon the American left. On the 22nd of August he crossed the Narrows to the Long Island shore with 15,000 troops, increasing the number to 20,000 on the 25th, and on the 27th surprised the Americans, driving them into their Brooklyn works and inflicting a loss of about 1400 men. Among the prisoners were Generals J. Sullivan and W. Alexander, *soi-disant* earl of Stirling. (See LONG ISLAND.) Howe has been criticized, rightly or wrongly, for failing to make full use of his victory. Washington skilfully evacuated his Brooklyn lines on the night of the 29th, and in a measure relieved the depression which the defeat had produced in his army. On the 15th of September Howe crossed the East river above the city, captured 300 of the militia defending the lines and occupied the city. Washington had withdrawn his main army to the upper part of the island. A skirmish, fought the next day, opposite the west front of the present Columbia University, and known as the affair of Harlem Heights, cost the British a loss of seventy of their light infantry. Delaying until the 12th of October, Howe again moved forward by water into Westchester county, and marching toward White Plains forced another retreat on Washington. In the fight on Chatterton Hill at the Plains, on the 28th of October, an American brigade was defeated. Instead of pressing Washington further, Howe then returned to Manhattan Island, and on the 16th of November captured Fort Washington with nearly 3000 prisoners. This was the heaviest blow to the Americans throughout the war in the north. The British then pushed down through New Jersey with designs on Philadelphia. Washington, still retreating with a constantly diminishing force, suddenly turned upon Lieutenant-Colonel Rall's advanced corps of Hessians at Trenton on the 26th of December and captured nearly 1000 prisoners. This brilliant exploit was followed by another on the 3rd of January, when Washington, again crossing the Delaware, outmarched Cornwallis at Trenton, and marching to his rear defeated three British regiments and three companies of light cavalry at Princeton, New Jersey. Marching on to Morristown, Washington encamped there on the flank of the British advance in New Jersey, thus ending the first campaign fought on the new issue of American Independence, which had been declared on the 4th of July 1776.

Brandywine.

While these closing successes inspirited the Americans, it was undeniable that the campaign had gone heavily against them. Having raised a permanent force for the war called the Continental Line, they awaited further operations of the enemy. Following up the occupation of New York, Howe proceeded in 1777 to capture Philadelphia. Complete success again crowned his movements. Taking his army by sea from New York to the head of the Chesapeake, he marched up into Pennsylvania, whither Washington had repaired to watch him, and on the 26th of September entered the city. The Americans attempted to check the advance of the British at the river Brandywine, where an action occurred on the 11th, resulting in their defeat (see BRANDYWINE); and on the 4th of October Washington directed a well-planned attack upon the enemy's camp at Germantown on the outskirts of the city, but failed of success. (See GERMANTOWN.)

Saratoga.

Howe's victorious progress in Pennsylvania was neutralized by disasters farther north. Burgoyne marched from Canada in June 1777, with a strong expeditionary force, to occupy Albany and put himself in touch with Howe at the other end of the Hudson. Driving the Americans under General Arthur St Clair out of Ticonderoga, and making his way through the deep woods with difficulty, he reached the Hudson at Fort Edward on the 30th of July. General Philip Schuyler, commanding the Americans in that quarter, retreated to Stillwater, 30 m. above Albany, barricading the roads and impeding Burgoyne's progress. Dissatisfaction with his conduct led Congress to replace him in command by General Gates. On the 13th of August Burgoyne despatched a force to Bennington, Vermont, under the German colonel Friedrich Baum, to capture stores and overawe the country. On the 16th Baum was attacked by General John Stark with the militia from the surrounding country, and was overwhelmed. Colonel Breyman, marching to his relief, was also routed. The misfortune cost the British 1000 men. Equally unfortunate was the fate of an expedition sent under Colonel Barry St Leger to co-operate with Burgoyne by way of the Mohawk Valley. On the 6th of August he was met at Oriskany by General Nicholas Herkimer and forced to retreat. Despite these disasters Burgoyne pushed south to Stillwater, where he was defeated by Gates's improvised army of continentals and militia in two battles on the 19th of September (Freeman's Farm) and the 7th of October (Bemis's Height). On the 17th he was forced to surrender. (See SARATOGA, BATTLE OF.) This disaster was followed by the alliance between America and France in 1778, and later by the addition of Spain to England's enemies—events of far-reaching importance.

A movement of importance, in 1778–79, was the expedition of George Rogers Clark, under the authority of the state of Virginia, against the British posts in the north-west. With a company of volunteers Clark captured Kaskaskia, the chief post in the Illinois country, on the 4th of July 1778, and later secured the submission of Vincennes, which, however, was recaptured by General Henry Hamilton, the British commander at Detroit. In the spring of 1779 Clark raised another force, and recaptured Vincennes from Hamilton. This expedition did much to free the frontier from Indian raids, gave the Americans a hold upon the north-west, of which their diplomats duly took advantage in the peace negotiations, and later, by giving the states a community of interest in the western lands, greatly promoted the idea of union.

In 1778 Sir Henry Clinton succeeded Howe in the chief command in America. With fewer resources than his predecessor had disposed of, he could accomplish practically nothing in the north. In June 1778 he evacuated Philadelphia, with the intention of concentrating his force at New York. Washington, who had passed the winter at Valley Forge, overtook him at Monmouth, N.J., and in an action on the 28th of June both armies suffered about equal loss. Thereafter (except in the winter of 1779, at Morristown) Washington made West Point on the Hudson the headquarters of his army, but Clinton avowed himself too weak to attack him there. In 1779 he attempted to draw Washington out of the Highlands, with the result that in the manœuvres he lost the garrison at Stony Point, 700 strong, the position being stormed by Wayne with the American light infantry on the 16th of July. During the summer General John Sullivan marched with a large force against the Indians (all the Iroquois tribes except the Oneidas and part of the Tuscaroras siding with the British during the war) and against the Loyalists of western New York, who had been committing great depredations along the frontier; and on the 29th of August he inflicted a crushing defeat upon them at Newtown, on the site of the present Elmira. In addition several Indian villages and the crops of the Indians were destroyed in the lake region of western New York.

Meanwhile the co-operation of the French became active. In July Count Rochambeau arrived at Newport, Rhode Island. That place had been occupied by the British from 1776 to the close of 1779. An unsuccessful attempt was made to drive them out in 1778 by the Americans assisted by the French admiral d'Estaing and a French corps. The year 1780 is also marked by the treason of General Benedict Arnold (*q.v.*), and the consequent execution of Major André. Minor battles and skirmishes occurred until in August 1781 Washington conceived the project of a combined American-French attack on Cornwallis at Yorktown, Va., the success of which was decisive of the war (see below).

Campaign in Georgia.

The inadequate results of the British campaigns against the northern colonies in 1776 and 1777 led the home government to turn its attention to the weaker colonies in the south. Operations in the north were not to cease, but a powerful diversion was now to be undertaken in the south with a view to the complete conquest of that section. Success there would facilitate further movements in the north. An isolated attack on Charleston, South Carolina, had been made by Sir Henry Clinton and Sir Peter Parker as early as June 1776, but this was foiled by the spirited resistance of General William Moultrie; after 1778 the southern attempts, stimulated in part by the activity of the French in the West Indies, were vigorously sustained. On the 29th of December of this year Colonel Archibald Campbell (1739–1791) with an expeditionary corps of 3500 men from Clinton's army in New York, captured Savannah, Georgia, defeating the American force under General Robert Howe. In the following month he pushed into the interior and occupied Augusta. General Benjamin Lincoln, succeeding Howe, undertook to drive the British out of Georgia, but General Augustine Prevost, who had commanded in Florida, moved up and compelled Lincoln to retire to Charleston. Prevost, making Savannah his headquarters, controlled Georgia. In September 1779 he was besieged by Lincoln in conjunction with a French naval and military force under Admiral d'Estaing, but successfully repelled an assault (October 9), and Lincoln again fell back to Charleston. In this assault Count Casimir Pulaski, on the American side, was mortally wounded.

Charleston.

The prestige thus won by the British in the south in 1779 was immensely increased in the following year, when they victoriously swept up through South and North Carolina. Failing, as stated, to achieve any advantage in the north in 1779, Sir Henry Clinton, under instructions from government, himself headed a combined military and naval expedition southward. He evacuated Newport, R.I. (October 25), left New York in command of the German general Wilhelm von Knyphausen, and in December sailed with 8500 men to join Prevost at Savannah. Cornwallis accompanied him, and later Lord Rawdon joined him with an additional force. Marching upon Charleston, Clinton cut off the city from relief, and after a brief siege compelled Lincoln to surrender on the 12th of May. (See CHARLESTON.) The loss of this place and of the 5000 troops included in the surrender was a serious blow to the American cause. The apparent submission of South Carolina followed. In June Clinton returned to New York, leaving Cornwallis in command, with instructions to reduce North Carolina also. Meanwhile an active and bitter partisan warfare opened. The British advance had been marked by more than the usual destruction of war; the Loyalists rose to arms; the whig population scattered and without much organization formed groups of riflemen and mounted troopers to harass the enemy. Little mercy was shown on either side. The dashing rider, Colonel Banastre Tarleton, cut to pieces (April 14, 1780) a detachment of Lincoln's cavalry, and followed it up by practically destroying Buford's Virginia regiment near the North Carolina border. On the other hand, daring and skilful leaders such as Francis Marion and Thomas Sumter kept the spirit of resistance alive by their sudden attacks and surprises of British outposts. Hanging Rock, Ninety-Six, Rocky Mount and other affairs brought their prowess and devotion into notice. By the month of August 1780, with the main British force encamped near the North Carolina line, the field seemed clear for the next advance.

Camden.

Guilford Court House.

The threatening situation in the Carolinas alarmed Congress and Washington and measures were taken to protect the distressed section. Before Cornwallis could be brought to bay he was faced successively by four antagonists—Generals Gates, Greene, Lafayette and Washington. They found in him the most capable and dangerous opponent of the war. Greene called him "the modern Hannibal." With Lincoln's surrender of nearly all the continental soldiers in the south, a new force had to be supplied to meet the British veterans. Two thousand men, mainly the Maryland line, were hurried down from Washington's camp under Johann de Kalb; Virginia and North Carolina put new men into the field, and the entire force was placed under command of General Gates. Gates marched towards Camden, S.C., and on the 16th of August encountered Cornwallis near that place. Each army by a night march attempted a surprise of the other, but the British tactics prevailed, and Gates was utterly routed. The reputation he had won at Saratoga was ruined on the occasion by over-confidence and incompetence. De Kalb was killed in the action. General Greene, standing next to Washington as the ablest and most trusted officer of the Revolution, succeeded Gates. Cornwallis marched leisurely into North Carolina, but before meeting Greene some months later he suffered the loss of two detachments sent at intervals to disperse various partisan corps of the Americans. On the 7th of October 1780 a force of 1100 men under Major Patrick Ferguson was surrounded at King's Mountain, S.C., near the North Carolina line, by bands of riflemen under Colonels Isaac Shelby, James Williams, William Campbell and others, and after a desperate fight on the wooded and rocky slopes, surrendered. Ferguson himself was killed. On the 17th of January 1781 General Daniel Morgan was attacked at Cowpens, south-west of King's Mountain, by Colonel Tarleton with his legion. Both were leaders of repute, and a most stirring action occurred in which Morgan, with Colonel William Washington leading his cavalry, practically destroyed Tarleton's corps. Despite the weakening his army suffered by these losses, Cornwallis marched rapidly through North Carolina, giving Greene a hard chase nearly to the Virginia line. On the 15th of March the two armies met at Guilford Court House (near the present Greensboro, N.C.), and a virtually drawn battle was fought. The British, by holding their ground with their accustomed tenacity when engaged with superior numbers, were tactically victors, but were further weakened by a loss of nearly 600 men. Greene, cautiously avoiding another Camden, retreated with his forces intact. With his small army, less than 2000 strong, Cornwallis declined to follow Greene into the back country, and retiring to Hillsborough, N.C., raised the royal standard, offered protection to the inhabitants, and for the moment appeared to be master of Georgia and the two Carolinas. In a few weeks, however, he abandoned the heart of the state and marched to the coast at Wilmington, N.C., to recruit and refit his command.

At Wilmington the British general faced a serious problem, the solution of which upon his own responsibility unexpectedly led to the close of the war within seven months. Instead of remaining in Carolina he determined to march into Virginia, justifying the move on the ground that until Virginia was reduced he could not firmly hold the more southern states he had just overrun. This decision was subsequently sharply criticized by Clinton as unmilitary, and as having been made contrary to his instructions. To Cornwallis he wrote in May: "Had you intimated the probability of your intention, I should certainly have endeavoured to stop you, as I did then as well as now consider such a move likely to be dangerous to our interests in the Southern Colonies." The danger lay in the suddenly changed situation in that direction; as General Greene, instead of following Cornwallis to the coast, boldly pushed down towards Camden and Charleston, S.C., with a view to drawing his antagonist after him to the points where he was the year before, as well as to driving back Lord Rawdon, whom Cornwallis had left in that field. In his main object, the recovery of the southern states, Greene succeeded by the close of the year; but not without hard fighting and repeated reverses. "We fight, get beaten, and fight again," were his words. On the 25th of April 1781 he was surprised in his camp at Hobkirk's Hill, near Camden, by Lord Rawdon and defeated, both sides suffering about an equal loss. On the 22nd of May he attempted to storm the strong British post at Ninety-Six but was repulsed;

and finally on the 8th of September he fought the last battle of the war in the lower southern states at Eutaw Springs, S.C.

Eutaw Springs.

In the first part of the action Greene was successful after a desperate conflict; in the pursuit, however, the Americans failed to dislodge the British from a stone house which they held, and their severe loss in both engagements was over 500 men. The British lost about 1000, one-half of whom were prisoners. Better success attended the American partisan operations directed by Greene and conducted by Marion, Sumter, Andrew Pickens, Henry Lee and William Washington. They fell upon isolated British posts established to protect the Loyalist population, and generally captured or broke them up. Rawdon found himself unable with his diminishing force to cover the country beyond Charleston; and he fell back to that place, leaving the situation in the south as it had been in the early part of 1780. On the American side, Greene was hailed as the deliverer of that section.

Virginia campaign.

Cornwallis, meantime, pursued his Virginia project. Leaving Wilmington, N.C., on the 25th of April 1781, he reached Petersburg on the 20th of May. There he found British detachments, 2000 strong, composed of troops whom Clinton had sent down separately under Generals Benedict Arnold and William Phillips to establish a base in the Chesapeake, as a diversion in favour of the operations of Cornwallis in the Carolinas. Virginia at the moment presented a clear field to the British, and they overran the state as far north as Fredericksburg and west to Charlottesville. At the latter place Jefferson, governor of the state, barely escaped capture by Tarleton's men. A small American force under Lafayette, whom Wayne reinforced during the summer, partially checked the enemy. At Green Spring, near Jamestown Island, Lafayette boldly attacked his antagonist on the 6th of July, but had to save himself by a hasty retreat. Early in August Cornwallis retired to Yorktown to rest and await developments. There he fortified himself, and remained until the American-French military and naval combination, referred to above, appeared and compelled his surrender. (See YORKTOWN.)

With this event war operations ceased. Preliminary articles of peace, signed on the 30th of November 1782, were followed by a definitive treaty concluded on the 3rd of September 1783. Charleston, S.C., was evacuated late in 1782; New York on the 25th of November 1783. The reasons of Great Britain's misfortunes and failure may be summarized as follows:—Misconception by the home government of the temper and reserve strength of her colonists, a population mainly of good English blood and instincts; disbelief at the outset in the probability of a protracted struggle covering the immense territory in America; consequent failure to despatch sufficient forces to the field; the safe and Fabian generalship of Washington; and finally, the French alliance and European combinations by which at the close of the conflict England was without a friend or ally on the continent.

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Effect of sea-power.

The naval operations of the War of Independence divide themselves naturally into two periods. (1) From 1775 till the summer of 1778 the British navy was engaged in co-operating with the troops employed against the insurgents, on the coasts, rivers and lakes of North America, or in endeavouring to protect British commerce against the enterprise of American privateers. (2) During the second period the successive interventions of France, Spain and Holland extended the naval war till it ranged from the West Indies to the Bay of Bengal. This second period lasted from the summer of 1778 to the middle of 1783, and it included both such operations as had already been in progress in America, or for the protection of commerce, and naval campaigns on a great scale carried out by the fleets of the maritime powers.

First Period.—The history of the naval war from 1775 to 1778 was made up of many small operations. The naval force at the disposal of the admirals commanding on the station, who until Lord Howe took up the command on the 12th of July 1776 were Samuel Graves and Molyneux Shuldham, was insufficient to patrol the long line of coast. A large part of such squadrons as there were was necessarily limited to aiding General Gage and Sir W. Howe at Boston, in seeking stores for the army and in supplying naval brigades. At other points of the coast the British navy was employed in punitive expeditions against the coast towns—as for example the burning of Falmouth (now Portland, Maine) in October 1775—which served to exasperate, rather than to weaken the enemy, or the unsuccessful attack on Charleston, S.C., in June 1776. It was wholly unequal to the task of blockading the many towns from which privateers could be fitted out. British commerce therefore suffered severely, even as far off as the Irish coasts, where it was found necessary to supply convoy to the Belfast linen trade. The Americans were not yet in a position to provide a fleet. On the 23rd of March 1776 Congress did indeed issue letters of marque and reprisal, and efforts were made to fit out a national force. But the so-called "continental" vessels which sailed with the commission of the Congress hardly differed in character, or in the nature of their operations, from the privateers. The British navy was able to cover the retreat of the army from Boston to Halifax in April 1776, and to convey it to New York in June. It assisted in the expedition to Philadelphia in July 1777. On the St Lawrence and the Lakes it was able to play a more aggressive part. The relief of Quebec by Captain—afterwards Sir Charles—Douglas in May 1776 forced the American general Arnold to retreat. The destruction of his squadron on Lake Champlain in October covered the frontier of Canada, and supplied a basis for the march of General Burgoyne in 1777 which ended in the surrender at Saratoga.

Second Period.—The disaster at Saratoga was followed in 1778 by war with France, which had already given much private help to the American privateers and to their forces in the field. The rupture came in March when the British ambassador, Lord Stormont, was recalled from Paris, but as neither fleet was ready for service, actual conflict did not take place till July. The French government was somewhat more ready than the British. On the 13th of April it despatched a squadron of twelve sail of the line and four frigates from Toulon to America under the command of the Count d'Estaing. As no attempt was made to stop him in the Straits of Gibraltar, he passed them on the 16th of May, and though the rawness of his crews and his own error in wasting time in pursuit of prizes delayed his passage, he reached the mouth of the Delaware on the 8th of July unopposed. The French government, which by the fault of the British administration was allowed to take the offensive, had three objects in view—to help the Americans, to expel the British from the West Indies and to occupy the main strength of the naval forces of Great Britain in the Channel. Therefore a second and more powerful fleet was fitted out at Brest under the command of the Count d'Orvilliers. The British government, having neglected to occupy the Straits of Gibraltar in time, despatched Admiral Byron from Plymouth on the 9th of June with thirteen sail of the line to join Admiral (Lord) Howe, Sir William's brother, in America, and collected a strong force at home, called the Western Squadron, under Viscount Keppel. Keppel, after a preliminary cruise in June, brought d'Orvilliers to action off Brest on the 27th of July. The fleets were equal and the action was indecisive,—as the two forces merely passed one another, cannonading. A violent quarrel exacerbated by political differences broke out among the British commands, which led to two courts-martial and to the resignation of Keppel, and did great injury to the discipline of the navy. No further event of note occurred in European waters. On the coast of America the news of the approach of d'Estaing compelled the British commanders to evacuate Philadelphia on the 18th of June. Howe then concentrated his force of nine small line-of-battle ships at Sandy Hook on the 29th of June, and on the 11th of July he learnt that d'Estaing was approaching. The French admiral did not venture to make an attack, and on the 22nd of July sailed to co-operate with the Americans in an endeavour to expel the British garrison from Rhode Island. Howe, who had received a small reinforcement, followed. The French admiral, who had anchored above Newport, R.I., came to sea to meet him, but both fleets were scattered by storms. D'Estaing sailed to Boston on the 21st of August. Howe received no help from Byron, whose badly appointed fleet was damaged and scattered by a gale on the 3rd of July in mid-Atlantic. His ships dropped in by degrees during September. Howe resigned on the 25th of that month, and was succeeded by Byron. The approach of winter made a naval campaign on the coast of North America dangerous. The operations of naval forces in the New World were largely dictated by the facts that from June to October are the hurricane months in the West Indies, while from October to June includes the stormy winter of the northern coast. On the 4th of November d'Estaing sailed for the West Indies, on the very day that Commodore William Hotham was despatched from New York to reinforce the British fleet in those waters. On the 7th of September the French governor of Martinique, the marquis de Bouillé, had surprised the British island of Dominica. Admiral Samuel Barrington, the British admiral in the Leeward Islands, had retaliated by seizing Santa Lucia on the 13th and 14th of December after the arrival of Hotham from North America. D'Estaing, who followed Hotham closely, was beaten off in two feeble attacks on Barrington at the Cul-de-Sac of Santa Lucia on the 15th of December. On the 6th of January 1779 Admiral Byron reached the West Indies. During the early part of this year the naval forces in the West Indies were mainly employed in watching one another. But in June, while Byron had gone to Antigua to guard the trade convoy on its way home, d'Estaing first captured St Vincent, and then on the 4th of July Grenada. Admiral Byron, who had returned, sailed in hopes of saving the island, but arrived too late. An indecisive action was fought off Grenada on the 6th of July. The war now died down in the West Indies. Byron returned home in August. D'Estaing, after co-operating unsuccessfully with the Americans in an attack on Savannah, in September also returned to Europe. In European waters the Channel had been invaded by a combined French and Spanish fleet of sixty-six sail of the line, Spain having now joined the coalition against Great Britain. Only thirty-five sail of the line could be collected against them under the command of Admiral Digby. But they came late and did nothing. The allies retired early in September and were not even able to molest the British trade convoys. In the meantime the Spaniards had formed the siege of Gibraltar.

So far the British navy had stood on the defensive, without material loss except in the West Indies, but without triumph. The operations of 1780 went on much the same lines. The British government, not feeling strong enough to blockade Brest and the Spanish ports, was compelled to regulate its movements by those of its opponents. In the Channel it was saved from disaster by the ineptitude of the French and Spanish fleets. The only real success achieved by this numerically imposing force was the capture on the 8th and 9th of August of a large British convoy of ships bound for the East and West Indies carrying troops. But on the American coast and in the West Indies more vigour was displayed. Early in the year Admiral Marriot Arbuthnot was sent to take command in North America. On the French side the count de Guichen was sent with reinforcements to the West Indies to take command of the ships left in the previous year by d'Estaing. He arrived in March, and was able to confine the small British force under Sir Hyde Parker at Gros Islet Bay in Santa Lucia. In May M. d'Arzac de Ternay was sent from Brest with seven line-of-battle ships, and a convoy carrying 6000 French troops to act with the Americans. He had a brush with a small British force under Cornwallis near Bermuda on the 20th of June, and reached Rhode Island on the 11th of July. During the rest of the year, and part of the next, the British and French naval forces in North American waters remained at their respective headquarters, New York and Newport, watching one another. The West Indies was again the scene of the most important operations of the year. In February and March a Spanish force from New Orleans, under Don Bernardo de Galvez, invaded West Florida with success. But the allies made no further progress. At the close of 1779 Sir George Rodney had been appointed to command a large naval force which was to relieve Gibraltar, then closely blockaded, and send stores to Minorca. Rodney was to go on to the West Indies with part of the fleet. He sailed on the 29th of December 1779 with the trade for the West Indies under his protection, captured a Spanish convoy on his way off Finisterre on the 8th of January, defeated a smaller Spanish force near Cape St Vincent on the 16th, relieved Gibraltar on the 19th, and left for the West Indies on the 13th of February. On the 27th of March he joined Sir Hyde Parker at Santa Lucia, and Guichen retired to Fort Royal in Martinique. Until July the fleets of Rodney and Guichen, of equal strength, were engaged in operations round the island of Martinique. The British admiral endeavoured to force on a close engagement. But in the first encounter on the 17th of April to leeward of the island, Rodney's orders were not executed by his captains, and the action was indecisive. He wished to concentrate on the rear of the enemy's line, but his captains scattered themselves along the French formation. In two subsequent actions, on the 15th and 19th of May, to windward of Martinique, the French admiral would not be brought to close action. The arrival of a Spanish squadron of twelve ships of the line in June gave a great numerical superiority to the allies, and Rodney retired to Gros Islet Bay in Santa Lucia. But nothing decisive occurred. The Spanish fleet was in bad health, the French much worn-out. The first went on to Havana, the second to San Domingo. In July, on the approach of the dangerous hurricane season, Rodney sailed for North America, reaching New York on the 14th of September. Guichen returned home with the most worn-out of his ships. On the 6th of December Rodney was back at Barbadoes from the North American station, where he was not able to effect anything against the French in Narragansett Bay.

The rambling operations of the naval war till the close of 1780—directed by the allies to such secondary objects as the capture of West Indian islands, or of Minorca and Gibraltar, and by Great Britain to defensive movements—began to assume a degree of coherence in 1781. Holland having now joined the allies, the British government was compelled to withdraw part of its fleet from other purposes to protect the North Sea trade. A desperate battle was fought on the Dogger Bank on the 5th of August between Sir Hyde Parker and the Dutch admiral Zoutman, both being engaged in protecting trade; but Holland did not affect the general course of the war. The allies again failed to make a vigorous attack on the British forces in the Channel. They could not even prevent Admiral George Darby from relieving Gibraltar and Minorca in April. The second of these places was closely invested later on, and was compelled to surrender on the 5th of February 1782. But a vigorous policy was carried out by France in the West Indies and America, while she began a most resolute attack on the British position in the East Indies.

In the West Indies Rodney, having received news of the breach with Holland early in the year, took the island of St Eustatius, which had been a great depot of contraband of war, on the 3rd of February. The British admiral was accused of applying himself so entirely to seizing and selling his booty that he would not allow his second in command, Sir Samuel Hood, who had recently joined him, to take proper measures to impede the arrival of French forces known to be on their way to Martinique. The French admiral, the count de Grasse, reached the island with reinforcements in April. Until July he was engaged in a series of skilful operations directed to menacing the British islands while he avoided being brought to battle by Rodney. In July he sailed for the coast of North America, whither he was followed in August by Sir S. Hood, Rodney having been compelled to return home in ill-health.

On the coast of North America the war came to its crisis. In the earlier part of the year the British at New York and the French at Newport continued to watch one another. In April the British admiral Arbuthnot did indeed succeed in baffling an attempt of the French to carry reinforcements to the American cause in Virginia. The action he fought off the capes of Virginia on the 16th of April was ill conducted, but his main purpose was achieved. Washington, who was wisely anxious to concentrate attack on one or other of the centres of British power in Virginia or New York, had to wait till the arrival of Grasse before he could see his ideas applied. The French admiral gave the allies a superiority of naval strength on the coast of Virginia, and Lord Cornwallis, the British commander, was beleaguered in Yorktown. Admiral Thomas Graves, Arbuthnot's successor, who had been joined by Hood from the West Indies, endeavoured to drive off the French fleet. But the feeble battle he fought on the 5th of September failed to shake the French hold on the Chesapeake, and Grasse having been reinforced, Graves sailed away. Yorktown fell on the 19th of October, and the war was settled as far as the coast of North America was concerned.

The French admiral, having rendered this vital service to his ally, now returned to the West Indies, whither he was followed by Hood, and resumed the attacks on the British islands. In January and February 1782 he conquered St Christopher, in spite of the most determined opposition of Hood, who with a much inferior force first drove him from his anchorage at Basseterre, and then repulsed his repeated attacks. The next purpose of the French was to combine with the Spaniards for an attack on Jamaica. Sir George Rodney, having returned to his command with reinforcements, baffled this plan by the series of operations which culminated in the battle of the 12th of April 1782. (See Saints, Battle of.) No further operations of note occurred in the West Indies. At home Howe relieved Gibraltar for the last time in September and October 1782.

The war in the East Indies formed a separate series of episodes. In 1778 the British authorities had little difficulty in seizing the French settlement of Pondicherry. A naval engagement of a very feeble kind took place on the 10th of August in the Bay of Bengal, between the British naval officer in command and M. de Tronjoly. But the French were too weak in these seas for offensive movements, and therefore remained quiescent at Bourbon and Mauritius till the beginning of 1782. In the spring of 1781 the bailli de Suffren was sent to the East with a small squadron; on his way he fell upon a British force which had been sent to take the Cape from the Dutch, and which he found in the Portuguese anchorage of Porto Praya, on the 16th of April. Having provided for the security of the Cape, Suffren went on to the French islands. He sailed from them early in 1782 to carry out a vehement attack on the British forces in the Bay of Bengal. From the 17th of February 1782 to the 20th of June 1783 he fought a series of fine actions against Sir Edward Hughes, by which he secured a marked superiority on the water. Though he had no port in which to refit and no ally save Hyder Ali, he kept the sea and did not even return to the French islands during the north-easterly monsoon. Suffren failed in his main purpose, which was to make such a capture as would put his government in a strong position during the negotiations for peace. But his capture of Trincomalee in July 1782 in spite of Sir Edward Hughes, and the heavy loss he inflicted on the British fleet in several of the actions he fought, constitute the most honourable part of the French naval operations in the war.

Authorities.—*The Influence of Sea Power upon History*, by Captain Mahan, gives the best critical examination of the naval aspects of the war. The French side will be found in the *Histoire de la marine française pendant la Guerre de l'Indépendence américaine* (Paris, 1877), by Captain Chevalier. For accounts of the American navy see C. O. Paullin, *The Navy of the American Revolution* (Chicago, 1906); E. S. Maclay, *History of the U.S. Navy*, vol. i. (New York, 1897); C. H. Lincoln, *Naval Records of the American Revolution* (Washington, 1906); and Edward Field, *Esek Hopkins, Commander-in-chief of the Continental Navy during the American Revolution* (Providence, R.I., 1898). For details of actions the reader may be referred to Beatson's *Naval and Military Memoirs of Great Britain from 1727 to 1783* (London, 1804), and to Sir W. Laird Clowes's *The Royal Navy: A History* (London, 1897, &c.). (D. H.)

AMERICAN WAR OF 1812. The war between the United States and Great Britain, commonly known as "of 1812," began by the American declaration of war on the 18th of June of that year, and lasted till the beginning of 1815. The treaty of peace signed at Ghent on the 24th of December 1814 was ratified by the president of the United States on the 17th of February 1815. These two years and a half of conflict were filled with isolated encounters which can hardly be reduced to coherent and ordered operations. Although the outbreak of war had been preceded by years of angry diplomatic dispute, the United States were absolutely unready, while Great Britain was still hard pressed by the hostility of Napoleon, and was compelled to retain the greater part of her forces and her best crews in European waters, till the ruin of the *Grande Armée* in Russia and the rising of Germany left her free to send an overwhelming force of ships to American waters.

The forces actually available on the American side when the war began consisted of a small squadron of very fine frigates and sloops in an efficient state. Twenty-two was the extreme limit of the naval force the States were able to commission. The paper strength of the army was 35,000, but the service was voluntary and unpopular, while there was an almost total want of trained and experienced officers. The available strength was a bare third of the nominal. The militia, called in to aid the regulars, proved untrustworthy. They objected to serve beyond the limits of their states, were not amenable to discipline, and behaved as a rule very ill in the presence of the enemy. On the British side, the naval force in American waters under Sir John Borlase Warren, who took up the general command on the 26th of September 1812, consisted of ninety-seven vessels in all, of which eleven were of the line and thirty-four were frigates, a power much greater than the national navy of America, but inadequate to the blockade of the long coast from New Brunswick to Florida. The total number of British troops present in Canada in July 1812 was officially stated to be 5004, consisting in part of Canadians.

The scene of operations naturally divided into three sections:—(1) the ocean; (2) the Canadian frontier, from Lake Huron, by Lakes Erie and Ontario, the course of the St Lawrence and Lake Champlain; (3) the coast of the United States. As the operations on these three fields had little interaction on one another, it will be more convenient to take them separately than to follow the confusing chronological order.

Operations on the Ocean.—These cover all cruises of sea-going ships, even when they did not go far from the coast. They again subdivide into the actions of national vessels, and the raids of the privateers. The first gave to the United States the most brilliant successes of the war. When it began two small squadrons were getting ready for sea at New York; the frigate "President" (44) and sloop "Hornet" (18), under Commodore John Rodgers, who had also the general command; and the frigates "United States" (44) and "Congress" (38), with the brig "Argus" (16) to which two guns were afterwards added, under Captain Stephen Decatur. Rodgers would have preferred to keep his command together, and to strike with it at the main course of British commerce, but he was overruled. He sailed on the 21st of June, and after chasing the British frigate "Belvidera" (36), which escaped into Halifax by throwing boats, &c., overboard, stood across the North Atlantic in search of a West Indian convoy, which he failed to sight, returning by the 31st of August to Boston. While he was absent, Captain Isaac Hull, commanding the "Constitution" (44), sailed from the Chesapeake, and after a narrow escape from a British squadron, which pursued him from the 18th to the 20th of July, reached Boston. Going to sea again on the 2nd of August he captured and burned the British frigate "Guerrière" (38). On the 8th of October Rodgers and Decatur sailed—the first on a cruise to the east, the second to the south. Commodore Rodgers met with no marked success, but on the 25th of October Captain Decatur in the "United States" captured the British frigate "Macedonian" (38), which he carried back to port. At the close of the month Captain Bainbridge sailed with the "Constitution," "Essex" (32) and "Hornet" (18) on a southerly cruise. On the 29th of December, when off Bahia, he fell in with the British frigate "Java" (38), which was carrying General Hislop, the governor of Bombay, to India, and took her after a sharp action. The "Essex" and "Hornet" were not in company. The first, under the command of Captain David Porter, went on to the Pacific, where she did great injury to British trade, till she was captured off Valparaiso by the British frigate "Phoebe" (38) and the sloop "Cherub" (24) on the 28th of March 1814. In these actions, except the last, the Americans had the advantage of greater size and a heavier broadside, but they showed excellent seamanship and gunnery. The capture of three British frigates one after another caused a painful impression in Great Britain and stimulated her to greater exertions. Vessels were accumulated on the American sea-board, and the watch became more strict. On the 1st of June 1813 the capture of the U.S. frigate "Chesapeake" (38), by the British frigate "Shannon" (38), a vessel of equal force, counterbalanced the moral effect of previous disasters. The blockade of American ports was already so close that the United States ships found it continually more difficult to get to sea, or to keep the sea without meeting forces of irresistibly superior strength.

The operations of American privateers were too numerous and far-ranging to be told in detail. They continued active till the close of the war, and were only partially baffled by the strict enforcement of convoy by the British authorities. A signal instance of the audacity of the American cruisers was the capture of the U.S. sloop "Argus" (20) by the British sloop "Pelican" (18) so far from home as St David's Head in Wales on the 14th of August 1813. The "Pelican's" guns were heavier than those of the "Argus."

Operations on the Lakes.—The American people, who had expected little from their diminutive navy, had calculated with confidence on being able to overrun Canada. As, however, they had taken no effectual measures to provide a mobile force they were disappointed. The British general, Sir George Prevost, was neither able nor energetic, but his subordinate, Major-General Isaac Brock, was both. In July, before the Americans were ready, Brock seized Mackinac at the head of Lake Huron; and on the 16th of August Detroit in the channel between Huron and Erie was surrendered. Kingston was held at the east end of Ontario. Montreal on the St Lawrence was a strong position on the British side to which, however, the Americans had an easy road of approach by Lake Champlain. Sound reasoning would have led the Americans to direct their chief attacks on Kingston and Montreal, since success at those points would have isolated the British posts on Lakes Ontario, Erie and Huron. But they were much influenced by fear of the Indians, who had been won over to the British side by the energy of Brock. They therefore looked more carefully to the lakes than to the course of the St Lawrence, and it may be added that their leaders showed an utter want of capacity for the intelligent conduct of war.

The impracticable character of the communications by land made it absolutely necessary for both parties to obtain control of the water. Neither had made any preparations, and the war largely resolved itself into a race of shipbuilding. The Americans, who had far greater facilities for building than the British, allowed themselves to be forestalled. In the second half of 1812 the British general, Sir Isaac Brock, lieutenant-governor of Upper Canada, adopted measures for opposing the Americans on the frontier line, between Huron and Erie. The American brigadier-general William Hull invaded Canada on the 12th of July from Detroit, just below the small Lake of St Clair between Huron and Erie. His army was mainly composed of militiamen, who behaved very badly, and his papers having been captured in a boat, his plans were revealed. General Brock drove him back and forced him to surrender at Detroit on the 16th of August. Brock now promptly transferred himself to the western end of Erie, where the American general Henry Dearborn was attempting another invasion. Brock fell in action on the 13th of October, while repulsing Dearborn's subordinate Van Rensselaer, a politician named to command by favour, and ignorant of a soldier's business. The Americans were driven back. In this field also their militia behaved detestably. The Canadians on the other hand, both the French who were traditionally amenable to authority and those of English descent, who being largely sons of loyalists of the War of Independence had a bitter hatred of the Americans, did excellent service. The discontent of New England with the war both hampered the American generals and also aided the British, who drew their supplies to a great extent from United States territory. On the 22nd of January 1813, at Frenchtown, the American troops under Winchester surrendered to a British and Indian force under Procter.

During the winter both sides were busy in building ships. On Ontario the Americans pushed on their preparations at Sackett's Harbour under Isaac Chauncey; the English were similarly engaged at Kingston. Sir James Lucas Yeo took command on the 15th of May 1813. On Erie the American headquarters were at Presqu' Isle, now the city of Erie; the English at Fort Malden. The American commander was Captain Oliver Perry, the British commander, Captain Robert Barclay. On Lake Ontario Yeo formed a more mobile though less powerful force than Chauncey's, and therefore manœuvred to avoid being brought to close action. Three engagements, on the 10th of August, 11th of September and 28th of September, led to no decisive result. By the close of the war Yeo had constructed a ship of 102 guns which gave him the superiority, and the British became masters of Lake Ontario. On Lake Erie the energy of Captain Perry, aided by what appears to have been the misjudgment of Barclay, enabled him to get a superior force by the 4th of August, and on the 10th of September he fought a successful action which left the Americans masters of Lake Erie. The military operations were subordinate to the naval. In April 1813 the Americans took York (now Toronto), and in May moved on Fort George; but a counter-attack by Yeo and Prevost on Sackett's Harbour, on the 29th of May, having made the Americans anxious about the safety of their base, naval support failed the American generals, and they were paralysed. A success was gained by them (October 5) at the Thames, where the Indian chief Tecumseh fell, but they made no serious progress. The Americans turned to the east of Ontario, intending to assail Montreal by the St Lawrence in combination with their forces at Lake Champlain. But the combination failed; they were severely harassed on the St Lawrence, and the invasion was given up.

The operations of 1814 bear a close resemblance to those of

1813, with, however, one important difference. The American generals, having by this time brought their troops to order, were able to fight with much better effect. Their attack on the Niagara peninsula led to hot fighting at Chippewa (July 5) and Lundy's Lane (July 25), the first a success for the Americans, the second a drawn battle. The fall of Napoleon having now freed the British government from the obligation to retain its army in Europe, troops from Spain began to pour in. But on the Canadian frontier they made little difference. In August 1814 Sir George Prevost attacked the American forces at Champlain. But his naval support, ill prepared, was hurried into action by him at Plattsburg on the 11th of September, and defeated. Prevost then retired. His management of the war, more especially on Lake Champlain, was severely criticized, and he was threatened with a court-martial, but died before the trial came on. A British occupation of part of the coast of Maine proved to be mere demonstration.

Operations on the American Coast.—When the war began the British naval forces were unequal to the work of blockading the whole coast. They were also much engaged in seeking for the American cruisers under Rodgers, Decatur and Bainbridge. The British government, having need of American foodstuffs for its army in Spain, was willing to benefit by the discontent of the New Englanders. No blockade of New England was at first attempted. The Delaware and Chesapeake were declared in a state of blockade on the 26th of December 1812. This was extended to the whole coast south of Narragansett by November 1813, and to the whole American coast on the 31st of May 1814. In the meantime much illicit trade was carried on by collusive captures arranged between American traders and British officers. American ships were fraudulently transferred to neutral flags. Eventually the United States government was driven to issue orders for the purpose of stopping illicit trading, and the commerce of the country was ruined. The now overpowering strength of the British fleet enabled it to occupy the Chesapeake and to execute innumerable attacks of a destructive character on docks and harbours. The burning by the American general McClure, on the 10th of December 1813, of Newark (Niagara on the Lake), for which severe retaliation was taken at Buffalo, was made the excuse for much destruction. The most famous of these destructive raids was the burning of the public buildings at Washington by Sir Alexander Cochrane, who succeeded Warren in April in the naval command, and General Robert Ross. The expedition was carried out between the 19th and 29th of August 1814, and was well organized and vigorously executed.[1] On the 24th the American militia, collected at Bladensburg to protect the capital, fled almost before they were attacked. A subsequent attack on Baltimore, in which General Ross was killed (September 12, 1814), was a failure. The expedition to New Orleans (*q.v.*) is separately dealt with.

Authorities.—In his *Sea Power in its Relations to the War of 1812* Captain Mahan has given a careful account of the war by land and sea with reference to services. *The Naval War of 1812*, by Theodore Roosevelt (New York, 1882), is lively but somewhat passionate, and not free from prejudice. A vehement statement of the Canadian side will be found in *How Canada was held for the Empire*, by James Hannay (London, Edinburgh, Toronto, 1905). See also *The Canadian War of 1812*, by Charles P. Lucas (Oxford, 1906). (D. H.)

AMERICUS, a city and the county-seat of Sumter county, Georgia, U.S.A., about 71 m. S.S.W. of Macon. Pop. (1880) 3635; (1890) 6398; (1900) 7674, of whom 4661 were of negro descent. It is served by the Central of Georgia and the Seaboard Air Line railways, and is the seat of the Third Congressional District Agricultural High School, a branch of the state university of Georgia. The city is in a rich sugar-cane and fruit country, is a large cotton and mule and horse market, and has division shops of the Seaboard Air Line railway. Among the city's manufactures are cotton-seed oil, fertilizers, chemicals, iron, carriages and wagons and harness (especially horse collars). The city owns the waterworks; the water-supply is obtained from artesian wells. Americus was settled in 1832, and was first chartered as a city in 1855.

AMERSFOORT, a town in the province of Utrecht, Holland, on the navigable Eem, and a junction station 14 m. by rail N.E. by E. of Utrecht. Pop. (1900) 19,089. It is situated in the midst of picturesque and undulating country, consisting of wide sandy heaths and woods, and dotted with many fine country houses. One of the most interesting of its few historic monuments is the Koppelpoort, an old gateway situated at the end of a fine avenue of trees bordering the canal. Close by is a lofty Gothic tower (1500), which belonged to the ancient church of St Mary, which was wrecked by an explosion of gunpowder in 1787. The large plain church of St George dates from the first half of the 13th century. There is also a Jansenist church, to which a seminary is attached. Besides these there are a town hall, a court of primary jurisdiction, industrial and other schools. Amersfoort has a large garrison, consisting chiefly of artillery, and manufactures woollen goods, cotton, silk, glass and brandy. It has also a considerable trade in tobacco, grown in the neighbourhood, and in corn and fish.

AMERSHAM, a market town in the Wycombe parliamentary division of Buckinghamshire, England, 24 m. W.N.W. of London by the Metropolitan railway. Pop. (1901) 2674. It is pleasantly situated in the narrow valley of the Misbourne stream, which is flanked by the well-wooded slopes of the Chiltern Hills. The church of St Mary is almost entirely Perpendicular, and has a beautiful south porch, brasses of the 15th, 16th and 17th centuries and numerous monuments, several of which, in a chantry, commemorate members of the family of Drake, lords of the manor. The town hall was built by Sir William Drake in 1642. At Coleshill, near Amersham, Edmund Waller the poet was born in 1606; he sat in parliament for the former borough of Amersham. The town has flour mills and breweries, and some straw-plaiting and lace-making are carried on in the vicinity. The district is one of the most beautiful near London; the village of Chenies, overlooking the valley of the Chess, is especially picturesque.

Amersham (Elmodesham, Agmondesham, Hagmondesham, Aumundesham, Homersham) at the time of the Domesday Survey was divided into no less than six holdings. The manor, or chief of them, was held by Geoffrey de Mandeville. At the time of Edward the Confessor it was held by Queen Edith. The manor afterwards descended to the families of Fitz Piers, Bohun and Strafford, and was granted by Henry VIII. to Sir John Russell, ancestor of the earls of Bedford. In 1638 Francis, earl of Bedford, conveyed it to William Drake, by whose descendants it is still held. The north chapel in the church of St Michael, Chenies, has been the burial-place of the Russell family since its erection in 1556, and contains a number of fine memorials, notably that of Anne, countess of Bedford (d. 1558), who founded the chapel. Amersham was formerly a parliamentary borough by prescription, and returned two members in 1300, 1306, 1307 and 1309. In 1623 this privilege was restored, and was only annulled by the Reform Bill of 1832. The annual fair, in September, is held under a charter secured by Geoffrey Fitz Peter, earl of Essex, in 1200, that on Whit Monday under a charter of 1614, secured by Edward, earl of Bedford, which transferred the Friday market, also granted under the earlier charter, to Tuesday.

AMES, FISHER (1758–1808), American statesman, orator and political writer, son of Nathaniel Ames, a physician, was born at Dedham, Massachusetts, on the 9th of April 1758. He graduated at Harvard College in 1774, and began the practice of the law at Dedham in 1781, but eventually abandoned that profession for the more congenial pursuit of politics. He was a prominent member of the Massachusetts convention which (February 1788) ratified for that state the Federal Constitution, and in the same year, having entered the lower house in the state legislature, he distinguished himself greatly by his eloquence and readiness in debate. During the eight years of Washington's administration (1789–1797) he was a prominent Federalist member of the national House of Representatives. On the 28th of April 1796, when the Republicans, hostile to the Jay Treaty, were on the point of holding up the appropriation necessary for its execution, Ames, who had just arisen from a sick-bed, made what has been considered the greatest speech of his life; before the delivery of his speech his opponents had claimed a majority of six, but the appropriation was finally passed, in the committee of the whole, by the casting vote of the chairman. When Washington retired from the presidency, Congress voted him an address and chose Ames to deliver it. In 1797 he returned to Dedham to resume the practice of the law, which the state of his health after a few years obliged him to relinquish. He published numerous essays, chiefly in relation to the contest between Great Britain and revolutionary France, as it might affect the liberty and prosperity of America. Ames was one of the group of New England ultra-Federalists known as the "Essex Junto," who opposed the French policy of President John Adams in 1798, and were conspicuous for their British sympathies. Four years before his death he was chosen president of Harvard College, an honour which his broken state of health obliged him to decline. He died on the 4th of July 1808.

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[1] The burning of Washington was an act of vandalism by no means approved of by many of the British officers who were compelled to take part in it. (See Smith, Sir Henry George Wakelyn.)

His writings and speeches, which abound in sparkling passages, displaying great fertility of imagination, were collected and published, with a memoir of the author, in 1809, by the Rev. Dr J. T. Kirkland, in one large octavo volume. A more complete edition in two volumes was published by his son, Seth Ames, at Boston, Mass., in 1854.

AMES, JOSEPH (1689–1759), English author, was born at Yarmouth on the 23rd of January 1689. He wrote an account of printing in England from 1471 to 1600, *Typographical Antiquities* (1749). Ames sent out circular letters with a list of two hundred and fifteen English printers with whose works he intended to deal, asking for any available information. He earned the gratitude of subsequent bibliographers by disregarding printed lists and consulting the title-pages of the books themselves. An interleaved copy of the work with many notes in the author's hand is now in the British Museum. Editions of his works were published with added information by William Herbert (3 vols., 1785–1790), and T. F. Dibdin (4 vols., 1810–1819). Ames's occupation is variously given. It is uncertain whether he was a ship-chandler, a patten-maker, a plane-iron maker or an ironmonger; but he led a prosperous life at Wapping, and amassed valuable collections of antiquities. He died on the 7th of October 1759. His other works are catalogues of English printers, of the collection of coins which belonged to the earl of Pembroke, of some two thousand English portraits, and *Parentalia* (1750), a memoir of the Wrens, undertaken in conjunction with Sir Christopher Wren's grandson, Stephen Wren. Part of his correspondence in bibliography is included in Nichols's *Literary Anecdotes and Illustrations*.

AMES, OAKES (1804–1873), American manufacturer, capitalist and politician, was born in Easton, Massachusetts, on the 10th of January 1804. As a manufacturer of shovels, in association with his father and his brother Oliver (1807–1877), he amassed a large fortune. In 1860 he became a member of the executive council of Massachusetts, and from 1863 to 1873 was a republican member of the national House of Representatives. As a member of the committee on railroads he became interested in the project, greatly aided by the government, to build a trans-continental railway, connecting the eastern states with California. Others having failed, he was induced in 1865 to assume the direction of the work, and to him more than to any other one man the credit for the construction of the Union Pacific railway was due. The execution was effected largely through a construction company, the Crédit Mobilier Company of America. In disposing of some of the stock of this company, Ames in 1867–1871 sold a number of shares to members of Congress at a price much below what these shares eventually proved to be worth. This, on becoming known, gave rise in 1872–1873 to a great congressional scandal. After an investigation by a committee of the House, which recommended the expulsion of Ames, a resolution was passed on the 28th of February 1873, "that the House absolutely condemns the conduct of Oakes Ames . . . in seeking to secure congressional attention to the affairs of a corporation in which he was interested, and whose interest directly depended upon the legislation of Congress, by inducing members of Congress to invest in the stocks of said corporation." Many have since attributed this resolution to partisanship, and the influence of popular clamour, and in 1883 the legislature of Massachusetts passed a resolution vindicating Ames. He died at North Easton, Mass., on the 8th of May 1873. His son, OLIVER AMES (1831–1895), was lieutenant-governor of Massachusetts from 1883 until 1887, and governor from 1887 to 1890.

See CRÉDIT MOBILIER OF AMERICA and the references there given. For a defence of Oakes Ames, see *Oakes Ames, A Memorial Volume* (Cambridge, Mass., 1884).

AMES, WILLIAM (1576–1633), English Puritan divine, better known, especially in Europe, as Amesius, was born of an ancient family at Ipswich, Suffolk, in 1576, and was educated at the local grammar school and at Christ's College, Cambridge, where, as throughout his life, he was an omnivorous student. He was considerably influenced by his tutor, the celebrated William Perkins, and by his successor, a man of kindred intellect and fervour, Paul Bayne. He graduated B.A. and M.A. in due course, and was chosen to a fellowship in Christ's College. He was universally beloved in the university. His own college (Christ's) would have chosen him for the mastership; but a party opposition led to the election of Valentine Cary, who had already quarrelled with Ames for disapproving of the surplice and other outward symbols. One of Ames's sermons became historical in the Puritan controversies. It was delivered on St Thomas's day (1609) before the feast of Christ's nativity, and in it he rebuked sharply "lusory lotts" and the "heathenish debauchery" of the students during the twelve days ensuing. The scathing vehemence of his denunciations led to his being summoned before the vice-chancellor, who suspended him "from the exercise of his ecclesiastical function and from all degrees taken or to be taken." After Cary's election he left the university and would have accepted the great church of Colchester, but the bishop of London refused to grant institution and induction. Like persecution awaited him elsewhere, and at last he passed over to Holland, being aided by certain wealthy English merchants who wished him to controvert the supporters of the English church in Leiden. At Rotterdam, clad in the fisherman's habit donned for the passage, he opposed Grevinchovius (Nicholas Grevinckhoven, d. 1632), minister of the Arminian or Remonstrant church, and overwhelmed him with his logical reasoning from Phil. ii. 13, "It is God that worketh in us both to will and to do." The fisherman-controversialist made a great stir, and from that day became known and honoured in the Low Countries. Subsequently Ames entered into a controversy in print with Grevinchovius on universal redemption and election, and cognate problems. He brought together all he had maintained in his *Coronis ad Collationem Hagiensem*—his most masterful book, which figures largely in Dutch church history. At Leiden, Ames became intimate with the venerable Mr Goodyear, pastor of the English church there. While thus resident in comparative privacy he was sent for to the Hague by Sir Horatio Vere, the English governor of Brill, who appointed him a minister in the army of the states-general, and of the English soldiers in their service, a post held by some of the greatest of England's exiled Puritans. He married a daughter of Dr Burgess, who was Vere's chaplain, and, on his father-in-law's return to England, succeeded to his place.

It was at this time he began his memorable controversy with Episcopius, who, in attacking the *Coronis*, railed against the author as having been "a disturber of the public peace in his native country, so that the English magistrates had banished him thence; and now, by his late printed *Coronis*, he was raising new disturbances in the peaceable Netherlands." It was a miserable libel and was at once rebutted by Goodyear. The *Coronis* had been primarily prepared for the synod of Dort, which sat from November 1618 until May 1619. At this celebrated synod the position of Ames was a peculiar one. The High Church party in England had induced Vere to dismiss him from the chaplaincy; but he was still held, deservedly, in such reverence, that it was arranged he should attend the synod, and accordingly he was retained by the Calvinist party at four florins a day to watch the proceedings on their behalf and advise them when necessary. A proposal to make him principal of a theological college at Leiden was frustrated by Archbishop Abbot; and when later invited by the state of Friesland to a professoriate at Franeker, the opposition was renewed, but this time abortively. He was installed at Franeker on the 7th of May 1622, and delivered a most learned discourse on the occasion on "Urim and Thummin." He soon brought renown to Franeker as professor, preacher, pastor and theological writer. He prepared his *Medulla Theologiae*, a manual of Calvinistic doctrine, for his students. His *De Conscientia, ejus Jure et Casibus* (1632), an attempt to bring Christian ethics into clear relation with particular cases of conduct and of conscience, was a new thing in Protestantism. Having continued twelve years at Franeker (where he was rector in 1626), his health gave way, and he contemplated removal to New England. But another door was opened for him. He yearned for more frequent opportunities of preaching to his fellow-countrymen, and an invitation to Rotterdam gave him such opportunity. His friends at Franeker were passionately opposed to the transference, but ultimately acquiesced. At Rotterdam he drew all hearts to him by his eloquence and fervour in the pulpit, and his irrepressible activity as a pastor. Home-controversy engaged him again, and he prepared his *Fresh Suit against Ceremonies*—the book which made Richard Baxter a Nonconformist. It ably sums up the issues between the Puritan school and that of Hooker. It was posthumously published. He did not long survive his removal to Rotterdam. Having caught a cold from a flood which inundated his house, he died in November 1633, at the age of fifty-seven, apparently in needy circumstances. He left, by a second wife, a son and a daughter. His valuable library found a home in New England.

Few Englishmen have exercised so formative and controlling an influence on European thought and opinion as Ames. He was a master in theological controversy, shunning not to cross swords with the formidable Bellarmine. He was a scholar among scholars, being furnished with extraordinary resources of learning. His works, which even the *Biographia Britannica* (1778) testifies were famous over Europe, were collected at Amsterdam in 5 vols. 4to. Only a very small proportion was translated into his mother tongue. His *Lectiones in omnes Psalmos Davidis* (1635) is exceedingly suggestive and terse in its style, reminding of Bengel's *Gnomon*, as does also his *Commentarius utriusque Epist. S. Petri*. His "Replies" to Bishop Morton and Dr Burgess on "Ceremonies" tell us that even kinship could not prevent him from "contending earnestly for the faith."

See John Quick's MS. *Icones Sacrae Anglicanae*, which gives the fisherman anecdote on the personal authority of one who was present; *Life* by Nethenus prefixed to collected edition of Latin works (5 vols., Amsterdam, 1658); Winwood's *Memorials*, vol. iii. pp. 346–347; Neal's *Puritans*, i. 532; Fuller's *Cambridge* (*Christ's College*); Hanbury's *Hist. Memorials*, i. 533; *Collections of the Massachusetts Historical Society*, vol. vi., fourth series, 1863, pp. 576–577.

AMES, a city of Story county, Iowa, U.S.A., about 35 m. N. of Des Moines, at the intersection of two lines of the Chicago & North-Western railway. Pop. (1890) 1276; (1900) 2422; (1905, state census) 3292. The city is the seat of the state college of agriculture and mechanic arts; this institution, opened in 1869, has for its use about 1175 acres of land, on which the state has erected, at a cost of $1,200,000, thirty-two college buildings, besides dwelling-houses and buildings for farm purposes. On the college campus are beautiful groves containing several hundred varieties of trees, and in a central position stands a campanile with excellent chimes. The college offers four-year courses in agronomy, animal husbandry, dairying, domestic economy, general science, veterinary medicine, and civil, mechanical, electrical and mining engineering. In 1909–1910 it had an enrollment of 2631 students (including 796 in the winter short course) and a library of 23,000 volumes. The cost of instruction and experimentation is met by the income from national grants (under the Morrill Acts of 1862 and 1882) and by state appropriations. Ames has a Carnegie library, and owns and operates its electric-lighting plant and waterworks. It was laid out as a town in 1864 and was named in honour of Oakes Ames, at the time one of the proprietors of the Cedar Rapids & Missouri River railway (now part of the Chicago & North-Western); five years later it was incorporated.

AMESBURY, a small town in the Wilton parliamentary division of Wiltshire, England, 8 m. N. of Salisbury, on the London & South-Western railway. Pop. (1901) 1143. It stands on a wooded upland, amid the chalk downs of Salisbury Plain. The church of St Mary is cruciform, with a low square tower, and is largely Early English, with some richly decorated windows in the chancel. A curious two-storeyed building which adjoins the north transept consists of a chapel with a piscina below and a priest's chamber above. Amesbury Abbey, a beautiful house built by Inigo Jones for the dukes of Queensberry, stands close to the village, in a park watered by the river Avon, here famous for its trout. Stonehenge (*q.v.*), the greatest surviving megalithic work in the British Isles, is a mile and a half distant; and on a hill near the village is Vespasian's Camp or the Ramparts, a large earthwork, which is undoubtedly of British, not Roman, origin.

At Amesbury (Ambresberia, Aumbresbery) a witenagemot was held in 932, while about 980 Ælfthryth (Ethelfrida), queen-dowager of Edgar, erected here a nunnery in expiation of the murder of her stepson. The house afterwards acquired such ill repute that in 1177 the nuns were dispersed and the house was attached to the abbey of Fontevrault, by whom it was re-established. From this date, by a succession of royal charters and private gifts, the nunnery amassed vast wealth and privileges, and became a fashionable retreat for ladies of high rank, among whose number were Eleanor, widow of Henry III., and Mary, daughter of Edward I. After the dissolution in 1540 the site was granted to Edward, earl of Hertford, afterwards duke of Somerset and protector of the kingdom. It subsequently passed to the duke of Queensberry. According to the Domesday, Amesbury was a royal manor and did not pay geld, but was under the obligation of providing one night's entertainment for the king. In 1317 the prioress obtained a Saturday market and a three days' fair at the feast of St Melor (Meliorus). The market was subsequently changed to Friday, and three additional fairs were granted. Pipe-clay abounds in the neighbourhood, and in the 17th century Amesbury was famous for the best pipes in England, many of which are preserved in Salisbury museum.

See *Victoria County History—Wiltshire*; Sir Richard Colt Hoare, *History of Modern Wiltshire* (1822–1844).

AMESBURY, a township of Essex county, in N.E. Massachusetts, U.S.A., situated on the Merrimac river, about 6 m. above its mouth. Pop. (1890) 9798; (1900) 9473, of whom 2448 were foreign-born; (1910, U.S. census), 9894. Amesbury is served by two divisions of the Boston & Maine railway, and is connected by electric line with Haverhill and Newburyport, Mass., and with Hampton Beach, New Hampshire, and Salisbury Beach, Mass., two summer resorts. The township covers a land area of about 13 sq. m. The surface is hilly. The Powow river, a small stream, passes through the centre of the township. There is a public library. Among Amesbury's manufactures are hats, cotton goods, carriages, automobile bodies, carriage and automobile lamps, thermometers, brass castings and motor boats. In 1905 the factory products were valued at $3,614,692. Amesbury was settled about 1644 as a separate part of Salisbury, and in 1654, by mutual agreement of the old and new "towns," became practically independent, although not legally a township until 1666 (named Amesbury, from the English town in Wilts, in 1667). It suffered repeatedly in the course of the colonial Indian wars. Quakers settled here as early as 1701. Josiah Bartlett (1729–1795), a signer of the Declaration of Independence, was born here, and is commemorated by a statue (1888) by Karl Gerhardt. Shipbuilding was an important industry in the 18th and especially the first quarter of the 19th century, and the U.S. frigate "Alliance" was built at Salisburypoint in 1778. A nail factory, one of the earliest in the country, was built on the Powow in 1796. The manufacture of iron began about 1710, of hats in 1769, of carriages in 1800 and of cotton goods in 1812. Paul Moody, who with F. C. Lowell constructed in 1814 at Waltham the first successful power-loom in America, was engaged in the manufacture of cotton goods in Amesbury. The township was the home of John G. Whittier from 1836 to 1892; here were written most of the poems of his middle and later life, many of which describe the surrounding country. In 1876 Merrimac township was created out of the territory of Amesbury; in 1886 the west part of the old township of Salisbury was united to Amesbury.

See Joseph Merrill, *History of Amesbury* (Haverhill, 1880); S. T. Pickard, *Whittier-land, A Handbook of North Essex* (Boston, New York, 1904).

AMETHYST, a violet or purple variety of quartz used as an ornamental stone. The name is generally said to be derived from the Gr. ἀ, "not," and μεθύσκειν, "to intoxicate," expressing the old belief that the stone protected its owner from strong drink. It was held that wine drunk out of a cup of amethyst would not intoxicate. According, however, to the Rev. C. W. King, the word may probably be a corruption of an Eastern name for the stone.

The colour of amethyst is usually attributed to the presence of manganese, but as it is capable of being much altered and even discharged by heat it has been referred by some authorities to an organic source. Ferric thiocyanate has been suggested, and sulphur is said to have been detected in the mineral. On exposure to heat, amethyst generally becomes yellow, and much of the cairngorm or yellow quartz of jewellery is said to be merely "burnt amethyst." Veins of amethystine quartz are apt to lose their colour on the exposed outcrop.

Amethyst is composed of an irregular superposition of alternate lamellae of right-handed and left-handed quartz. (See QUARTZ.) It has been shown by Prof. J. W. Judd that this structure may be due to mechanical stresses. In consequence of this composite formation, amethyst is apt to break with a rippled fracture, or to show "thumb markings," and the intersection of two sets of curved ripples may produce on the fractured surface a pattern something like that of "engine turning." Some mineralogists, following Sir D. Brewster, apply the name of amethyst to all quartz which exhibits this structure, regardless of its colour.

The amethyst was used as a gem-stone by the ancient Egyptians, and was largely employed in antiquity for intaglios. Beads of amethyst are found in Anglo-Saxon graves in England. Amethyst is a very widely distributed mineral, but fine clear specimens fit for cutting as ornamental stones are confined to comparatively few localities. Such crystals occur either in cavities in mineral-veins and in granitic rocks, or as a lining in agate geodes. A huge geode, or "amethyst-grotto," from near Santa Cruz in southern Brazil, was exhibited at the Düsseldorf Exhibition of 1902. Many of the hollow agates of Brazil and Uruguay contain a crop of amethyst-crystals in the interior. Much fine amethyst comes from Russia, especially from near Mursinka in the Ekaterinburg district, where it occurs in drusy cavities in granitic rocks. Many localities in India yield amethyst; and it is found also in Ceylon, chiefly as pebbles.

Purple corundum, or sapphire of amethystine tint, is called *Oriental amethyst*, but this expression is often applied by jewellers to fine examples of the ordinary amethystine quartz, even when not derived from Eastern sources.

Amethyst occurs at many localities in the United States, but rarely fine enough for use in jewellery. Among these may be mentioned Amethyst Mountain, Texas; Yellowstone National Park; Delaware Co., Pennsylvania; Haywood Co., North Carolina; Deer Hill, and Stow, Maine. It is found also in the Lake Superior district. See G. F. Kunz, *Gems &c. of North America* (1890), and *Report for 12th Census* (vol. "Mines and Quarries"). (F.W.R.*)

AMHARA, the central province of Abyssinia. The chief town, Gondar (*q.v.*), by which name the province is also known, was the residence of the negus negusti, or emperor, of Abyssinia from the middle ages up to 1854. The speech of the inhabitants, Amharic, which differs in several features from the dialects spoken in Tigré and Shoa, is the official language of Abyssinia.

AMHERST, JEFFREY AMHERST, BARON (1717–1797), British soldier, was the son of Jeffrey Amherst of Riverhead, Kent, and by the interest of the duke of Dorset obtained an ensigncy in the Guards in 1731. He served in Germany and the Low Countries as aide-de-camp to General (Lord) Ligonier, and was present at Dettingen, Fontenoy and Roucoux. He then served on Cumberland's staff, and took part with the duke in the later campaigns of the Austrian Succession war, in the battle of Val, and the North German campaign of 1757, including the battle of Hastenbeck. A year previously he had been promoted to a lieutenant-colonelcy. In 1758 William Pitt caused Amherst to be made a major-general, and gave him command of an expedition to attack the French in North America. For the great plan of conquering Canada, Pitt chose young and ardent officers, with Amherst, distinguished for steadiness and self-control, as their commander-in-chief. The first victory of the expedition, the capture of Louisburg (July 26, 1758), was soon followed by other successes, and Amherst was given the chief command of all the forces in the theatre of war. In the campaign of 1759 Amherst's own share was the capture of Ticonderoga and Crown Point, while Fort Niagara fell to another column, and Quebec was taken by Wolfe. In 1760 a concentric march on Montreal was carried out with complete success. Amherst was immediately appointed governor-general of British North America, and in the following year was made a K.B. His conduct of the operations against the Indians under Pontiac was, however, far from being as successful as his generalship against regular troops; and he returned to England in 1763, being made governor of Virginia and colonel of the 60th regiment in the same year. In 1768 the king, who had had a quarrel with Amherst, made amends by giving him another colonelcy; in 1770 he was made governor of Guernsey; and two years later, though not yet a full general, he was made lieutenant-general of the ordnance and acting commander-in-chief of the forces. In this capacity he was the chief adviser at headquarters during the American War of Independence. He was created a peer in 1776, was promoted general in 1778 and became colonel of the 2nd Horse Grenadiers (2nd Life Guards) two years later. He aided in suppressing the Gordon riots of 1780. The rest of his active life, with a short interval in 1782–1783, he spent at the Horse Guards as commander-in-chief, but he was no longer capable of good service, and in 1795 he was succeeded by the duke of York. In 1796 Lord Amherst was made field-marshal; and he died on the 3rd of August 1797 at "Montreal," his residence in Kent.

AMHERST, WILLIAM PITT AMHERST, EARL (1773–1857), governor-general of India, was the nephew of Jeffrey, Baron Amherst, and succeeded to his title in 1797 by the remainder provided when the patent of nobility was renewed in 1788. In 1816 he was sent as ambassador extraordinary to the court of China, with a view of establishing more satisfactory commercial relations between that country and Great Britain. On arriving in the Peiho he was given to understand that he could only be admitted to the emperor's presence on condition of performing the *ko-tou* (kow-tow), a ceremony which Western nations consider degrading, and which is, indeed, a homage exacted by a Chinese sovereign from his tributaries. To this Lord Amherst, following the advice of Sir George T. Staunton, who accompanied him as second commissioner, refused to consent, as Lord Macartney had done in 1793, unless the admission was made that his sovereign was entitled to the same show of reverence from a mandarin of his rank. In consequence of this he was not allowed to enter Pekin, and the object of his mission was frustrated. His ship, the "Alceste," after a cruise along the coast of Korea and to the Loo-Choo Islands, on proceeding homewards was totally wrecked on a sunken rock in Gaspar Strait. Lord Amherst and part of his shipwrecked companions escaped in the ship's boats to Batavia, whence relief was sent to the rest. The ship in which he returned to England in 1817 having touched at St Helena, he had several interviews with the emperor Napoleon (see Ellis's *Proceedings of the Late Embassy to China*, 1817; M'Leod's *Narrative of a Voyage in H.M.S. "Alceste,"* 1817). Lord Amherst held the office of governor-general of India from August 1823 to February 1828. The principal event of his government was the first Burmese war of 1824, resulting in the cession of Arakan and Tenasserim to Great Britain. He was created Earl Amherst of Arakan in 1826. On his return to England he lived in retirement till his death in March 1857.

See A. Thackeray and R. Evans, *Lord Amherst* ("Rulers of India" series), 1894.

AMHERST, a town and district in the Tenasserim division of Lower Burma. The town is situated about 30 m. S. of Moulmein. It was founded by the British in 1826 on the restoration of the town of Martaban to the Burmese, and named in compliment to the governor-general of India of that day; but in 1827 the headquarters were transferred to Moulmein. Amherst has been eclipsed in prosperity by the latter city, and is now merely a bathing-place for Moulmein.

The district forms a narrow strip of land between the Indian Ocean and the mountains which separate it from the independent kingdom of Siam. It has an area of 7062 sq. m. and had a population in 1901 of 300,173; it consists partly of fertile valleys formed by spurs of mountain system which divides it from Siam, and partly of a rich alluvial tract created by the great rivers which issue from them. The most important of these are the Salween and the Gyaing, formed by the junction of the Hlaingbwè and Haungtharaw rivers. The river highways bring down inexhaustible supplies of rice to Moulmein, the chief town of the district, as also of the province of Tenasserim. The district is subject to very heavy rainfall approaching 150 in. in the year, and has a uniform temperature of about 80° F. throughout the twelvemonth.

AMHERST, a village of Amherst township, Hampshire county, Massachusetts, U.S.A., in the central part of the state, about 7 m. N.E. of Northampton. Pop. of the township (1890) 4512; (1900) 5028; **(1910, U. S. census) 5112.** It is served by the Boston & Maine and the Central Vermont railways, and by interurban electric railways to Northampton, Holyoke, Sunderland and Pelham. The village is picturesquely situated on a plateau within a rampart of hills on the E. side of the Connecticut river valley. About 3 m. to the S. are the Holyoke Mountains (so called), while on the three remaining sides the land slopes to meadows, beyond which rise on the W. the Hampshire and Berkshire Hills, on the N. the Sugar Loaf Mountains and Mt. Toby, and on the E. the Pelham Hills, including Mt Lincoln (1246 ft.). Two small rivers (Mill and Fort) flow through the township. Amherst is a quiet, pleasing, academic village of attractive homes. It is noteworthy as the seat of Amherst College, one of the best known of the smaller colleges of the United States. Amherst Academy (opened about 1814, chartered 1816), a co-educational school at which Mary Lyon, the founder of Mt. Holyoke College, was educated, preceded the college (not co-educational), which was opened in 1821 and was chartered in 1825. It was originally a collegiate charitable institution, its basis being a fund for the schooling of ministers, and the charity element has remained very large relatively to other colleges. The principal college buildings are College Hall (1828); College Chapel (1828); the Henry T. Morgan Library; Williston Hall, containing the Mather Art Museum, the rooms of the Young Men's Christian Association, and several lecture-rooms; Walker Hall, with college offices and lecture-rooms; Hitchcock Hall; Barrett Hall (1859), the first college gymnasium built in the United States, now used as a lecture hall; the Pratt Gymnasium and Natatorium and the Pratt Health Cottage, whose donors also gave to the college the Pratt Field; an astronomical observatory; and the two dormitories, North College and South College, supplemented by several fraternity houses. The natural history collections (including the very large ichnological collection of President Hitchcock, and Audubon's collection of birds) are of exceptional richness. At Amherst is also the Massachusetts Agricultural College (co-educational; 1867) and experiment station (1887). Among the presidents of Amherst College have been in 1845–1854 and in 1876–1890 respectively—Edward Hitchcock, the famous geologist, and the Rev. Julius H. Seelye (1824–1895), a well-known educationalist. The township seems to have been first settled in 1731; it was incorporated in 1759 as a "district" (*i.e.* having all the rights of a township save corporate representation in the legislature) and in 1776 as a "town" (township). It was originally part of Hadley. Its name was given to it in honour of General Jeffrey Amherst (1717–1797). During the Shays' Rebellion Amherst was a centre of disaffection and a rallying-point of the insurgents. Noah Webster lived in the village from 1812 to 1822, when working on his *Dictionary*; and Emily Dickinson and Helen M. Fiske (later Helen Hunt-Jackson, "H. H.") were born here.

See William Seymour Tyler, *A History of Amherst College* (New York, 1896), and Carpenter and Morehouse, *The History of the Town of Amherst* (New York, 1896).

AMHERST, the county town of Cumberland county, and port of entry in Novia Scotia, Canada, at the head of Chignecto Bay and on the Intercolonial railway, 138 m. from Halifax. Pop. (1901) 4964. It is situated in a rich agricultural and mining district, and contains county and railway buildings and numerous mills and factories. It is the distributing centre for the surrounding district, and exports railway carriages, engines, boilers, stoves, &c.

AMHURST, NICHOLAS (1697–1742), English poet and political writer, was born at Marden, Kent, on the 16th of October 1697. He was educated at the Merchant Taylors' School, and received an exhibition (1716) to St John's College, Oxford. In 1719 he was expelled from the university, ostensibly for his irregularities of conduct, but in reality, according to his own account, because of his whig principles, which were sufficiently evident in a congratulatory epistle to Addison, in *Protestant Popery; or the Convocation* (1718), an attack on the opponents of Bishop Hoadly, and in *The Protestant Session . . . by a member of the Constitution Club at Oxford* (1719), addressed to James, first Earl Stanhope, and printed anonymously, but doubtless by Amhurst. He had satirized Oxford morals in *Strephon's Revenge; a Satire on the Oxford Toasts* (1718), and he attacked from time to time the administration of the university and its principal members. An old Oxford custom on public occasions permitted some person to deliver from the rostrum a humorous, satirical speech, full of university scandal. This orator was known as *Terrae filius*. In 1721 Amhurst produced a series of bi-weekly satirical papers under this name, which ran for seven months and incidentally provides much curious information. These publications were reprinted in 1726 in two volumes as *Terrae Filius; or the secret history of the University of Oxford; in several essays. . . .* He collected his poems in 1720, and wrote another university satire, *Oculus Britanniae*, in 1724. On leaving Oxford for London he became a prominent pamphleteer on the opposition side. On the 5th of December 1726 he issued the first number of the *Craftsman*, a weekly periodical, which he conducted under the pseudonym of Caleb D'Anvers. The paper contributed largely to the final overthrow of Sir Robert Walpole's government, and reached a circulation of 10,000 copies. For this success Amhurst's editorship was not perhaps chiefly responsible. It was the organ of Lord Bolingbroke and William Pulteney, the latter of whom was a frequent and caustic contributor. In 1737 an imaginary letter from Colley Cibber was inserted, in which he was made to suggest that many plays by Shakespeare and the older dramatists contained passages which might be regarded as seditious. He therefore desired to be appointed censor of all plays brought on the stage. This was regarded as a "suspected" libel, and a warrant was issued for the arrest of the printer. Amhurst surrendered himself instead, and suffered a short imprisonment. On the overthrow of the government in 1742 the opposition leaders did nothing for the useful editor of the *Craftsman*, and this neglect is said to have hastened Amhurst's death, which took place at Twickenham on the 27th of April 1742.

AMIANTHUS, a corruption of *amiantus* (Gr. ἀμίαντος, undefiled), a name applied to the finer kinds of asbestos (*q.v.*), in consequence, it is said, of the mineral being unaffected by fire. Some of the finest amianthus, with long silky flexible fibres, occurs in the district of the Tarentaise in Savoy. According to Dr J. W. Evans, the ancient amianthus, derived mostly from Karystos in Euboea and from Cyprus, was probably a fibrous serpentine, or chrysotile (now called locally παμπακόπετρα, or cotton-stone).

See *Mineralogical Mag.* (London) vol. xiv. no. 65 (1906), art. by J. W. Evans.

AMICABLE NUMBERS, two numbers so related that the sum of the factors of the one is equal to the other, unity being considered as a factor. Such a pair are 220 and 284; for the factors of 220 are 1,2,4,5,10,11,20,22,44,55 and 110, of which the sum is 284; and the factors of 284 are 1,2,4,71, and 142, of which the sum is 220. Amicable numbers were known to the Pythagoreans, who accredited them with many mystical properties. A general formula by which these numbers could be derived was invented by the Arabian astronomer Tobit ben Korra (836-901): if $p=3\cdot2^m-1$, $q=3\cdot2^{m-1}-1$ and $r=9\cdot2^{2m-1}-1$, where m is an integer and p,q,r prime numbers, then $2^m pq$ and $2^m r$ are a pair of amicable numbers. This formula gives the pairs 220 and 284, 17,296 and 18,416, 9,463,584 and 9,437,056. The pair 6232 and 6368 are amicable, but they cannot be derived from this formula. Amicable numbers have been studied by Al Madshritti (d. 1007), René Descartes, to whom the formula of Tobit ben Korra is sometimes ascribed, C. Rudolphus and others.

AMICE (earlier forms: *amyt*, *amys*, O. Fr. *amit*, Lat. *amictus*, from *amicire*, to throw or wrap round, the change of *t* to *s* being probably due to an early confusion with the *aumuce*: see ALMUCE), a liturgical vestment of the Western Church. It is a rectangular piece of cloth which is wrapped round the neck, shoulders and breast. Sometimes, more particularly in Germany, it is called the *humerale* (from *humerus*, shoulder). According to modern Roman use, laid down by the decree of the Congregation of Rites in 1819, the amice must be of linen or of a hempen material, not wool; and, as directed by the new Roman Missal (1570), a small cross must be sewn or embroidered in the middle of it. In putting it on it is first laid on the head, then allowed to fall on the shoulders, and finally folded round the chest and tied with the strings attached for that purpose (see fig. 1). The amice is now worn under the alb, except at Milan and Lyons, where it is put on over it. The vestment was at first a perfectly plain white cloth, but in the 12th century the custom arose of decorating the upper border with a band of embroidery, the parure (*parura*) or "apparel." This was abandoned at Rome about the end of the 15th century and is not prescribed in the Missal; it survived, however, in many parts of Europe till much later. This apparel, when the vestment has been adjusted, forms a sort of stiff collar which appears above the chasuble or dalmatic (see fig. 2). In some exceptional cases, as at Milan, it has become detached from the amice and is fixed like a collar to the chasuble.

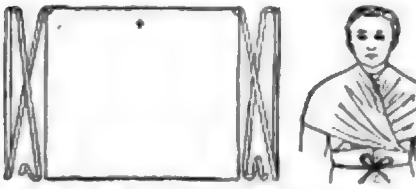

From Braun, *Liturgische Gewandung*, by permission of the publisher, B. Herder.

FIG. 1.—Amice of the Present Day.

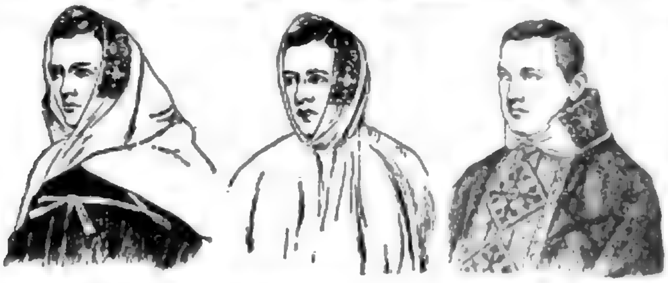

Redrawn from Braun, *Liturgische Gewandung*.

FIG. 2.—Medieval Method of putting on the Amice.

The Latin word *amictus* was applied to any wrap-like garment, and, according to Father Braun, the liturgical amice originated in the ordinary neck-cloth worn by all classes of Romans. It had at the outset no liturgical significance whatever, and was simply adopted by the clergy for the same reason that the clergy of the 18th century wore wigs—because it was part of the full dress of ordinary life. The first record of its ecclesiastical use is at Rome in the 8th century, when it was worn only with the dalmatic and was known as the *anabolagium* (*anagolaium*, *anagolagium*, from Gr. ἀναβόλαιον), a name it continued to bear at Rome till the 13th century. In the 9th century it spread to the other countries that adopted the Roman use: it is mentioned in an inventory of vestments given by Abbot Angilbert (d. 814) to the monastery at Centula (St Riguier) and in the *de clericorum institutione* of Hrabanus Maurus (*c.* 820). The amice was worn first simply as a shoulder-cloth, but at the end of the 9th century the custom grew up of putting it on over the head and of wearing it as a hood, either while the other vestments were being put on or, according to the various uses of local churches, during part of the Mass, though never during the canon. This ceased at Rome at the same time as the apparel disappeared; but two relics of it survive—(1) in the directions of the Missal for putting on the amice, (2) in the ordination of subdeacons, when the bishop lays the vestment on the ordinand's head with the words, "Take the amice, which symbolizes discipline over the tongue, &c." The priest too in putting it on prays, "Place on my head the helmet of salvation, &c."

The amice, whatever its origin or symbolism, became specifically a vestment associated with the sacrifice of the Mass, and as such it was rejected with the other "Mass vestments" in England at the Reformation. Its use has, however, been revived in many Anglican churches, the favourite form being the medieval apparelled amice. (See VESTMENTS.) A vestment akin to the amice is also worn in the Armenian and some other oriental churches, but it is unknown to the Orthodox Eastern Church.

Akin to the amice is a vestment peculiar to the popes, the *fanone* (Med. Lat. *fano*, "cloth," Goth. *fana*, "cloth," Mod. Ger. *Fahne*, "a flag"), also called the *orale* (from *ora*, an edge, border). This is at present a circular broad collar of two thicknesses of silk, ornamented with gold stripes and a gold-embroidered cross (see fig. 3). It is put on after the alb, &c., and under the tunicle, dalmatic and chasuble, but then drawn up so as to fall over the latter like a collar. The fanone was originally a cloth like the amice and was wrapped round neck and shoulders; until the 15th century, moreover, it was not worn with the amice. Since then, however, both vestments have been worn, one under, the other over, the alb. It is worn by the popes only on certain special days or occasions, and forms part of the vestments in which they are buried.

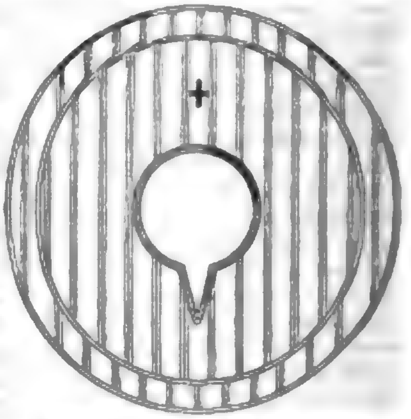

From Braun, *Liturgische Gewandung*.

FIG. 3.—The Papal Fanone.

See Joseph Braun, S. J., *Die liturgische Gewandung*, pp. 21-56 (Freiburg im Breisgau, 1907), and bibliography to the article VESTMENTS.

AMICI, GIOVANNI BATTISTA (1786–1863), Italian astronomer and microscopist, was born on the 25th of March 1786 at Modena. After studying at Bologna, he became professor of mathematics at Modena, and in 1831 was appointed inspector-general of studies in the duchy. A few years later he was chosen director of the observatory at Florence, where he also lectured at the museum of natural history. He died at Florence on the 10th of April 1863. His name is best known for the improvements he effected in the mirrors of reflecting telescopes and especially in the construction of the microscope. He was also a diligent and skilful observer, and busied himself not only with astronomical subjects, such as the double stars, the satellites of Jupiter and the measurement of the polar and equatorial diameters of the sun, but also with biological studies of the circulation of the sap in plants, the fructification of plants, infusoria, &c.

AMICIS, EDMONDO DE (1846–1908), Italian writer, was born at Oneglia, in Liguria, on the 21st of October 1846. After some schooling at Cuneo and Turin, he was sent to the Military School at Modena, from which he was appointed to a lieutenancy in the 3rd regiment of the line in 1865. He fought at the battle of Custozza in 1866. In 1867 he became director of the *Italia*

Militare, Florence. In the following year he published his first book, *La Vita Militare*, which consisted of sketches of military life, and attained wide popularity. After the overthrow of the pope's temporal power in 1870, De Amicis retired from the army and devoted himself to literature, making his headquarters at Turin. Always a traveller by inclination, he found opportunity for this in his new leisure, and some of his most popular books have been the product of his wanderings. Several of these have been translated into English and the other principal languages of Europe. The most important of these are his descriptions of Spain (1873), Holland (1874), Constantinople (1877) and Morocco (1879). These gained him a well-deserved reputation as a brilliant depicter of scenery and the external aspects of life; solid information is not within their sphere; and much of their success is owing to the opportunities they afford for spirited illustration. Subsequently De Amicis greatly extended his fame as a writer of fiction, especially by *Il Romanzo d' un Maestro*, and the widely read *Il Cuore* (translated into English as *An Italian Schoolboy's Journal*); later volumes from his pen being *La Carozza di tutti* (centring round an electric tram), *Memorie*, *Speranze e glorie*, *Ricordi d' infanzia è di scuola*, *L' Idioma gentile*, and a volume of short stories, *Nel Regno dell' Amore*. He died suddenly of heart disease at Bordighera on the 12th of March 1908.

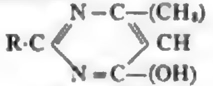
AMICUS CURIAE (Lat. for "a friend of the court"), a term used primarily in law, signifying a person (usually a member of the bar) who, having special knowledge but not being engaged in the suit, intervenes during its hearing to give information for the assistance of the court, either upon some fact relevant to the issue or upon a point of law, such as the hearing of a local custom, the precedent of some decided case, &c.

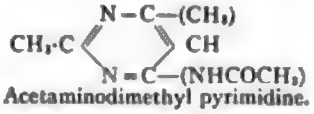
AMIDINES, in organic chemistry, the name given to compounds of general formula $R{\cdot}C:(NH){\cdot}NH_2$, which may be considered as derived from the acid-amides by replacement of oxygen by the divalent imino ($=NH$) group. They may be prepared by the action of ammonia or amines on imide chorides, or on thiamides (O. Wallach, A. Bernthsen); by the action of ammonium chloride or hydrochlorides of amines on nitriles; by condensing amines and amides in presence of phosphorus trichloride; by the action of hydrochloric acid on acid-amides (O. Wallach, *Ber.*, 1882, 15, p. 208); and by the action of ammonia or amines on imino-ethers (A. Pinner, *Ber.*, 1883, 16, p. 1647; 1884, 17, p. 179). They are monacid bases, which are not very stable; they readily take up the elements of water (when boiled with acids or alkalies), yielding amides and ammonia. On dry distillation they yield nitriles and ammonia. When warmed with sulphuretted hydrogen they yield thiamides, $R{\cdot}C:(NH){\cdot}NHR+H_2S=R{\cdot}C(NH_2)(SH)NHR=R{\cdot}CSNH_2+NH_2{\cdot}R$ or $RCS{\cdot}NHR+NH_3$. With β-ketonic esters, $HO(CH_3)C:CH{\cdot}CO_2R$, they yield oxypyrimidines (A. Pinner, *Ber.*, 1890, 23, p. 3820).

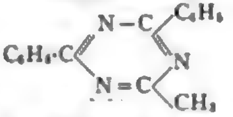
Formamidine, $HC:(NH)NH_2$, is only known in the form of its salts, the hydrochloride being obtained by the action of ammonia on the hydrochloride of formimido-ethyl ether (A. Pinner, *Ber.*, 1883, 16, p. 357). *Acetamidine*, $CH_3C:(NH){\cdot}NH_2$, is alkaline in reaction, and readily splits up into acetic acid and ammonia when warmed with acids. Its hydrochloride melts at 163° C., and crystallizes from alcohol in colourless deliquescent prisms. Acetic anhydride converts the base into an acetamino-dimethyl pyrimidine, acetic acid and acetamide being also formed.

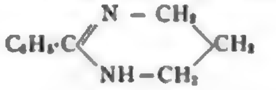
Benzamidine, $C_6H_5{\cdot}C:(NH)NH_2$, forms colourless crystals which melt at 75–80° C. When warmed it breaks down into ammonia and cyanphenine (s-triphenyl triazine). It condenses with acetic anhydride to form a methyldiphenyl triazine, acetamide being also formed; with acetyl-acetone to form dimethylphenyl pyrimidine (A. Pinner, *Ber.*, 1893, 26, p. 2125); and with trimethylene bromide to form a phenyl tetrahydropyrimidine (Pinner). H. v. Pechmann (*Ber.*, 1895, 28, p. 2362) has shown that amidines of the type $R{\cdot}C:(NY){\cdot}NHZ$ sometimes react as if they possessed the constitution $R{\cdot}C:(NZ){\cdot}NHY$; but this only appears to occur when Y and Z are groups which function in the same way. If Y and Z are groups which behave very differently, then there is apparently no tautomerism and a definite formula can be given to the compound.

The formulae of the ringed compounds mentioned above are here shown:


Oxypyrimidine.


Acetaminodimethyl pyrimidine.


Methyldiphenyl triazine.


Phenyl tetrahydropyrimidine.

AMIEL, HENRI FRÉDÉRIC (1821–1881), Swiss philosopher and critic, was born at Geneva on the 27th of September 1821. He was descended from a Huguenot family driven to Switzerland by the revocation of the edict of Nantes. Losing his parents at an early age, he travelled widely, became intimate with the intellectual leaders of Europe and made a special study of German philosophy in Berlin. In 1849 he was appointed professor of aesthetics at the academy of Geneva, and in 1854 became professor of moral philosophy. These appointments, conferred by the democratic party, deprived him of the support of the aristocratic party; which comprised nearly all the culture of the city. This isolation inspired the one book by which Amiel lives, the *Journal Intime*, which, published after his death, obtained a European reputation. It was translated into English by Mrs Humphry Ward. Although second-rate as regards productive power, Amiel's mind was of no inferior quality, and his journal gained a sympathy which the author had failed to obtain in his life. In addition to the *Journal*, he produced several volumes of poetry and wrote studies on Erasmus, Madame de Staël and other writers. He died in Geneva on the 11th of March 1881. His chief poetical works are *Grains de mil*, *Il penseroso*, *Part du rêve*, *Les Etrangères*, *Charles le Téméraire*, *Romancero historique*, *Jour à jour*.

See *Life of Amiel* by Mdlle Berthe Vadier (Paris, 1885); Paul Bourget, *Nouveaux essais* (Paris, 1885); E. Scherer, introd. to the *Journal* and in *Études sur la litt. contemp.* (vol. viii.).

AMIENS, a city of northern France, capital of the department of Somme, on the left bank of the Somme, 81 m. N. of Paris on the Northern railway to Calais. Pop. (1906) 78,407. Amiens was once a place of great strength, and still possesses a citadel of the end of the 16th century, but the ramparts which surrounded it have been replaced by boulevards, bordered by handsome residences. Suburbs, themselves bounded by another line of boulevards, have arisen beyond these limits, and the city also extends to the right bank of the Somme. The busy quarter of Amiens lies between the river and the railway, which for some distance follows the inner line of boulevards. The older and more picturesque quarter is situated directly on the Somme; its narrow and irregular streets are intersected by the eleven arms of the river and it is skirted on the north by the canal derived therefrom. Besides its boulevards Amiens has the ample park or Promenade de la Hotoie to the west and several fine squares, notably the Place Longueville and the Place St Denis, in which stands the statue of the famous 17th-century scholar Charles Ducange. The cathedral (see ARCHITECTURE: *Romanesque and Gothic Architecture in France*; and CATHEDRAL), which is perhaps the finest church of Gothic architecture in France, far exceeds the other buildings of the town in importance. Erected on the plans of Robert de Luzarches, chiefly between 1220 and 1288, it consists of a nave, nearly 140 ft. in height, with aisles and lateral chapels, a transept with aisles, and a choir (with deambulatory) ending in an apse surrounded by chapels. The total length is 469 ft., the breadth 216 ft. The façade, which is flanked by two square towers without spires, has three portals decorated with a profusion of statuary, the central portal having a remarkable statue of Christ of the 13th century; they are surmounted by two galleries, the upper one containing twenty-two statues of the kings of Judah in its arcades, and by a fine rose-window. A slender spire rises above the crossing. The southern portal is remarkable for a figure of the Virgin and other statuary. In the interior, which contains beautifully carved stalls, a choir-screen in the flamboyant style and many other works of art, the most striking features are the height of the nave and the boldness of the columns supporting the vaulting. The chief of the other churches of Amiens is St Germain (15th century), which has some good stained glass. The hôtel de ville, begun in 1550, a belfry of the 14th and 18th centuries and several old mansions are of interest. Amiens has a rich library and admirable collections of paintings, sculptures and antiquities in the museum of Picardy. Its learned associations include the Société des Antiquaires de Picardie, by whom the museum was built in 1854–1864. The city is the seat of a bishop, a prefect, a court of appeal and a court of assizes, and headquarters of the II. Army Corps. There are also tribunals of first instance and of commerce, a board of trade-arbitrators, a chamber of commerce and a branch of the Bank of France. The educational institutions include lycées for boys and girls, training-colleges for teachers, a preparatory school of medicine, a school of music and a school of iron-working and wood-working. The textile industries for which Amiens has been celebrated since the middle ages include manufactures of velvet, cotton-, wool-, silk-, hemp- and flax-spinning, and the weaving of hosiery and a variety of mixed fabrics. Manufactures of machinery, chemicals, blacking, polish and sugar, and printing, dyeing and iron-founding are also carried on. Market gardens, known as *hortillonnages*, intersected by small canals derived from the Somme and Avre, cover a considerable area to the north-east of Amiens; and the city has trade in vegetables, as well as in grain, sugar, wool, oil-seeds and the duck-pasties and macaroons for which it is renowned.

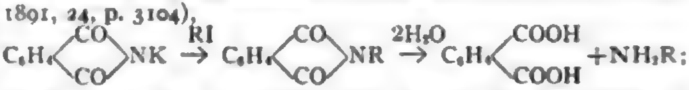
Amiens occupies the site of the ancient *Samarobriva*, capital of the Ambiani, from whom it probably derives its name. At the beginning of the 4th century Christianity was preached there by St Firmin, its first bishop. During the middle ages its territory formed the countship of Amiénois. The authority of the counts was, however, balanced by that of the bishops, and early in the 12th century the citizens, profiting by this rivalry, gained a charter of enfranchisement. The fief became for the first time a dependency of the French crown in 1185, when Philip of Alsace, count of Flanders, ceded it to Philip Augustus. It more than once passed out of the power of the French kings, notably in 1435, when, by the treaty of Arras, it came into the possession of the dukes of Burgundy, to whom it belonged till 1477. Surprised by the Spaniards in 1597, the city was recaptured from them after a long siege by Henry IV. Till 1790 it was the capital of the *gouvernement* of Picardy (*q.v.*). The famous treaty between Great Britain, France, Spain and Holland which took its name from Amiens was signed in the hôtel de ville on the 25th of March 1802. During the war between France and Germany, Amiens, after an important action, fell into the hands of the Prussians on the 28th of November 1870. (See FRANCO-GERMAN WAR.)

See A. de Calonne, *Histoire de la ville d'Amiens* (1900); John Ruskin, *The Bible of Amiens* (1881); *La Picardie historique et monumentale*, tome i., published by the Société des Antiquaires de Picardie (1893).

AMINES, in chemistry, derivatives of ammonia in which one or more of the hydrogen atoms are replaced by alkyl or aryl groups. The replacement of one hydrogen atom by one alkyl or aryl group gives rise to primary amines; of two hydrogen atoms by two groups, to secondary amines; of three hydrogen atoms by three groups, to tertiary amines. The tertiary amines possess the power of combining with one molecular proportion of an alkyl iodide to form quaternary ammonium salts. The structural relations of these compounds may be shown thus: NH_3; NH_2R; NHR_2; NR_3; NR_4I.
Ammonia; primary amine; secondary amine; tertiary amine; quaternary ammonium iodide.

Aliphatic amines.—These compounds possess properties very similar to those of ammonia, the lowest members of the series being combustible gases readily soluble in water. The next higher members of the series are liquids of low boiling point also readily soluble in water, the solubility and volatility, however, decreasing with the increasing carbon content of the molecule, until the highest members of the series are odourless solids of high boiling point and are insoluble in water. They are all strong bases, readily forming salts with the mineral acids and double salts with the chlorides of gold, platinum and mercury. They are ionized in aqueous solution to a much greater extent than ammonia, the quaternary ammonium bases being the most ionized, and the secondary bases being more strongly ionized than the primary or tertiary bases. For data concerning the conductivity of the organic bases see G. Bredig (*Zeit. für phys. Chem.*, 1894, 13, p. 289).

Many methods have been devised for the preparation of the amines, the first amine having been isolated in 1849 by A. Wurtz on boiling methyl isocyanate with caustic potash, $CON{\cdot}CH_3 + 2KHO = CH_3NH_2 + K_2CO_3$. The primary amines may also be prepared by heating the alkyl iodides with ammonia (A. W. Hofmann); by the reduction of nitriles with alcohol and sodium (A. Ladenburg, *Ber.*, 1886, 19, p. 783); by heating the esters of nitric acid with alcoholic ammonia at 100° C. (O. Wallach, *Ber.*, 1881, 14, p. 421); by the action of reducing agents on nitroparaffins; by the action of zinc and hydrochloric acid on aldehyde ammonias (German Patent 73,812); by the reduction of the phenylhydrazones and oximes of aldehydes and ketones with sodium amalgam in the presence of alcohol and sodium acetate (J. Tafel, *Ber.*, 1886, 19, p. 1925; 1889, 22, p. 1854; H. Goldschmidt, *Ber.*, 1886, 19, p. 3232); by the action of dilute hydrochloric acid on the isonitriles, $R{\cdot}NC + 2H_2O = R{\cdot}NH_2 + H_2CO_2$; by heating the mustard oils with a mineral acid, by the hydrolysis of the alkyl phthalimides (S. Gabriel, *Ber.*, 1887, 20, p. 2224; 1891, 24, p. 3104),



$$C_6H_4\langle{}^{CO}_{CO}\rangle NK \xrightarrow{RI} C_6H_4\langle{}^{CO}_{CO}\rangle NR \xrightarrow{2H_2O} C_6H_4\langle{}^{COOH}_{COOH} + NH_2R;$$

by distilling the amino-acids with baryta; by the action of bromine and caustic potash on the acid-amides (A. W. Hofmann, *Ber.*, 1885, 18, p. 2734; 1886, 19, p. 1822);

$$CH_3CONH_2 \rightarrow CH_3CONHBr \rightarrow CH_3CONKBr \rightarrow CH_3NCO \rightarrow CH_3NH_2;$$

and by the hydrolysis of substituted urethanes (Th. Curtius, *Ber.*, 1894, 27, p. 779; 1896, 29, p. 1166),

$$\underset{\text{acid}}{R{\cdot}COOH} \rightarrow \underset{\text{ester}}{R{\cdot}COOR^1} \xrightarrow{N_2H_4{\cdot}H_2O} \rightarrow \underset{\text{hydrazide}}{R{\cdot}CONH{\cdot}NH_2} \xrightarrow{HONO}$$
$$\underset{\text{azide}}{R{\cdot}CON_3} \xrightarrow{C_2H_5OH} \underset{\text{urethane}}{R{\cdot}NH{\cdot}CO_2C_2H_5} \xrightarrow{HCl} R{\cdot}NH_2$$

The secondary amines are prepared, together with the primary and tertiary, by the action of ammonia on the alkyl iodides (see below), or by the hydrolysis of para-nitroso derivatives of tertiary aromatic amines, such as para-nitrosodimethylaniline, thus: $NO{\cdot}C_6H_4{\cdot}N(CH_3)_2 + H_2O = NO{\cdot}C_6H_4{\cdot}OH + NH(CH_3)_2$. By the action of ammonia on the alkyl iodides a complex mixture of primary, secondary and tertiary amines, along with a quaternary ammonium salt, is obtained, the separation of which is difficult. The method worked out by A. W. Hofmann is as follows:—the mixture is distilled with caustic potash, when the primary, secondary and tertiary amines distil over, and the quaternary ammonium salt remains behind unaffected. The aqueous solution of the amines is now shaken up with diethyl oxalate, when the primary amine forms a crystalline dialkyl oxamide and the secondary amine an insoluble liquid, which is an ethyl dialkyl oxamate, the tertiary amine not reacting: $(CO_2C_2H_5)_2 + 2NH_2R = (CO{\cdot}NHR)_2 + 2C_2H_5OH$; $(CO_2C_2H_5)_2 + NHR_2 = C_2H_5O_2C{\cdot}CONR_2 + C_2H_5OH$. The tertiary amine is then distilled off, the residual products separated by filtration and finally hydrolysed by a caustic alkali.

The primary, secondary and tertiary amines may be readily distinguished by their behaviour with various reagents. Primary amines when heated with alcoholic potash and chloroform yield isonitriles, which are readily detected by their offensive smell. The secondary and tertiary amines do not give this reaction. With nitrous acid, the primary amines yield alcohols, the secondary amines yield nitrosamines and the tertiary amines do not react: $R{\cdot}NH_2 + ONOH = R{\cdot}OH + N_2 + H_2O$; $R_2NH + ONOH = R_2N{\cdot}NO + H_2O$. With benzene sulphochloride in the presence of alkali, the primary amines yield compounds of the type $C_6H_5SO_2NHR$, soluble in alkalies, whilst the secondary amines yield compounds of the type $C_6H_5SO_2NR_2$, insoluble in alkalies (O. Hinsberg, *Ber.*, 1890, 23, p. 2963). Primary amines heated with carbon bisulphide in alcoholic solution are converted into mustard oils, when the dithiocarbamate first produced is heated with a solution of mercuric chloride.

Methylamine, CH_3NH_2, occurs in *Mercurialis perennis*, in bone-oil, and herring brine. It is also a decomposition product of many alkaloids. At ordinary temperatures it is a gas, but may be condensed to a liquid which boils at - 6° C. It has a strong ammoniacal smell, burns readily and is exceedingly soluble in water. Its critical temperature is 155° C. and critical pressure 72 atmos. (C. Vincent, J. Chappuis, *Jahresb.*, 1886, p. 202). Dimethylamine, $(CH_3)_2NH$, is found in Peruvian guano. It is a heavy vapour which condenses at 7° C. to a liquid, having a pronounced fish-like smell. Trimethylamine, $(CH_3)_3N$, is very similar to dimethylamine, and condenses to a liquid which boils at 3·2–3·8° C. It is usually obtained from "vinasses," the residue obtained from the distillation of beet sugar alcohol, and is used in the manufacture of potassium bicarbonate by the Solvay process, since its hydrochloride is much more soluble than potassium carbonate. Tetramethylammonium iodide, $N(CH_3)_4I$, is the chief product obtained by the action of methyl iodide on ammonia (Hofmann). It crystallizes in quadratic prisms and has a bitter taste. By warming its aqueous solution with an excess of silver oxide it is converted into tetramethylammonium hydroxide, $N(CH_3)_4OH$, which crystallizes in hygroscopic needles, and has a very alkaline reaction. It forms many crystalline salts and absorbs carbon dioxide. It precipitates many metallic hydroxides. On dry distillation it is resolved into trimethylamine and methyl alcohol. If the nitrogen atom in the quaternary ammonium salts be in combination with four different groups, then the molecule is asymmetrical, and the salt can be resolved into optically active enantiamorphous isomerides. W. J. Pope (*Jour. Chem. Soc.*, 1901, 79, p. 828) has resolved benzyl-allyl-phenyl-methylamine iodide by boiling with silver *d*-camphorsulphonate in a nearly anhydrous mixture of acetone and ethyl acetate. The silver iodide is separated and the solvent distilled off. The residue crystallizes slowly, and the crystalline product is almost wholly *d*-benzyl-allyl-phenyl-ammonium-*d*-sulphonate, the corresponding *l*-compound remaining as a syrupy residue. The corresponding iodides are obtained by the addition of potassium iodide to solutions of the sulphonates, and are optically active antipodes.

Diamines.—The diamines contain two amino groups and bear the same relation to the glycols that the primary monamines bear to the primary alcohols. They are of importance, since the higher homologues are identical in many cases with the ptomaines produced by the putrefactive action of some bacteria on albumen and other related substances. Ethylene diamine, $C_2H_4(NH_2)_2$, may be prepared by heating ethylene dibromide with alcoholic ammonia to 100° C. (F. S. Cloez, *Jahresb.*, 1853, p. 468); or by the action of tin and hydrochloric acid on cyanogen (T. Fairley, *Ann. Suppl.*, 3, 1864, p. 372). It is an alkaline liquid, which when anhydrous boils at 116·5° C. Nitrous acid converts it into ethylene oxide. It combines directly with many metallic salts. (See S. F. Jörgensen, *Jour. pr. Chem.*, 1889 (2), 39, p. 8.) Trimethylene diamine, $NH_2 \cdot (CH_2)_3 \cdot NH_2$, is prepared by the action of ammonia on trimethylene bromide (E. Fischer, *Ber.*, 1884, 17, p. 1799). It is a liquid which boils at 135–136° C., and is readily soluble in alcohol, ether, chloroform and benzene. Tetramethylene diamine (putrescine), $NH_2 \cdot (CH_2)_4 \cdot NH_2$, is prepared by reducing ethylene dicyanide (succinonitrile) with sodium in absolute alcoholic solution (A. Ladenburg, *Ber.*, 1886, 19, p. 780). It melts at 27° C., and is easily soluble in water. Pentamethylene diamine (cadaverine), $NH_2 \cdot (CH_2)_5 \cdot NH_2$,is prepared by reducing trimethylene cyanide in ether solution by zinc and hydrochloric acid (A. Ladenburg, *Ber.*, 1883, 16, p. 1151). J. v. Braun (*Ber.*, 1904, 37, p. 3583) has prepared pentamethylene derivatives from piperidine by the action of phosphorus pentachloride. On heating piperidine with phosphorus pentachloride to 200°C. in a sealed tube pentamethylene dichloride is obtained, and this on treatment with potassium phthalimide gives a condensation product of composition, $C_6H_4[CO]_2N(CH_2)_5N[CO]_2C_6H_4$, which is finally hydrolysed by hydrochloric acid. Cadaverine is a syrup at ordinary temperatures, and boils at 178–179° C. It is readily soluble in water and alcohol, but only slightly soluble in ether.

Aromatic Amines.—The aromatic amines in some respects resemble the aliphatic amines, since they form salts with acids, and double salts with platinum chloride, and they also distil without decomposition. On the other hand, they are much weaker bases than the aliphatic amines, their salts undergoing hydrolytic dissociation in aqueous solution. The primary aromatic amines may be prepared by the reduction of the nitro-hydrocarbons, the reducing agents used being either alcoholic-ammonium sulphide (N. Zinin), zinc and hydrochloric acid (A. W. Hofmann), an alcoholic solution of stannous chloride (containing hydrochloric acid) (R. Anschutz, *Ber.*, 1886, 19, p. 2161), tin and hydrochloric acid, or, on the manufacturing scale, iron and hydrochloric acid. They may also be obtained by the reduction of nitroso compounds and of hydrazo compounds and of hydrazones (J. Tafel, *Ber.*, 1886, 19, p. 1924), by distilling the amido-acids with lime, by heating phenols with zinc chloride ammonia (V. Merz, *Ber.*, 1880, 13, p. 1298), and by heating the secondary and tertiary bases with concentrated hydrochloric acid to about 180° C.

At a temperature of about 300–400° C. the alkyl chloride formed in this reaction attacks the benzene nucleus and replaces hydrogen by an alkyl group or groups, forming primary amines homologous with the original amine; thus methylaniline hydrochloride is converted into para- and ortho-toluidine hydrochloride, and trimethyl phenyl ammonium iodide is converted into mesidine hydriodide. It is to be noted that only traces of the aromatic amines are produced by heating the halogen substituted benzenes with ammonia, unless the amino group be situated in the side chain, as in the case of benzylamine.

The primary amines are colourless liquids or crystalline solids, which are insoluble in water, but readily soluble in the common organic solvents. When heated with alkyl or aryl iodides, they are converted into secondary and tertiary amines. Concentrated nitric acid attacks them violently, producing various oxidation products, but if the amino group be "protected" by being previously acetylated, then nitro derivatives are obtained. When heated with concentrated sulphuric acid for some time, they are sulphonated. They form condensation products with aldehydes, benzaldehyde and aniline forming benzylidene aniline, $C_6H_5N{:}CHC_6H_5$, and when heated with acids they form anilides. They give the isonitrile reaction (see above) when warmed with chloroform and a caustic alkali, and form alkyl thioureas when heated with an alcoholic solution of carbon bisulphide. When warmed with a solution of nitrous acid, they are converted into phenols; if, however, nitrous acid be added to an ice-cold solution of a primary amine in excess of mineral acid, a diazonium salt is formed (see AZO COMPOUNDS and DIAZO COMPOUNDS), or in absence of excess of acid, a diazoamine is produced.

The secondary amines may be of two types—namely,the purely aromatic amines, and the mixed secondary amines, which contain an aromatic residue and an alkyl group. The purely aromatic amines result upon heating the primary amines with their hydrochlorides, and, in some cases, by heating a phenol with a primary amine and anhydrous zinc chloride. The mixed secondary amines are prepared by the action of alkyl iodides on the primary amines, or by heating salts of the primary amine with alcohols under pressure. The mixed secondary amines have basic properties, but the purely aromatic secondary amines are only very feeble bases. Both classes readily exchange the imide hydrogen for acid radicals, and give nitrosamines with nitrous acid. The secondary amines do not give the isonitrile reaction.

The tertiary amines may also be of two types, the purely aromatic and the mixed type. The mixed tertiary amines are produced by the action of alkyl halides on the primary amines. The simplest aromatic tertiary amine, triphenylamine, is prepared by the action of brombenzene on sodium diphenylamine (C. Heydrich, *Ber.*, 1885, 18, p. 2156). The simplest aromatic monamine is aniline (*q.v.*), and the simplest mixed amines are mono- and di-methyl aniline. These substances are treated in the article ANILINE.

The aromatic amine resembling the aliphatic amines is benzylamine, $C_6H_5 \cdot CH_2 \cdot NH_2$, which may be prepared by reducing benzonitrile in alcoholic solution by means of zinc and acetic acid (O. Mendius, *Ann.* 1862, 121, p. 144), or by metallic sodium (E. Bamberger, *Ber.*, 1887, 20, p. 1709). It can also be obtained by the action of ammonia on benzyl chloride (S. Cannizzaro, *Ann.*, 1865, 134, p. 128), but di- and tri-benzylamines are simultaneously formed. It is a liquid, which boils at 183° C., and is miscible in all proportions with water, alcohol and ether. It is basic in character, and has a strongly alkaline reaction. Diphenylamine, $(C_6H_5)_2NH$, is the simplest representative of the true aromatic secondary amines. It is prepared by heating aniline and aniline hydrochloride for some hours to 210–240° C, (Ch. Girard and G. de Laire, *Zeit für. Chem.*, 1866, p. 438). It crystallizes in white plates, which melt at 45° C. and boil at 302° C. It is almost insoluble in water, but readily volatilizes in steam. When heated with monobasic saturated acids and zinc chloride it yields acridines.

Aromatic Diamines.—The diamines are prepared by reducing the nitranilines or the dinitrohydrocarbons. They crystallize in plates, and for the most part distil without decomposition. Orthophenylene diamine, $C_6H_4(NH_2)_2$, crystallizes from water in plates, which melt at 102–103° C. and boil at 256–258° C. When heated with 10% hydrochloric acid to 180° C. it yields pyrocatechin (Jacob Meyer, *Ber.*, 1897, 30, p. 2569). The ortho-diamines are characterized by the large number of condensation products they form. (See IMIDAZOLES, QUINOXALINES, &c.). Metaphenylene diamine crystallizes in rhombic plates which melt at 63° C. and boil at 287° C. It is easily soluble in water and alcohol. When heated with 10 % hydrochloric acid to 180° C. it yields resorcin (J. Meyer). Paraphenylene diamine may be prepared as above, and also by the reduction of amidoazobenzene. It crystallizes in tables which melt at 140° C. and boil at 267° C. When heated with 10 % hydrochloric acid to 180° C. it yields hydroquinone (J. Meyer). Manganese dioxide and dilute sulphuric acid oxidize it to quinone. The three classes of diamines may be distinguished by their behaviour towards nitrous acid. The ortho-compounds condense to azimido benzenes, the meta-compounds yield azo-dyestuffs, and the para-compounds yield bis-diazo compounds of the type $XN_2 \cdot C_6H_4 \cdot N_2X$.

AMIOT, JEAN JOSEPH MARIE (1718–1793), French Jesuit missionary, was born at Toulon in February 1718. He entered the Society of Jesus in 1737 and was sent in 1750 as a missionary to China. He soon won the confidence of the emperor Kien-lung and spent the remainder of his life at Pekin, where he died on the 9th of October 1793. Amiot was eminently fitted to make good use of the advantages which his situation afforded, and his works did more than had ever been done before to make known to the Western world the thought and life of the Far East. His *Dictionnaire tatare-mantchou-français* (Paris, 1789) was a work of great value, the language having been previously quite unknown in Europe. His other writings are to be found chiefly in the *Mémoires concernant l'histoire, les sciences et les arts de Chinois* (15 vols., Paris, 1776–1791). The *Vie de Confucius*, the twelfth volume of that collection, is complete and accurate.

For full bibliography see De Backer and C. Sommervogel, *Bibliothèque de la Cie. de Jésus*, i. 294-303; for his works on Chinese music see F. J. Fétis, *Biog. univers. des musiciens* (Brussels, 1837–1844).

AMIR, or AMEER (an Arabic word meaning "commander," from the root *amr*, "commanding"), a title common in the Mahommedan East. The form *emir* is also commonly employed in English. The word originally signified a military commander, but very early came to be extended to anyone bearing rule, Mahomet himself being styled by the pagan Arabs amir of Mecca. Thus the term gradually came to be applied to any high office-bearer, or to any lord or chief. The caliph has the style of *Amir ul Omara*, "lord of lords." The title *Amir ul Muminim*, or "commander of the faithful," now borne by the sultan of Turkey, was first assumed by Abu Bekr, and was taken by most of the various dynasties which claimed the caliphate, including the Fatimites, the Spanish Omayyads and the Almohades. The Almoravides and the Merinides assumed the style of *Amir ul Muslimin*, "commander of the Mussulmans."

The use of the word is, in fact, closely akin to that of the English "lord," sometimes connoting office, as in *Amir ul-ahghal* (minister of finance) under the Almohades (*cf.* "lord of the treasury"), sometimes mere dignity, as in the case of the title of honour borne by all descendants of the Prophet, or of the title *Mir* assumed by men of great rank in the Far East. Sometimes it implies a temporary office of dignity and command—*e.g.* the *Amir ul-haj*, "commander of the pilgrimage" (to Mecca). Sometimes again it connotes the meaning of "sovereign lord," in which sense it was early assumed by the princes of Sind and by the rulers of Afghanistan and Bokhara, the title implying a lesser dignity than that of sultan. Thus too it is very generally applied in the East to the chiefs of independent or semi-independent tribes. In the Lebanon both the Christian clans and the Druses are ruled by hereditary *amirs*. Finally the word (confused not unnaturally with the particle usually attached to it) was borrowed by the West, and is the origin of the English "admiral."

AMIS ET AMILES, the title of an old French romance based on a widespread legend of friendship and sacrifice. In its earlier and simpler form it is the story of two friends, one of whom, Amis, was smitten with leprosy because he had committed perjury to save his friend. A vision informed him that he could only be cured by bathing in the blood of Amiles's children. When Amiles learnt this he killed the children, who were, however, miraculously restored to life after the cure of Amis. The tale was probably of Oriental origin, and introduced to the West by way of Byzantium. It found its way into French literature through the medium of Latin, as the names Amicus and Amelius indicate, and was eventually attached to the Carolingian cycle in the 12th-century *chanson de geste* of *Amis et Amiles*. This poem is written in decasyllabic assonanced verse, each stanza being terminated by a short line. It belongs to the heroic period of French epic, containing some passages of great beauty, notably the episode of the slaying of the children, and maintains a high level of poetry throughout. Amis has married Lubias and become count of Blaives (Blaye), while Amiles has become seneschal at the court of Charlemagne, and is seduced by the emperor's daughter, Bellisant. The lovers are betrayed, and Amiles is unable to find the necessary supporters to enable him to clear himself by the ordeal of single combat, and fears, moreover, to fight in a false cause. He is granted a reprieve, and goes in search of Amis, who engages to personate him in the combat. He thus saves his friend, but in so doing perjures himself. Then follows the leprosy of Amis, and, after a lapse of years, his discovery of Amiles and cure. There are obvious reminiscences in this story of Damon and Pythias, and of the classical instances of sacrifice at the divine command. The legend of Amis and Amiles occurs in many forms with slight variations, the names and positions of the friends being sometimes reversed. The crown of martyrdom was not lacking, for Amis and Amiles were slain by Ogier the Dane at Novara on their way home from a pilgrimage to the Holy Land. *Jourdain de Blaives*, a *chanson de geste* which partly reproduces the story of *Apollonius of Tyre*, was attached to the *geste* of Amis by making Jourdain his grandson.

The versions of *Amis and Amiles* include—(*a*) numerous Latin recensions in prose and verse, notably that given by Vincent de Beauvais in his *Speculum historiale* (lib. xxiii. cap. 162–166 and 169); (*b*) an Anglo-Norman version in short rhymed couplets, which is not attached to the Charlemagne legend and agrees fairly closely with the English *Amis and Amiloun* (Midland dialect, 13th century); these with the old Norse version are printed by E. Kölbing, *Altengl. Bibl.* vol. ii. (1889), and the English romance also in H. Weber, *Metrical Romances*, vol. ii. (1810); (*c*) the 12th-century French *chanson de geste* analysed by P. Paris in *Hist. litt. de la France* (vol. xxii.), and edited by K. Hofmann (Erlangen, 1882) with the addition of *Jourdain de Blaives*; (*d*) the Latin *Vita Sanct. Amici et Amelii* (pr. by Kölbing. *op. cit.*) and its Old-French translation, *Li amitiés de Ami et Amile*, ed. L. Moland and C. d'Héricault in *Nouvelles* . . .

du xiiie siècle (Paris, 1856); (*e*) a 14th-century drama, *Un Miracle de Notre Dame d'Amis et Amile*, ed. L. J. N. Monmerqué and F. Michel in *Théâtre fr. au moyen âge* (1839); (*f*) old Norse, Icelandic, Danish versions, &c. (see K. Hofmann, *op. cit.*); (*g*) an imitation which under the name of *Oliver and Artus* was current in many languages and was the subject of Hans Sachs's comedy, *Die treuen Gesellen* (1556); (*h*) *Engelhart und Engeltrut*, by the minnesinger Conrad von Würzburg (ed. M. Haupt, Leipzig, 1844, 2nd ed., 1900); (*i*) the late prose romances, with many changes and additions, *Milles et Amys*, printed by A. Verard (Paris, *c.* 1503), &c., for which see G. Brunet, *Manuel du libraire*, s.v. "Milles." A different version of the legend is inserted at considerable length in *L'Ystoire des sept sages* (ed. G. Paris, *Soc. des anc. textes fr.*, 1876), in which the friends are called Alexandre and Louis, and Bellisant Florentine. For a further bibliography see L. Gautier, *Bibl. des chansons de geste* (Paris, 1897). William Morris's version of the French romance was printed at the Kelmscott Press in 1894. See also the essay by W. Pater in *The Renaissance*, 1893.

AMITERNUM, an ancient town of the Sabines, situated about 5 m. N. of Aquila, in the broad valley of the Aternus, from which, according to Varro, it took its name. It was stormed by the Romans in 293 B.C., and though it suffered from the wars of the Republican period, it seems to have risen to renewed prosperity under the empire. This it owed largely to its position. It lay at the point of junction of four roads—the Via Caecilia, the Via Claudia Nova and two branches of the Via Salaria, which joined it at the 64th and 80th miles respectively. The fertility of its territory was also praised by ancient authors. There are considerable remains of an aqueduct, an amphitheatre and a theatre (the latter excavated in 1880—see *Notizie degli scavi*, 1880, 290, 350, 379), all of which belong to the imperial period, while in the hill on which the village of S. Vittorino is built are some Christian catacombs. Amiternum was the birthplace of the historian Sallust. In a gorge 1½ m. east are massive remains of cyclopean walls (*i.e.* in rough blocks), probably intended to regulate the flow of the stream (N. Persichetti in *Römische Mitteilungen*, 1902, 134 *seq.*).

AMLWCH (*llwch* = "lake"), a market town of Anglesey, North Wales, situated on slightly rising ground on the N. coast of the island, 15 m. N.W. of Beaumaris and 262 m. from London, by the London & North-Western railway. Pop. of urban district (1901) 2994. Originally it owed its whole importance to the copper mines of the Parys (probably, Parry's) mountain, as, before ore was discovered in March 1768, it was a small hamlet of fishermen. The mines once produced 3000 tons of metal annually, copper smelting being largely carried on, but have now almost ceased working. Though apparently not mentioned by Ptolemy, they were perhaps Roman. Robert Parys, chamberlain of North Wales under Henry IV., is often given as their godfather. The poor harbour called the "port," protected by a breakwater, has been cut out of the rock (shingle). Amlwch is the terminus of the branch railway from Gaerwen to Amlwch, formerly the Anglesey Central Railway Company. Porthllechog, or Bull Bay (so called from the Bull Rock), at a mile's distance, is a small but favourite watering-place. Beyond, on the coast, some 3 m. distant, are the remains of a British fort and of the Llanllaianau monastery, opposite the Middle Mouse islet and close to Llanbadrig old church and Cemmaes. Industries include slate quarrying, shipbuilding, iron and brass foundries, alum, vitriol, manure, guano and tobacco works. At Llanllaianau was found, in 1841, a stone coffin, holding a well-preserved skeleton of 7½ ft. in length. The coffin was apparently of Aberdovey (Aberdyfi) limestone, much corroded. At Llangefni, not far from Amlwch, in 1829, and at Llangristiolus, 3 m. distant from Llangefni, about 1770, were found human bones of a high antiquity, between Glan Hwfa and Fron, and at Capel, respectively. The town has an old Anglican church (St Eleth's).

AMMAN, JOHANN CONRAD (1669–*c.*1730), Swiss physician, was born at Schaffhausen in 1669. After graduating at Basel in 1687 he began to practise at Amsterdam, where he gained a great reputation. He was one of the earliest writers on the instruction of the deaf and dumb, and first called attention to his method in his *Surdus loquens* (Amsterdam, 1692), which was often reprinted, and was reproduced by John Wallis in the *Philosophical Transactions* (1698). His process consisted principally in exciting the attention of his pupils to the motions of his lips and larynx while he spoke, and then inducing them to imitate these movements, till he brought them to repeat distinctly letters, syllables and words. The edition of Caelius Aurelianus, which was undertaken by the Wetsteins in 1709, was superintended by Amman. He died about 1730 at Warmoud, near Leiden.

AMMAN, JOST (1539–1591), Swiss artist, celebrated chiefly for his engravings on wood, was born at Zürich. Of his personal history little is known beyond the fact that he removed in 1560 to Nuremberg, where he continued to reside until his death in March 1591. His productiveness was very remarkable, as may be gathered from the statement of one of his pupils, that the drawings he made during a period of four years would have filled a hay wagon. A large number of his original drawings are contained in the Berlin collection of engravings. The genuineness of not a few of the specimens to be seen elsewhere is at least questionable. A series of copperplate engravings by Amman of the kings of France, with short biographies, appeared at Frankfort in 1576. He also executed many of the woodcut illustrations for the Bible published at Frankfort by Sigismund Feierabend. Another serial work, the *Panoplia Omnium Liberalium Mechanicarum et Sedentariarum Artium Genera Continens*, containing 115 plates, is of great value. Amman's drawing is correct and spirited, and his delineation of the details of costume, &c., is minute and accurate. He executed too much, however, to permit of his reaching the highest style of art. Paintings in oil and on glass are attributed to him, but no specimen of these is known to exist.

AMMAN, PAUL (1634–1691), German physician and botanist, was born at Breslau in 1634. In 1662 he received the degree of doctor of physic from the university of Leipzig, and in 1664 was admitted a member of the society *Naturae Curiosorum*, under the name of Dryander. Shortly afterwards he was chosen extraordinary professor of medicine in the above-mentioned university; and in 1674 he was promoted to the botanical chair, which he again in 1682 exchanged for the physiological. He died at Leipzig in 1691. He seems to have been a man of critical mind and extensive learning. His principal works were: *Medicina Critica* (1670); *Paraenesis ad Docentes occupata circa Institutionum Medicarum Emendationem* (1673); *Irenicum Numae Pompilii cum Hippocrate* (1689); *Supellex Botanica* (1675); and *Character Naturalis Plantarum* (1676).

AMMANATI, BARTOLOMEO (1511–1592), Florentine architect and sculptor. He studied under Bandinelli and Jacopo Sansovino, and closely imitated the style of Michelangelo. He was more distinguished in architecture than in sculpture. He designed many buildings in Rome, Lucca and Florence, an addition to the Pitti Palace in the last-named city being one of his most celebrated works. He was also employed in 1569 to build the beautiful bridge over the Arno, known as Ponte della Trinita—one of his celebrated works. The three arches are elliptic, and though very light and elegant, have resisted the fury of the river, which has swept away several other bridges at different times. Another of his most important works was the fountain for the Piazza della Signoria. In 1550 Ammanati married Laura Battiferri, an elegant poet and an accomplished woman.

AMMIANUS, MARCELLINUS, the last Roman historian of importance, was born about A.D. 325–330 at Antioch; the date of his death is unknown, but he must have lived till 391, as he mentions Aurelius Victor as the city prefect for that year. He was a Greek, and his enrolment among the *protectores domestici* (household guards) shows that he was of noble birth. He entered the army at an early age, when Constantius II. was emperor of the East, and was sent to serve under Ursicinus, governor of Nisibis and *magister militiae*. He returned to Italy with Ursicinus, when he was recalled by Constantius, and accompanied him on the expedition against Silvanus the Frank, who had been forced by the unjust accusations of his enemies into proclaiming himself emperor in Gaul. With Ursicinus he went twice to the East, and barely escaped with his life from Amida or Amid (mod. Diarbekr), when it was taken by the Persian king Shapur (Sapor) II. When Ursicinus lost his office and the favour of Constantius, Ammianus seems to have shared his downfall; but under Julian, Constantius's successor, he regained his position. He accompanied this emperor, for whom he expresses enthusiastic admiration, in his campaigns against the Alamanni and the Persians; after his death he took part in the retreat of Jovian as far as Antioch, where he was residing when the conspiracy of Theodorus (371) was discovered and cruelly put down. Eventually he settled in Rome, where, at an advanced age, he wrote (in Latin) a history of the Roman empire from the accession of Nerva to the death of Valens (96–378), thus forming a continuation of the work of Tacitus. This history (*Rerum Gestarum Libri XXXI.*) was originally in thirty-one books; of these the first thirteen are lost, the eighteen which remain cover the period from 353 to 378. As a whole it is extremely valuable, being a clear, comprehensive and impartial account of events by a contemporary of soldierly honesty, independent judgment and wide reading. "Ammianus is an accurate and faithful guide, who composed the history of his own times without indulging the prejudices and passions which usually affect the mind of a contemporary" (Gibbon). Although Ammianus was no doubt a heathen, his attitude towards Christianity is that of a man of the world, free from prejudices in favour of any form of belief. If anything he himself inclined to neo-Platonism. His style is generally harsh, often pompous and extremely obscure, occasionally even journalistic in tone, but the author's foreign origin and his military life and training partially explain this. Further, the work being intended for public recitation, some rhetorical embellishment was necessary, even at the cost of simplicity. It is a striking fact that Ammianus, though a professional soldier, gives excellent pictures of social and economic problems, and in his attitude to the non-Roman peoples of the empire he is far more broad-minded than writers like Livy and Tacitus; his digressions on the various countries he had visited are peculiarly interesting. In his description of the empire—the exhaustion produced by excessive taxation, the financial ruin of the middle classes, the progressive decline in the morale of the army—we find the explanation of its fall before the Goths twenty years after his death.

The work was discovered by Poggio, who copied the original MS. *Editio princeps* (bks. 14-26) by Sabinus, 1474; completed by Accursius, 1533; with variorum notes, by Wagner-Erfurdt, 1808; latest edition of text, Gardthausen, 1874-1875. English translations by P. Holland, 1609; Yonge (Bohn's Classical Library), 1862; also Max Büdinger, *Ammianus Marcellinus und die Eigenart seines Geschichtswerkes* (1895); F. Liesenberg, *Die Sprache des Ammianus Marcellinus* (1888–1890); T. R. Glover, *Life and Letters in the Fourth Century* (1901); Abbé Gimazane, *Ammianus Marcellinus, sa vie et son œuvre* (Toulouse, 1889), a work containing a number of very doubtful theories. For a criticism of his views on Roman society see S. Dill, *Roman Society in the Last Century of the Western Empire* (London, 1898).

AMMIRATO, SCIPIONE (1531–1601), Italian historian, born at Lecce, in the kingdom of Naples. His father, intending him for the profession of law, sent him to study at Naples, but his own decided preference for literature prevented him from fulfilling his father's wishes. Entering the church, he resided for a time at Venice, and afterwards engaged in the service of Pope Pius IV. In 1569 he went to Florence, where he was fortunate in securing the patronage and support of Duke Cosimo I., who gave him a residence at the Medici Palace and the Villa Zopaja on the understanding that he should write his *Istorie Fiorentine* (1600), the work by which he is best known. In 1595 he was made a canon of the cathedral of Florence. He died in 1601. Among the other works of Ammirato, some of which were first published after his death, may be mentioned discourses on Tacitus and genealogies of the families of Naples and Florence.

AMMON, the Graecized name of an Egyptian deity, in the native language Amūn, connected by the priests with a root meaning "conceal." He was, to begin with, the local deity of Thebes, when it was an unimportant town on the east bank of the river, about the region now occupied by the temple of Karnak. The XIth dynasty sprang from a family in the Hermonthite nome or perhaps at Thebes itself, and adorned the temple of Karnak with statues. Amenemhē, the name of the founder of the XIIth dynasty, was compounded with that of Amūn and was borne by three of his successors. Several Theban kings of the later part of the Middle Kingdom adopted the same name; and when the Theban family of the XVIIth dynasty drove out the Hyksos, Ammon, as the god of the royal city, was again prominent. It was not, however, until the rulers of the XVIIIth dynasty carried their victorious arms beyond the Egyptian frontiers in every direction that Ammon began to assume the proportions of a universal god for the Egyptians, eclipsing all their other deities and asserting his power over the gods of all foreign lands. To Ammon the Pharaohs attributed all their successful enterprises, and on his temples they lavished their wealth and captured spoil.

Ammon is figured of human form, wearing on his head a plain deep circlet from which rise two straight parallel plumes, perhaps representing the tail feathers of a hawk. Two main types are seen: in the one he is seated on a throne, in the other he is standing, ithyphallic, holding a scourge, precisely like Min, the god of Coptos and Chemmis (Akhmim). The latter may be his original form, as a god of fertility, before whom the king ceremoniously breaks up the ground for sowing or cuts the ripe corn. His consort was sometimes called Amaune (feminine of Amūn), but more usually Mūt, "mother": she was human-headed, wearing the double crown of Upper and Lower Egypt, and their son was Khons (Chon or Chons), a lunar god, represented as a youth wearing the crescent and disk of the moon. A great temple was built to Mūt at Karnak not later than the XVIIIth dynasty, and another to Khons not later than the XXth dynasty.

The name of Rē, the sun-god, was generally joined to Ammon, especially in his title as "king of the gods": the rule of heaven belonged to the sun-god in the Egyptian cosmos, and this identification with Rē was only logical for a supreme deity. Ammon was entitled "lord of the thrones of the two lands," or, more proudly still, "king of the gods." Such indeed was his unquestioned position when suddenly he was overthrown and his worship proscribed. Not even a henotheist fervently worshipping one of many gods, Amenophis (Amenhotp) IV. of the XVIIIth dynasty became the monotheist Akhenaton; discarding all the gods of Egypt, and especially persecuting Ammon the arch-god, he devoted himself to the purer and more sublime worship of Aton, the sun. But he failed to win the permanent adhesion of the people to his reform, or to conciliate or entirely crush the enormously powerful priesthood of Ammon. A few years after the reformer's death, the old cults were re-established and the monuments of Aton studiously defaced. Hymns were then addressed to Amen-rē, which are almost monotheistic in expression. The cult of the supreme god spread throughout Egypt and was carried by the Egyptian conquerors into other lands, Syria, Ethiopia and Libya, and was accepted by the natives both in Ethiopia and in the Libyan oases, where civilization was low and Egyptian influence permanent. After the XXth dynasty the centre of power was removed from Thebes, and the authority of Ammon began to wane. In the XXIst dynasty the secondary line of priest kings of Thebes upheld his dignity to the best of their power, and the XXIInd dynasty favoured Thebes: but as the sovereignty weakened the division between Upper and Lower Egypt asserted itself, and thereafter Thebes would have rapidly decayed had it not been for the piety of the kings of Ethiopia towards Ammon, whose worship had long prevailed in their country. Thebes was at first their Egyptian capital, and they honoured Ammon greatly, although their wealth and culture were not sufficient to effect much. Ammon (Zeus) continued to be the great god of Thebes in its decay, and notwithstanding that a nome-capital in the north of the Delta and many lesser temples, from El Hibeh in Middle Egypt to Canopus on the sea, acknowledged Ammon as their supreme divinity, he probably in some degree represented the national aspirations of Upper Egypt as opposed to Middle and Lower Egypt: he also remained the national god of Ethiopia, where his name was pronounced Amane. The priests of Amane at Meroe and Napata, in fact, regulated through his oracle the whole government of the country, choosing the king, directing his military expeditions (and even compelling him to commit suicide, according to Diodorus) until in the 3rd century B.C. Arkamane (Ergamenes) broke through the bondage and slew the priests. Ammon had yet another outburst of glory. There was an oracle of Ammon established for some centuries in Libya, in the distant oasis of Siwa. Such was its reputation among the Greeks that Alexander journeyed thither, after the battle of Issus, and during his occupation of Egypt, in order to be acknowledged the son of the god. The Egyptian Pharaohs of the XVIIIth dynasty had likewise been proclaimed mystically sons of this god, who, it was asserted, had impregnated the queen-mother; and on occasion wore the ram's horns of Ammon, even as Alexander is represented with them on coins.

The Egyptian goose (*chenalopex*) is figured in the XVIIIth dynasty as sacred to Ammon; but his most frequent and celebrated incarnation was the woolly sheep with curved ("Ammon") horns (as opposed to the oldest native breed with long horizontal twisted horns and hairy coat, sacred to Khnum or Chnumis). It is found as representing Ammon from the time of Amenophis III. onwards.

As king of the gods Ammon was identified by the Greeks with Zeus and his consort Mût with Hera. Khnum was likewise identified with Zeus probably through his similarity to Ammon; his proper animal having early become extinct, Ammon horns in course of time were attributed to this god also.

See Erman, *Handbook of Egyptian Religion* (London, 1907); Ed. Meyer, art. "Ammon" in Roscher's *Lexikon der griechischen und römischen Mythologie*; Pietschmann, arts. "Ammon," "Ammoneion" in Pauly-Wissowa, *Realencyclopädie*; and works on Egyptian religion quoted under EGYPT, section *Religion*. (F. Ll. G.)

AMMON, CHRISTOPH FRIEDRICH VON (1766–1850), German theological writer and preacher, was born at Baireuth. He studied at Erlangen, held various professorships in the philosophical and theological faculties of Erlangen and Göttingen, succeeded Franz Reinhard (1753–1812) in 1813 as court preacher and member of the consistorial court at Dresden, retired from these offices in 1849, and died on the 21st of May 1850. Seeking to establish for himself a middle position between rationalism and supernaturalism, he declared for a "rational supernaturalism," and contended that there must be a gradual development of Christian doctrine corresponding to the advance of knowledge and science. But at the same time he sought, like other representatives of this school of thought, such as K. G. Bretschneider and Julius Wegscheider, to keep in close touch with the historical theology of the Protestant churches. He was a man of great versatility and extensive learning, a philologist and philosopher as well as a theologian, and a very voluminous author. His principal theological work was the *Fortbildung des Christenthums zur Weltreligion*, in 4 volumes (Leipzig, 1833–1840). *Entwurf einer reinbiblischen Theologie* appeared in 1792 (2nd ed., 1801), *Summa Theologiae Christianae* in 1803 (other editions, 1808, 1816, 1830); *Das Leben Jesu* in 1842, and *Die wahre und falsche Orthodoxie* in 1849. Von Ammon's style in preaching was terse and lively, and some of his discourses are regarded as models of pulpit treatment of political questions.

See Herzog-Hauck, *Realencyklopädie*; Otto Pfleiderer, *The Development of Theology in Germany since Kant*, pp. 89 ff.

AMMONIA (NH_3). Salts of ammonia have been known from very early times; thus the term *Hammoniacus sal* appears in the writings of Pliny (*Nat. Hist.* xxxi. 39), although it is not known whether the term is identical with the more modern sal-ammoniac (*q.v.*). In the form of sal-ammoniac, ammonia was known, however, to the alchemists as early as the 13th century, being mentioned by Albertus Magnus, whilst in the 15th century Basil Valentine showed that ammonia could be obtained by the action of alkalies on sal-ammoniac. At a later period when sal-ammoniac was obtained by distilling the hoofs and horns of oxen, and neutralizing the resulting carbonate with hydrochloric acid, the name spirits of hartshorn was applied to ammonia. Gaseous ammonia was first isolated by J. Priestley in 1774 and was termed by him "alkaline air." In 1777 K. W. Scheele showed that it contained nitrogen, and C. L. Berthollet, in about 1785, ascertained its composition.

Ammonia is found in small quantities as the carbonate in the atmosphere, being produced from the putrefaction of nitrogenous animal and vegetable matter; ammonium salts are also found in small quantities in rain-water, whilst ammonium chloride (sal-ammoniac) and ammonium sulphate are found in volcanic districts; and crystals of ammonium bicarbonate have been found in Patagonian guano. Ammonium salts too are found distributed through all fertile soil, in sea-water, and in most plant and animal liquids, and also in urine.

Ammonia can be synthesized by submitting a mixture of nitrogen and hydrogen to the action of the silent electric discharge, the combination, however, being very imperfect. It is obtained by the dry distillation of nitrogenous vegetable and animal products; by the reduction of nitrous acid and nitrites with nascent hydrogen; and also by the decomposition of ammonium salts by alkaline hydroxides or by slaked lime, the salt most generally used being the chloride (*sal-ammoniac, q.v.*) thus $2NH_4Cl + Ca(OH)_2 = CaCl_2 + 2H_2O + 2NH_3$. It also results on decomposing magnesium nitride (Mg_3N_2) with water, $Mg_3N_2 + 6H_2O = 3Mg(OH)_2 + 2NH_3$. Large quantities of ammonia and ammonium salts are now obtained from the ammoniacal liquor of gas-works.

Ammonia is a colourless gas possessing a characteristic pungent smell and a strongly alkaline reaction; it is lighter than air, its specific gravity being 0·589 (air = 1). It is easily liquefied and the liquid boils at −33·7° C., and solidifies at −75° C. to a mass of white crystals. It is extremely soluble in water, one volume of water at 0° C. and normal pressure absorbs 1148 volumes of ammonia (Roscoe and W. Dittmar). All the ammonia contained in an aqueous solution of the gas may be expelled by boiling. It does not support combustion; and it does not burn readily unless mixed with oxygen, when it burns with a pale yellowish-green flame. Ammonia gas has the power of combining with many substances, particularly with metallic halides; thus with calcium chloride it forms the compound $CaCl_2 \cdot 8NH_3$, and consequently calcium chloride cannot be used for drying the gas. With silver chloride it forms two compounds (F. Isambert, *Comptes rendus*, 1868, lxvi. p. 1259)—one, $AgCl \cdot 3NH_3$ at temperatures below 15° C.; the other, $2AgCl \cdot 3NH_3$ at temperatures above 20° C. On heating these substances, ammonia is liberated and the metallic chloride remains. It was by the use of silver chloride ammonia compounds that in 1823 M. Faraday was first able to liquefy ammonia. It can be shown by Isambert's results that the compound $AgCl \cdot 3NH_3$ cannot be formed above 20° C., by the action of ammonia on silver chloride at atmospheric pressure; whilst $2AgCl \cdot 3NH_3$, under similar conditions, cannot be formed above about 68° C. Liquid ammonia is used for the artificial preparation of ice. It readily dissolves sodium and potassium, giving in each case a dark blue solution. At a red heat ammonia is easily decomposed into its constituent elements, a similar decomposition being brought about by the passage of electric sparks through the gas. Chlorine takes fire when passed into ammonia, nitrogen and hydrochloric acid being formed, and unless the ammonia be present in excess, the highly explosive nitrogen chloride NCl_3 is also produced. With iodine it reacts to form *nitrogen iodide*. This compound was discovered in 1812 by Bernard Courtois, and was originally supposed to contain nitrogen and iodine only, but in 1840 R. F. Marchand showed that it contained hydrogen, whilst R. Bunsen showed that no oxygen was present. As regards its constitution, it has been given at different times the formulae NI_3, NHI_2, NH_2I, $N_2H_3I_3$, &c., these varying results being due to the impurities in the substance, owing to the different investigators working under unsuitable conditions, and also to the decomposing action of light. F. D. Chattaway determined its composition as $N_2H_3I_3$, by the addition of excess of standard sodium sulphite solution, in the dark, and subsequent titration of the excess of the sulphite with standard iodine. The constitution has been definitely determined by O. Silberrad (*Jour. of Chem. Soc.*, 1905, lxxxvii. p. 55) by the interaction of nitrogen iodide with zinc ethyl, the products of the reaction being triethylamine and ammonia; the ammonia liberated was absorbed in hydrochloric acid, and 95% of the theoretical amount of the ammonium chloride was obtained. On these grounds O. Silberrad assigns the formula $NH_3 \cdot NI_3$ to the compound, and explains the decomposition as taking place, $2NH_3 \cdot NI_3 + 6Zn(C_2H_5)_2 = 6ZnC_2H_5 \cdot I + 2NH_3 + 2N(C_2H_5)_3$. The hydrogen in ammonia is capable of replacement by metals, thus magnesium burns in the gas with the formation of magnesium nitride Mg_3N_2, and when the gas is passed over heated sodium or potassium, sodamide, $NaNH_2$, and potassamide, KNH_2, are formed.

One of the most characteristic properties of ammonia is its power of combining directly with acids to form salts; thus with hydrochloric acid it forms ammonium chloride (sal-ammoniac); with nitric acid, ammonium nitrate, &c. It is to be noted that H. B. Baker (*Journal of Chem. Soc.*, 1894, lxv. p. 612) has shown that perfectly dry ammonia will not combine with perfectly dry hydrochloric acid, moisture being necessary to bring about the reaction. The aqueous solution of ammonia is very basic in its reactions, and since it is a weak electrolyte, one must assume the solution to contain a certain amount of ammonium hydroxide NH_4OH, although it is probably chiefly composed of a solution of ammonia in water. (On the constitution of aqueous ammonia solutions see also Carl Frenzel, *Zeit für angew. Chemie*, xxxii. 3, p. 319.) Ammonia finds a wide application in organic chemistry as a synthetic reagent; it reacts with alkyl iodides to form amines (*q.v.*), with esters to form acid amides (*q.v.*), with halogen fatty acids to form amino-acids; while it also combines with isocyanic esters to form alkyl ureas and with the mustard oils to form alkyl thioureas. Aldehydes also combine directly with ammonia.

Liquid ammonia possesses strong ionizing powers, and solutions of salts in liquid ammonia have been much studied. For details see E. C. Franklin and C. A. Kraus, *Amer. Chem. Jour.*, 1899, xxi. p. 8; 1900, xxiv. p. 83; 1902, xxviii. p. 277; also Carl Frenzel, *Zeits für Elektrochemie*, 1900, vi. p. 477.

The salts produced by the action of ammonia on acids are known as the ammonium salts and all contain the compound radical ammonium (NH_4). Numerous attempts have been made to isolate this radical, but so far none have been successful. By the addition of sodium amalgam to a concentrated solution of ammonium chloride, the so-called ammonium amalgam is obtained as a spongy mass which floats on the surface of the liquid; it decomposes readily at ordinary temperatures into ammonia and hydrogen; it does not reduce silver and gold salts, a behaviour which distinguishes it from the amalgams of the alkali metals, and for this reason it is regarded by some chemists as being merely mercury inflated by gaseous ammonia and hydrogen. M. le Blanc has shown, however, that the effect of ammonium amalgam on the magnitude of polarization of a battery is comparable with that of the amalgams of the alkali metals.

Many of the ammonium salts are made from the ammoniacal liquor of gas-works, by heating it with milk of lime and then absorbing the gas so liberated in a suitable acid. (See GAS: *Manufacture*.)

Ammonium bromide, NH_4Br, can be prepared by the direct action of bromine on ammonia. It crystallizes in colourless prisms, possessing a saline taste; it sublimes on heating and is easily soluble in water. On exposure to air it gradually assumes a yellow colour and becomes acid in its reaction.

Ammonium chloride, NH_4Cl. (See SAL-AMMONIAC.)

Ammonium fluoride, NH_4F, may be obtained by neutralizing ammonia with hydrofluoric acid. It crystallizes in small prisms, having a sharp saline taste, and is exceedingly soluble in water. It decomposes silicates on being heated with them.

Ammonium iodide, NH_4I, can be prepared by the action of hydriodic acid on ammonia. It is easily soluble in water, from which it crystallizes in cubes, and also in alcohol. It gradually turns yellow on standing in moist air, owing to decomposition with liberation of iodine.

Ammonium chlorate, NH_4ClO_3, is obtained by neutralizing chloric acid with either ammonia or ammonium carbonate, or by precipitating barium, strontium or calcium chlorates with ammonium carbonate. It crystallizes in small needles, which are readily soluble in water, and on heating, decompose at about 102° C., with liberation of nitrogen, chlorine and oxygen. It is soluble in dilute aqueous alcohol, but insoluble in strong alcohol.

Ammonium carbonates. The commercial salt is known as sal-volatile or salt of hartshorn and was formerly obtained by the dry distillation of nitrogenous organic matter such as hair, horn, decomposed urine, &c., but is now obtained by heating a mixture of sal-ammoniac, or ammonium sulphate and chalk, to redness in iron retorts, the vapours being condensed in leaden receivers. The crude product is refined by sublimation, when it is obtained as a white fibrous mass, which consists of a mixture of hydrogen ammonium carbonate, $NH_4 \cdot HCO_3$, and ammonium carbamate, NH_2COONH_4, in molecular proportions; on account of its possessing this constitution it is sometimes called ammonium sesquicarbonate. It possesses a strong ammoniacal smell, and on digestion with alcohol the carbamate is dissolved and a residue of ammonium bicarbonate is left; a similar decomposition taking place when the sesquicarbonate is exposed to air. Ammonia gas passed into a strong aqueous solution of the sesquicarbonate converts it into normal ammonium carbonate, $(NH_4)_2CO_3$, which can be obtained in the crystalline condition from a solution prepared at about 30° C. This compound on exposure to air gives off ammonia and passes back to ammonium bicarbonate.

Ammonium bicarbonate, $NH_4 \cdot HCO_3$, is formed as shown above and also by passing carbon dioxide through a solution of the normal compound, when it is deposited as a white powder, which has no smell and is only slightly soluble in water. The aqueous solution of this salt liberates carbon dioxide on exposure to air or on heating, and becomes alkaline in reaction. The aqueous solutions of all the carbonates when boiled undergo decomposition with liberation of ammonia and of carbon dioxide.

Ammonium nitrate, NH_4NO_3, is prepared by neutralizing nitric acid with ammonia, or ammonium carbonate, or by double decomposition between potassium nitrate and ammonium sulphate. It can be obtained in three different crystalline forms, the transition points of which are 35° C., 83° C. and 125° C. It is easily soluble in water, a considerable lowering of temperature taking place during the operation; on this account it is sometimes used in the preparation of freezing mixtures. On gentle heating, it is decomposed into water and nitrous oxide. P. E. M. Berthelot in 1883 showed that if ammonium nitrate be rapidly heated the following reaction takes place with explosive violence:—$2NH_4NO_3 = 4H_2O + 2N_2 + O_2$.

Ammonium nitrite, NH_4NO_2, is formed by oxidizing ammonia with ozone or hydrogen peroxide; by precipitating barium or lead nitrites with ammonium sulphate, or silver nitrite with ammonium chloride. The precipitate is filtered off and the solution concentrated. It forms colourless crystals which are soluble in water and decompose on heating, with the formation of nitrogen.

Ammonium phosphates. The normal phosphate, $(NH_4)_3PO_4$, is obtained as a crystalline powder, on mixing concentrated solutions of ammonia and phosphoric acid, or on the addition of excess of ammonia to the acid phosphate $(NH_4)_2HPO_4$. It is soluble in water, and the aqueous solution on boiling loses ammonia and the acid phosphate $NH_4H_2PO_4$ is formed. Diammonium hydrogen phosphate, $(NH_4)_2HPO_4$, is formed by evaporating a solution of phosphoric acid with excess of ammonia. It crystallizes in large transparent prisms, which melt on heating and decompose, leaving a residue of metaphosphoric acid, (HPO_3). Ammonium dihydrogen phosphate, $NH_4 \cdot H_2PO_4$, is formed when a solution of phosphoric acid is added to ammonia until the solution is distinctly acid. It crystallizes in quadratic prisms.

Ammonium sodium hydrogen phosphate, $NH_4 \cdot NaHPO_4 \cdot 4H_2O$. (See MICROCOSMIC SALT.)

Ammonium sulphate $(NH_4)_2SO_4$ is prepared commercially from the ammoniacal liquor of gas-works (see GAS: *Manufacture*) and is purified by recrystallization. It forms large rhombic prisms, has a somewhat saline taste and is easily soluble in water. The aqueous solution on boiling loses some ammonia and forms an acid sulphate. It is used largely as an artificial manure, and also for the preparation of other ammonium salts.

Ammonium persulphate $(NH_4)_2S_2O_8$ has been prepared by H. Marshall (*Jour. of Chem. Soc.*, 1891, lix. p. 777) by the method used for the preparation of the corresponding potassium salt (see SULPHUR). Pure specimens are difficult to obtain. It is very soluble in cold water, a large fall of temperature accompanying solution.

Ammonium sulphide, $(NH_4)_2S$, is obtained, in the form of micaceous crystals, by passing sulphuretted hydrogen mixed with a slight excess of ammonia through a well-cooled vessel; the hydrosulphide $NH_4{\cdot}HS$ is formed at the same time. It dissolves readily in water, but is probably partially dissociated in solution. The *hydrosulphide* $NH_4{\cdot}HS$ can be obtained as a white solid, by mixing well-cooled ammonia with a slight excess of sulphuretted hydrogen. According to W. P. Bloxam (*Jour. of Chem. Soc.*, 1895, lxvii. p. 283), if sulphuretted hydrogen is passed into strong aqueous ammonia at ordinary temperature, the compound $(NH_4)_2S{\cdot}2NH_4HS$ is obtained, which, on cooling to 0° C. and passing more sulphuretted hydrogen, forms the compound $(NH_4)_2S{\cdot}12NH_4HS$. An ice-cold solution of this substance kept at 0° C. and having sulphuretted hydrogen continually passed through it gives the hydrosulphide. Several complex polysulphides of ammonium have been isolated, for details of which see Bloxam's paper quoted above. Compounds are known which may be looked upon as derived from ammonia by the replacement of its hydrogen by the sulpho-group (HSO_3); thus potassium ammon-trisulphonate, $N(SO_3K)_3{\cdot}2H_2O$, is obtained as a crystalline precipitate on the addition of excess of potassium sulphite to a solution of potassium nitrite, $KNO_2+3K_2SO_3+2H_2O=N(SO_3K)_3+4KHO$. It can be recrystallized by solution in alkalies. On boiling with water, it is converted, first into the disulphonate $NH(SO_3K)_2$ thus, $N(SO_3K)_3+H_2O=NH(SO_3K)_2+KHSO_4$, and ultimately into the monosulphonate $NH_2{\cdot}SO_3K$. The disulphonate is more readily obtained by moistening the nitrilosulphonate with dilute sulphuric acid and letting it stand for twenty-four hours, after which it is recrystallized from dilute ammonia. It forms monosymmetric crystals which by boiling with water yield amidosulphonic acid. (See also E. Divers, *Jour. of Chem. Soc.*, 1892, lxi. p. 943.) Amidosulphonic acid crystallizes in prisms, slightly soluble in water, and is a stable compound.

Ammonia and ammonium salts can be readily detected, in very minute traces, by the addition of *Nessler's solution*, which gives a distinct yellow coloration in the presence of the least trace of ammonia or ammonium salts. Larger quantities can be detected by warming the salts with a caustic alkali or with quicklime, when the characteristic smell of ammonia will be at once apparent. The amount of ammonia in ammonium salts can be estimated quantitatively by distillation of the salts with sodium or potassium hydroxide, the ammonia evolved being absorbed in a known volume of standard sulphuric acid and the excess of acid then determined volumetrically; or the ammonia may be absorbed in hydrochloric acid and the ammonium chloride so formed precipitated as ammonium chlorplatinate, $(NH_4)_2PtCl_6$.

AMMONIACUM, or GUM AMMONIAC, a gum-resin exuded from the stem of a perennial herb (*Dorema ammoniacum*), natural order Umbelliferae. The plant grows to the height of 8 or 9 ft., and its whole stem is pervaded with a milky juice, which oozes out on an incision being made at any part. This juice quickly hardens into round tears, forming the "tear ammoniacum" of commerce. "Lump ammoniacum," the other form in which the substance is met with, consists of aggregations of tears, frequently incorporating fragments of the plant itself, as well as other foreign bodies. Ammoniacum has a faintly fetid, unpleasant odour, which becomes more distinct on heating; externally it possesses a reddish-yellow appearance, and when the tears or lumps are freshly fractured they exhibit a waxy lustre. It is chiefly collected in central Persia, and comes to the European market by way of Bombay. Ammoniacum is closely related to asafetida and galbanum (from which, however, it differs in yielding no umbelliferone) both in regard to the plant which yields it and its therapeutical effects. Internally it is used in conjunction with squills in bronchial affections; and in asthma and chronic colds it is found useful, but it has no advantages over a number of other substances of more constant and active properties (Sir Thomas Fraser). Only the "tear ammoniacum" is official.

African ammoniacum is the product of a plant said to be *Ferula tingitana*, which grows in North Africa; it is a dark-coloured gum-resin, possessed of a very weak odour and a persistent acrid taste.

AMMONITES, or the "children of Ammon," a people of east Palestine who, like the Moabites, traced their origin to Lot, the nephew of the patriarch Abraham, and must have been regarded, therefore, as closely related to the Israelites and Edomites. Both the Ammonites and Moabites are sometimes spoken of under the common name of the children of Lot (Deut. ii. 19; Ps. lxxxiii. 8); and the whole history shows that they preserved throughout the course of their national existence a sense of the closest brotherhood. According to the traditions, the original territory of the two tribes was the country lying immediately on the east of the Dead Sea, and of the lower half of the Jordan, having the Jabbok for its northern boundary; and of this tract the Ammonites laid claim to the northern portion between the Arnon and the Jabbok, out of which they had expelled the Zamzummim (Judg. xi. 13; Deut. ii. 20 sqq.; cf. Gen. xiv. 5), though apparently it had been held, in part at least, conjointly with the Moabites, or perhaps under their supremacy (Num. xxi. 26, xxii. 1; Josh. xiii. 32). From this their original territory they had been in their turn expelled by Sihon, king of the Amorites, who was said to have been found by the Israelites, after their deliverance from Egypt, in possession of both Gilead and Bashan, that is, of the whole country on the left bank of the Jordan, lying to the north of the Arnon (Num. xxi. 13). By this invasion, as the Moabites were driven to the south of the Arnon, which formed their northern boundary from that time, so the Ammonites were driven out of Gilead across the upper waters of the Jabbok where it flows from south to north, which henceforth continued to be their western boundary (Num. xxi. 24; Deut. ii. 37, iii. 16). The other limits of the *Ammonitis*, or country of the Ammonites ('Αμμανῖτις χώρα, 2 Mac. iv. 26), there are no means of exactly defining. On the south it probably adjoined the land of Moab; on the north it may have met that of the king of Geshur (Josh. xii. 5); and on the east it probably melted away into the desert peopled by Amalekites and other nomadic races.

The chief city of the country, called Rabbah, or Rabbath of the children of Ammon, *i.e.* the metropolis of the Ammonites (Deut. iii. 11), and Rabbathammana by the later Greeks (Polyb. v. 7. 4), whose name was changed into Philadelphia by Ptolemy Philadelphus, a large and strong city with an acropolis, was situated on both sides of a branch of the Jabbok, bearing at the present day the name of Nahr 'Ammān, the river of Ammon, whence the designation "city of waters" (2 Sam. xii. 27; see *Survey of E. Pal* (Pal. Explor. Fund), pp. 19 sqq. The ruins called Ammān by the natives are extensive and imposing. The country to the south and east of Ammān is distinguished by its fertility; and ruined towns are scattered thickly over it, attesting that it was once occupied by a population which, however fierce, was settled and industrious, a fact indicated also by the tribute of corn paid annually to Jotham (2 Chron. xxvii. 5).

The traditional history of Ammon as related in the Old Testament is not free from obscurity, due to the uncertain date of the various references and to the doubt whether the individual details belong to the particular period to which each is ascribed. (See further MOAB.) From the Assyrian inscriptions we learn that the Ammonite king *Ba'sa* (Baasha) (son) of Ruhubi, with 1000 men joined Ahab and the Syrian allies against Shalmaneser II. at the battle of Karkar in 854. In 734 their king Sanip(b)u was a vassal of Tiglathpileser IV., and his successor, P(b)udu-ilu, held the same position under Sennacherib and Esarhaddon. Somewhat later, their king Amminadab was among the tributaries who suffered in the course of the great Arabian campaign of Assurbanipal. With the neighbouring tribes, the Ammonites helped the Babylonian monarch Nebuchadrezzar against Jehoiakim (2 Kings xxiv. 2); and if they joined Zedekiah's conspiracy (Jer. xxvii. 3), and were threatened by the Babylonian army (Ezek. xxi. 20 sqq.), they do not appear to have suffered punishment at that period, perhaps on account of a timely submission. When, after the destruction of Jerusalem, the fugitive Jews were again gathered together, it was at the instigation of Baalis, king of Ammon, that Gedaliah, the ruler whom Nebuchadrezzar had appointed over them, was murdered, and new calamities were incurred (Jer. xl. 14); and when Nehemiah prepared to rebuild the walls of Jerusalem an Ammonite was foremost in opposition (Neh. ii. 10,19, iv. 1-3).[1] True to their antecedents, the Ammonites, with some of the neighbouring tribes, did their utmost to resist and check the revival of the Jewish power under Judas Maccabaeus (1 Macc. v. 6; cf. Jos. *Ant. Jud.* xii. 8. 1.). The last notice of them is in Justin Martyr (*Dial. cum Tryph.* § 119), where it is affirmed that they were still a numerous people. The few Ammonite names that have been preserved (Nahash, Hanun, and those mentioned above, Zelek in 2 Sam. xxiii. 37 is textually uncertain) testify, in harmony with other considerations, that their language was Semitic, closely allied to Hebrew and to the language of the Moabites. Their national deity was Molech or Milcon. (See Moloch.) (S. A. C.)

AMMONIUS GRAMMATICUS, the supposed author of a treatise entitled *Περὶ ὁμοίων καὶ διαφόρων λέξεων* (*On the Differences of Synonymous Expressions*), of whom nothing is known. He was formerly identified with an Egyptian priest who, after the destruction of the pagan temple at Alexandria (389), fled to Constantinople, where he became the tutor of the ecclesiastical historian Socrates. But it seems more probable that the real author was Herennius Philo of Byblus, who was born during the reign of Nero and lived till the reign of Hadrian, and that the treatise in its present form is a revision prepared by a later Byzantine editor, whose name may have been Ammonius.

Text by Valckenaer, 1739, Schäfer, 1822; Kopp, *De Ammonii . . . Distinctionibus Synonymicis*, 1883.

AMMONIUS HERMIAE (5th century A.D.); Greek philosopher, the son of Hermias or Hermeias, a fellow-pupil of Proclus. He taught at Alexandria, and had among his scholars Asclepius, John Philoponus, Damascius and Simplicius. His commentaries on Plato and Ptolemy are lost. Those on Aristotle are all that remain of his reputedly numerous writings. Of the commentaries we have—(1) one on the *Isagoge* of Porphyry (Venice, 1500 fol.); (2) one on the *Categories* (Venice, 1503 fol.), the authenticity of which is doubted by Brandis; (3) one on the *De Interpretatione* (Venice, 1503 fol.). They are printed in Brandis's scholia to Aristotle, forming the fourth volume of the Berlin *Aristotle*; they are also edited (1891–1899) in A. Busse's *Commentaria in Aristot. Graeca*. The special section on fate was published separately by J. C. Orelli, *Alex. Aphrod., Ammonii, et aliorum de Fato quae supersunt* (Zürich, 1824). A life of Aristotle, ascribed to Ammonius, but with more accuracy to John Philoponus, is often prefixed to editions of Aristotle. It has been printed separately, with Latin translation and scholia, at Leiden, 1621, at Helmstadt, 1666, and at Paris, 1850. Other commentaries on the *Topics* and the first six books of the *Metaphysics* still exist in manuscript. Of the value of the logical writings of Ammonius there are various opinions. K. Prantl speaks of them with great, but hardly merited, contempt.

For a list of his works see J. A. Fabricius, *Bibliotheca Graeca*, v. 704-707; C. A. Brandis, *Über d. Reihenf. d. Bücher d. Aristot. Org.*, 283 f.; K. Prantl, *Gesch. d. Logik*, i. 642.

AMMONIUS SACCAS (3rd century A.D.), Greek philosopher of Alexandria, often called the founder of the neo-Platonic school. Of humble origin, he appears to have earned a livelihood as a porter; hence his nickname of "Sack-bearer" (*Σακκᾶς*, for *σακκοφόρος*). The details of his life are unknown, insomuch that he has frequently been confused with a Christian philosopher of the same name. Eusebius (*Church History*, vi. 19), who is followed by Jerome, asserts that he was born a Christian, remained faithful to Christianity throughout his life, and even produced two works called *The Harmony of Moses and Jesus* and *The Diatessaron, or Harmony of the Four Gospels*, which is said by some to exist in a Latin version by Victor, bishop of Capua. Porphyry, quoted by Eusebius, *ib.* vi. 19. 6, however, says that he apostatized in later life and left no writings behind him. There seems no reason, therefore, to doubt that Eusebius is here referring to the Christian philosopher. After long study and meditation, Ammonius opened a school of philosophy in Alexandria. His principal pupils were Herennius, the two Origens, Cassius Longinus and Plotinus. As he designedly wrote nothing, and, with the aid of his pupils, kept his views secret, after the manner of the Pythagoreans, his philosophy must be inferred mainly from the writings of Plotinus. As Zeller points out, however, there is reason to think that his doctrines were rather those of the earlier Platonists than those of Plotinus. Hierocles, writing in the 5th century A.D., states that his fundamental doctrine was an eclecticism, derived from a critical study of Plato and Aristotle. His admirers credited him with having reconciled the quarrels of the two great schools. His death is variously given between A.D. 240 and 245. See Neo-Platonism, Origen.

Bibliography.—C. Rösler, *De commentitiis philosophiae Ammoniaceae fraudibus et noxis* (Tübingen, 1786); L. J. Dehaut, *Essai historique sur la vie et la doctrine d' Ammonius Saccas* (Brussels, 1836); E. Zeller, "Ammonius Saccas und Plotinus," *Arch. f. Gesch. d. Philos.* vii., 1894, pp. 295-312; E. Vacherot, *Hist. crit. de l'école d'Alexandrie* (Paris, 1846); T. Whittaker, *The Neo-platonists* (Camb., 1901); Eusebius, *Hist. Eccles.*, trans. A. C. M'Giffert (Oxford and New York, 1890), notes on passages quoted above.

AMMUNITION, a military term (derived, through the French, from Lat. *munire*, to provide), for consumable stores used in attack or defence, such as rifle cartridges, cartridges, projectiles, igniting tubes and primers for ordnance, &c.

The components of ammunition intended for rifles and ordnance may be divided into (*a*) explosives and propellants (see Explosives and Gunpowder), (*b*) projectiles of all kinds, and (*c*) cartridges. The military classification of explosives differs somewhat from that of the Explosives Act 1875, but, broadly speaking, they are divided into two groups. The first of these comprises explosives in bulk, made-up cartridges for cannon, and filled quick-firing cartridges; Group II. contains small-arm cartridges, fuzes, primers, tubes, filled shells (fuzed or unfuzed), &c. Each group is subdivided, and arrangements are made for storing certain divisions of Group I. in a magazine in separate compartments. All the divisions of Group II. are, and the remaining divisions of Group I. (comprising wet gun-cotton, picric acid and Q.F. cartridges) may be, stored in ammunition stores.

These general conditions apply to the *storage of ammunition in fortresses*. Here the positions for the magazine and ammunition stores are so chosen as to afford the best means of protection from an ememy's fire. Huge earth parapets cover these buildings, which are further strengthened, where possible, by traverses protecting the entrances. For the purpose of filling, emptying and examining cannon cartridges and shell, a laboratory is generally provided at some distance from the magazine. The various stores for explosives are classified into those under magazine conditions (viz. magazines, laboratories and cartridge stores) and those with which these restrictions need not be observed (viz. ammunition and shell stores). The interior walls of a magazine are lined and the floors laid so that there may be no exposed iron or steel. At the entrance there is a lobby or barrier, inside which persons about to enter the magazine change their clothes for a special suit, and their boots for a pair made without nails. In an ammunition or shell store these precautions need not be taken except where the shell store and the adjacent cartridge store have a common entrance; persons entering may do so in their ordinary clothes. A large work may have a main magazine and several subsidiary magazines, from which the stock of cartridges is renewed in the cartridge stores attached to each group of guns or in the expense cartridge stores and cartridge recesses. The same applies to main ammunition stores which supply the shell stores, expense stores and recesses.

The supply of ammunition may be divided roughly into (*a*) that for guns forming the movable armament, (*b*) that for guns placed in permanent positions. The movable armament will consist of guns and howitzers of small and medium calibre, and it is necessary to arrange suitable expense cartridge stores and shell stores in close proximity to the available positions. They can generally be constructed to form part of the permanent work in the projected face of traverses or other strong formations, and should be arranged for a twenty-four hours' supply of ammunition. These stores are refilled from the main magazine every night under cover of darkness. Light railways join the various positions. The guns mounted in permanent emplacements are divided into groups of two or three guns each, and usually each group will require but one calibre of ammunition. A cartridge store, shell store and a general store, all well ventilated, are arranged for the especial service of such a group of guns. In the cartridge store the cylinders containing the cartridges are so placed and labelled that the required charge, whether reduced or full, can be immediately selected. In the shell store also for the same reason the common shell are separated from the armour-piercing or shrapnel. Each nature of projectile is painted in a distinctive manner to render identification easy. The fuzes, tubes, &c., are placed in the general store with the tools and accessories belonging to the guns. The gun group is distinguished by some letter and the guns of the group by numerals; thus, $\frac{A}{1}$ is No. 1 gun of group A. The magazine and shell stores are also indicated by the group letter, and so that mistakes, even by those unaccustomed to the fort, may be avoided, the passages are pointed out by finger posts and direction boards. For the immediate service of each gun a few cartridges and projectiles are stored in small receptacles—called cartridge and shell recesses respectively—built in the parapet as near the gun position as practicable. In some cases a limited number of projectiles may be placed close underneath the parapet if this is conveniently situated near the breech of the gun and not exposed to hostile fire.

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[1] The allusions in Jer. xlix. 1-6; Zeph. ii. 8-11; Ezek. xxi. 28-32; Judg. xi. 12-28, have been taken to refer to an Ammonite occupation of Israelite territory after the deportation of the east Jordanic Israelites in 734, but more probably belong to a later event. The name Chephar-Ammoni (in Benjamin; Josh. xviii. 24) seems to imply that the "village" became a settlement of "Ammonites." Some light is thrown upon the obscure history of the post-exile period by the references to the mixed marriages which aroused the reforming zeal of Ezra and culminated in the exclusion of Ammon and Moab from the religious community—on the ground of incidents which were ascribed to the time of the "exodus" (Deut. xxiii. 3 sqq.; Ezr. ix. 1 sqq.; Neh. xiii. 1 sqq.).

In order to supply the ammunition sufficiently rapidly for the efficient service of modern guns, hydraulic, electric or hand-power hoists are employed to raise the cartridges and shell from the cartridge store and shell store to the gun floor, whence they are transferred to a derrick or loading tray attached to the mounting for loading the gun.

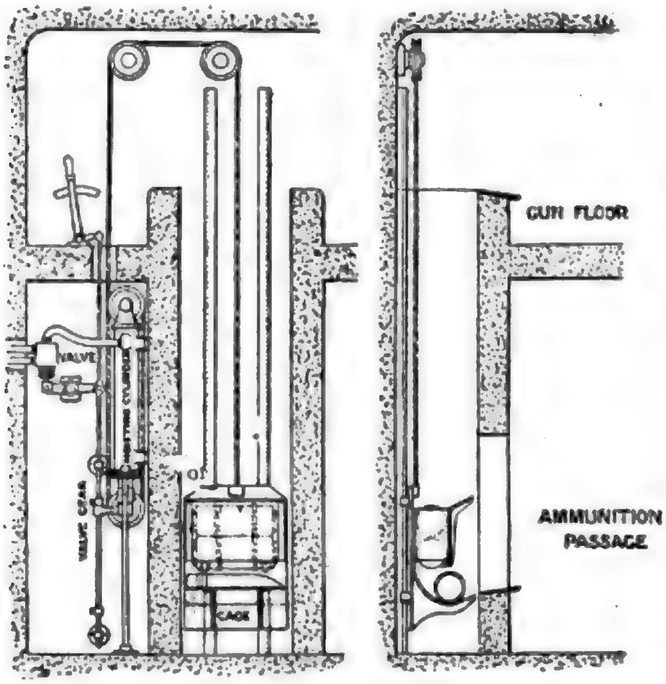


Fig. 1.—Ammunition Hoist.

Projectiles for B.L. guns above 6-in. calibre are stored in shell stores ready filled and fuzed standing on their bases, except shrapnel and high-explosive shell, which are fuzed only when about to be used. Smaller sizes of shells are laid on their sides in layers, each layer pointing in the opposite direction to the one below to prevent injury to the driving bands. Cartridges are stored in brass corrugated cases or in zinc cylinders. The corrugated cases are stacked in layers in the magazine with the mouth of the case towards a passage between the stacks, so that it can be opened and the cartridges removed and transferred to a leather case when required for transport to the gun. Cylinders are stacked, when possible, vertically one above the other. The charges are sent to the gun in these cylinders, and provision is made for the rapid removal of the empty cylinders.

The number and nature of rounds allotted to any fortress depends on questions of policy and location, the degrees of resistance the nature of the works and *personnel* could reasonably be expected to give, and finally on the nature of the armament. That is to say, for guns of large calibre three hundred to four hundred rounds per gun might be sufficient, while for light Q.F. guns it might amount to one thousand or more rounds per gun. (A. G. H.)

Supply of ammunition in the field.

With every successive improvement in military arms there has necessarily been a corresponding modification in the method of supplying ammunition and in the quantity required to be supplied. When hand-to-hand weapons were the principal implements of battle, there was, of course, no such need, but even in the middle ages the archers and crossbowmen had to replenish the shafts and bolts expended in action, and during a siege stone bullets of great size, as well as heavy arrows, were freely used. The missiles of those days were, however, interchangeable, and at the battle of Towton (1461) the commander of the Yorkist archers, by inducing the enemy to waste his arrows, secured a double supply of ammunition for his own men. This interchangeability of war material was even possible for many centuries after the invention of firearms. At the battle of Liegnitz (1760) a general officer was specially commissioned by Frederick the Great to pack up and send away, for Prussian use, all the muskets and ammunition left on the field of battle by the defeated Austrians. Captured material is, of course, utilized whenever possible, at the present time, and in the Chino-Japanese War the Japanese went so far as to prepare beforehand spare parts for the Chinese guns they expected to capture (Wei-Hai-Wei, 1895), but it is rare to find a modern army trusting to captures for arms and ammunition; almost the only instance of the practice is that of the Chilean civil war of 1891, in which the army of one belligerent was almost totally dependent upon this means of replenishing stores of arms and cartridges. But what was possible with weapons of comparatively rough make is no longer to be thought of in the case of modern arms. The Lee-Metford bullet of ·303 in. diameter can scarcely be used in a rifle of smaller calibre, and in general the minute accuracy of parts in modern weapons makes interchangeability almost impossible. Further, owing to the rapidity with which, in modern arms, ammunition is expended, and the fact that, as battles are fought at longer ranges than formerly, more shots have to be fired in order to inflict heavy losses, it is necessary that the reserves of ammunition should be as close as possible to the troops who have to use them. This was always the case even with the older firearms, as, owing to the great weight of the ammunition, the soldier could carry but few rounds on his person. Nevertheless it is only within the past seventy years that there has grown up the elaborate system of ammunition supply which now prevails in all regularly organized armies. That which is described in the present article is the British, as laid down in the official *Combined Training* (1905) and other manuals. The new system designed for stronger divisions, and others, vary only in details and nomenclature.

Infantry.—The infantry soldier generally carries, in pouches, bandoliers, &c., one hundred rounds of small-arms ammunition (S.A.A.), and it is usual to supplement this, when an action is imminent, from the regimental reserve (see below). It is to be noticed that every reduction in the calibre of the rifle means an increase in the number of rounds carried. One hundred rounds of the Martini-Henry ammunition weighed 10lb 10 oz.; the same weight gives 155 with ·303 ammunition (incl. charges), and if a ·256 calibre is adopted the number of rounds will be still greater. It is, relatively, a matter of indifference that the reserves of ammunition include more rounds than formerly; it is of the highest importance that the soldier should, as far as possible, be independent of fresh supplies, because the bringing up of ammunition to troops closely engaged is laborious and costly in lives. The *regimental reserves* are carried in S.A.A. carts and on pack animals. Of the former each battalion has six, of the latter eight. The six carts are distributed, one as reserve to the machine gun, three as reserve to the battalion itself, and two as part of the *brigade reserve*, which consists therefore of eight carts. The brigade reserve communicates directly with the brigade ammunition columns of the artillery (see below). The eight pack animals follow the eight companies of their battalion. These, with two out of the three battalion carts, endeavour to keep close to the firing line, the remaining cart being with the reserve companies. Men also are employed as carriers, and this duty is so onerous that picked men only are detailed. Gallantry displayed in bringing up ammunition is considered indeed to justify special rewards. The amount of S.A.A. in regimental charge is 100 rounds in the possession of each soldier, 2000 to 2200 on each pack animal, and 16,000 to 17,600 in each of four carts, with, in addition, about 4000 rounds with the machine gun and 16,000 more in the fifth cart.

Artillery.—The many vehicles which accompany batteries (see ARTILLERY) carry a large quantity of ammunition, and with the contents of two wagons and the limber each gun may be considered as well supplied, more especially as fresh rounds can be brought up with relatively small risk, owing to the long range at which artillery fights and the use of cover. Each brigade of artillery has its own *ammunition column*, from which it draws its reserve in the first instance.

Ammunition Columns.—An ammunition column consists of military vehicles carrying gun and S.A. ammunition for the combatant unit to which the column belongs. Thus the ammunition columns of a division, forming part of the brigades of field artillery, carry reserve ammunition for the guns, the machine guns of the infantry and the rifles of all arms. Generally speaking, the ammunition column of each of the artillery brigades furnishes spare ammunition for its own batteries and for one of the brigades of infantry. All ammunition columns are officered and manned by the Royal Artillery. They are not reserved exclusively to their own brigades, divisions, &c., but may be called upon to furnish ammunition to any unit requiring it during an action. The officers and men of the R.A. employed with the ammunition column are, as a matter of course, immediately available to replace casualties in the batteries. Teams, wagons and *matériel* generally are also available for the same purpose. The horse artillery, howitzer and heavy brigades of artillery have each their own ammunition columns, organized in much the same way and performing similar duties. The ammunition column of the heavy brigade is divisible into three sections, so that the three batteries, if operating independently, have each a section at hand to replenish the ammunition expended. The horse artillery brigade ammunition columns carry, besides S.A.A. for all corps troops other than artillery, the reserve of pom-pom ammunition. In action these columns are on the battlefield itself. Some miles to the rear are the divisional and corps troops columns, which on the one hand replenish the empty wagons of the columns in front, and on the other draw fresh supplies from the depots on the line of communication. These also are in artillery charge; a divisional column is detailed to each division (*i.e.* to replenish each set of brigade ammunition columns), and the corps troops column supplies the columns attached to the heavy, howitzer and horse artillery brigades. The ammunition thus carried includes ordinarily seven or eight kinds at least. S.A.A., field, horse, howitzer and heavy gun shrapnel, howitzer and heavy gun lyddite shells, cartridges for the four different guns employed and pom-pom cartridges for the cavalry,—in all twelve distinct types of stores would be carried for a complete army corps. Consequently the rounds of each kind in charge of each ammunition column must vary in accordance with the work expected of the combatant unit to which it belongs. Thus pom-pom ammunition is out of place in the brigade ammunition columns of field artillery, and S.A.A. is relatively unnecessary in that attached to a heavy artillery brigade. Under these circumstances a column may be unable to meet the particular wants of troops engaged in the vicinity; for instance, a cavalry regiment would send in vain to a heavy artillery ammunition section for pom-pom cartridges. The point to be observed in this is that the fewer the natures of weapons used, the more certain is the ammunition supply. (C. F. A.)

Shot.

The first projectiles fired from cannon were the darts and stone shot which had been in use with older weapons. These darts ("garros") had iron heads or were of iron wrapped with leather to fit the bore of small guns, and continued in use up to nearly the end of the 16th century. Spherical stone shot were chosen on account of cheapness; forged iron, bronze and lead balls were tried, but the expense prevented their general adoption. Further, as the heavy metal shot necessitated the use of a correspondingly large propelling charge, too great a demand was made on the strength of the feeble guns of the period. Stone shot being one-third the weight of those of iron the powder charge was reduced in proportion, and this also effected an economy. Both iron and stone shot were occasionally covered with lead, probably to preserve the interior of the bore of the gun. Cast iron, while known in the 14th century, was not sufficiently common to be much used for the manufacture of shot, although small ones were made about that time. They were used more frequently at the latter part of the following century. Towards the end of the 16th century nearly all shot were of iron, but stone shot were still used with guns called Petrieroes (hence the name) or Patararoes, for attacking weak targets like ships at short range.

Case shot are very nearly as ancient as spherical shot. They can be traced back to the early part of the 15th century, and they have practically retained their original form up to the present date. They are intended for use at close quarters when a volley of small shot is required. With field guns they are not of much use at ranges exceeding about four hundred yards; those for heavy guns are effective up to one thousand yards. In the earlier forms lead or iron shot were packed in wood casks or in canvas bags tied up with twine like the later quilted shot. In the present (fig. 2) type small shot are placed in a cylindrical case of sheet iron, with iron ends, one end being provided with handles. For small guns the bullets are made of lead and antimony—like shrapnel bullets—while for larger calibres they are of cast iron weighing from two ounces to three and a half pounds each.

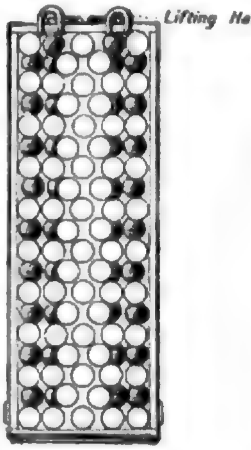


FIG. 2.—Case Shot.

Grape shot is now obsolete. It consisted generally of three tiers of cast-iron balls separated by iron plates and held in place by an iron bolt which passed through the centre of the plates.

There was also another type called *quilted shot* which consisted of a number of small shot in a canvas covering tied up by rope. *Chain shot*, in the days of sailing ships, was much in favour as a means of destroying rigging. Two spherical shot were fastened together by a short length of chain. On leaving the gun they began gyrating around each other and made a formidable missile.

Red-hot shot were invented in 1579 by Stephen Batory, king of Poland. They were used with great effect by the English during the siege of Gibraltar, especially on the 13th of September 1782, when the French floating batteries were destroyed, together with a large part of the Spanish fleet. *Martin's shell* was a modified form; here a cast-iron shell was filled with molten cast iron and immediately fired. On striking the side of a ship the shell broke up, freeing the still molten iron, which set fire to the vessel.

Rotation.—Projectiles intended for R.M.L. guns were at first fitted with a number of gun-metal studs arranged around them in a spiral manner corresponding to the twist of rifling. This was defective, as it allowed, as in the old smooth-bore guns, the powder gas to escape by the clearance (called "windage") between the projectile and the bore, with a consequent loss of efficiency; it also quickly eroded the bore of the larger guns. Later the rotation was effected by a cupped copper disc called a "gas check" attached to the base end of the projectile. The powder gas pressure expanded the rim of the gas check into the rifling grooves and prevented the escape of gas; it also firmly fixed the gas check to the projectile, thus causing it to rotate. A more regular and efficient action of the powder gas was thus ensured, with a corresponding greater range and an improvement in accuracy. With the earlier Armstrong (R.B.L.) guns the projectiles were coated with lead (the late Lord Armstrong's system), the lead being forced through the rifling grooves by the pressure of the exploded powder gas. The lead coating is, however, too soft with the higher velocities of modern B.L. guns. Mr Vavasseur, C.B., devised the plan of fitting by hydraulic pressure a copper "driving band" into a groove cut around the body of the projectile. This is now universal. It not only fulfils the purpose of rotating the projectile, but renders possible the use of large charges of slow-burning explosive. The copper band, on being forced through the gun, gives rise to considerable resistance, which allows the propelling charge to burn properly and thus to exert its enormous force on the projectile.

The laws which govern the designs of projectiles are not well defined. Certain formulae are used which give the thickness of the walls of the shell for a known chamber pressure in the gun, and for a particular stress on the material of the shell. The exact proportions of the shell depend, however, greatly on experimental knowledge.

Armour-piercing Shot and Shell.—On the introduction of iron ships it was found that the ordinary cast-iron projectile readily pierced the thin plating, and in order to protect the vital parts of the vessel wrought-iron armour of considerable thickness was placed on the sides. It then became necessary to produce a projectile which would pierce this armour. This was effected by Sir W. Palliser, who invented a method of hardening the head of the pointed cast-iron shot. By casting the projectile point downwards and forming the head in an iron mould, the hot metal was suddenly chilled and became intensely hard, while the remainder of the mould being formed of sand allowed the metal to cool slowly and the body of the shot to be made tough.

These shot proved very effective against wrought-iron armour, but were not serviceable against compound and steel armour. A new departure had, therefore, to be made, and forged steel shot with points hardened by water, &c., took the place of the Palliser shot. At first these forged steel shot were made of ordinary carbon steel, but as armour improved in quality the projectiles followed suit, and, for the attack of the latest type of cemented steel armour, the projectile is formed of steel—either forged or cast—containing both nickel and chromium. Tungsten steel has also been used with success.

Armour-piercing shot or shell are generally cast from a special mixture of chrome steel melted in pots; they are afterwards forged into shape. The shell is then thoroughly annealed, the core bored and the exterior turned up in the lathe. The shell is finished in a similar manner to others described below. The final or tempering treatment is very important, but details are kept strictly secret. It consists in hardening the head of the projectile and tempering it in a special manner, the rear portion being reduced in hardness so as to render it tough. The cavity of these projectiles is capable of receiving a small bursting charge of about 2 % of the weight of the complete projectile, and when this is used the projectile is called an *armour-piercing shell*. The shell, whether fuzed or unfuzed, will burst on striking a medium thickness of armour. Armour-piercing shells, having a bursting charge of about 3 % of the weight of the complete projectile, are now often fitted with a soft steel cap (fig. 3) for the perforation of hard steel armour. For the theory of the action of the cap see Armour Plates.

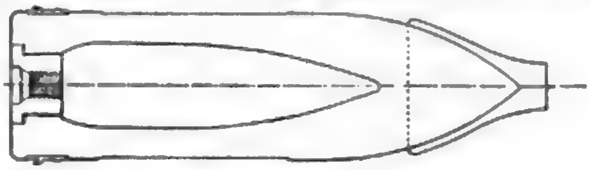


FIG. 3.—Capped A.P. Shell.

Even with these improvements the projectile cannot, with a reasonable velocity, be relied upon to pierce one calibre in thickness of modern cemented steel armour.

Shell.

Explosive shells do not appear to have been in general use before the middle of the 16th century. About that time hollow balls of stone or cast iron were fired from mortars. The balls were nearly filled with gunpowder and the remaining space with a slow-burning composition. This plan was unsatisfactory, as the composition was not always ignited by the flash from the discharge of the gun, and moreover the amount of composition to burn a stipulated time could not easily be gauged. The shell was, therefore, fitted with a hollow forged iron or copper plug, filled with slow-burning powder. It was impossible to ignite with certainty this primitive fuze simply by firing the gun; the fuze was consequently first ignited and the gun fired immediately afterwards. This entailed the use of a mortar or a very short piece, so that the fuze could be easily reached from the muzzle without unduly endangering the gunner. Cast-iron spherical common shell (fig. 4) were in use up to 1871. For guns they were latterly fitted with a wooden disc called a *sabot*, attached by a copper rivet, intended to keep the fuze central when loading. They were also supposed to reduce the rebounding tendency of the shell as it travelled along the bore on discharge. Mortar shell (fig. 5) were not fitted with sabots.

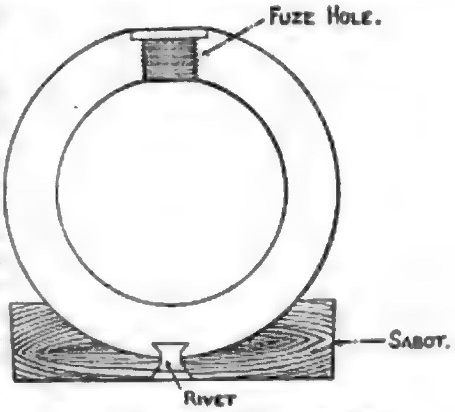


FIG. 4.—Spherical Common Shell.

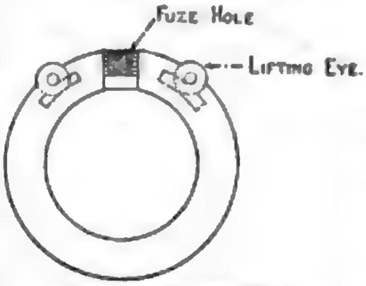


FIG. 5.—Mortar Shell.

Cast iron held its own as the most convenient material for projectiles up to recent years, steel supplanting it, first for projectiles intended for piercing armour, and afterwards for common shell for high-velocity guns where the shock of discharge has been found too severe for cast iron.

Common shell is essentially a material destructor. Filled with ordinary gunpowder, the larger natures are formidable projectiles for the attack of fortifications and the unarmoured portions of warships. On bursting they break up into somewhat large pieces, which carry destruction forward to some distance from the point of burst. For the attack of buildings common shell are superior to shrapnel and they are used to attack troops posted behind cover where it is impossible for shrapnel to reach them; their effect against troops is, however, generally insignificant. When filled with lyddite, melinite, &c., they are called high-explosive (H.E.) shell (see below). Common shell for modern high-velocity guns may be made of cast steel or forged steel; those made of cast iron are now generally made for practice, as they are found to break up on impact, even against earthworks, before the fuze has time to act; the bursting charge is, therefore, not ignited or only ignited after the shell has broken up, the effect of the bursting charge being lost in either case. So long as the shell is strong enough to resist the shocks of discharge and impact against earth or thin steel plates, it should be designed to contain as large a bursting charge as possible and to break up into a large number of medium-sized pieces. Their effect between decks is generally more far-reaching than lyddite shell, but the purely local effect is less. Light structures, which, at a short distance from the point of burst, successfully resist lyddite shell and confine the effect of the explosion, may be destroyed by the shower of heavy pieces produced by the burst of a large common shell.

To prevent the premature explosion of the shell, by the friction of the grains of powder on discharge, it is heated and coated internally with a thick lacquer, which on cooling presents a smooth surface. Besides this the bursting charge of all shell of 4-in. calibre and upwards (also with all other natures except shrapnel) is contained in a flannel or canvas bag. The bag is inserted through the fuze hole and the bursting charge of pebble and fine grain powder gradually poured in. The shell is tapped on the outside by a wood mallet to settle the powder down. When all the powder has been got in, the neck of the bag is tied and pushed through the fuze hole. A few small shalloon primer bags, filled with seven drams of fine grain powder, are then inserted to fill up the shell and carry the flash from the fuze through the burster bag.

In the United States specially long common shell called *torpedo shell*, about 4·7 calibres in length, are employed with the coast artillery 12-in. mortars. They were made of cast steel, but owing to a premature explosion in a mortar, supposed to be due to weakness of the shell, they are now made of forged steel. The weight of the usual projectile for this mortar is 850 ℔. The torpedo shell, however, weighs 1000 ℔ and contains 137 ℔ of high explosive; it is not intended for piercing armour but for producing a powerful explosion on the armoured deck of a warship. The compression, and consequent generation of heat on discharge of the charge in these long shell, render them liable to premature explosion if fired with high velocities. Some inventors have, therefore, sought to overcome this by dividing the shell transversely into compartments and so making each portion of the charge comparatively short.

Cast-steel common shell (fig. 6) are cast in sand moulds head downwards from steel of the required composition to give the proper tenacity. A large head, which is subsequently removed, is cast on the base to give solidity and soundness to the castings. The castings are annealed by placing them in a furnace or oven until red hot, then allowing them to cool gradually. The process of casting is very similar to that for the old cast-iron commonshell, which, however, were cast base downwards. The steel castings after being annealed are dressed and carefully examined for defects. The exterior of the body is generally ground by an emery wheel or turned in a lathe; the groove for the driving band is also turned and the fuze hole fitted with a gun-metal bush. Forged-steel common shell are made from solid steel billets. These are heated to redness and shaped by a series of punches which force the heated metal through steel dies by hydraulic pressure. If the shell is intended for a nose fuze the base end is shaped by the press and the head subsequently formed by a properly shaped die, or, in the case of small shell, the head can, when red hot, be spun up in a lathe by a properly formed tool. For a base fuze shell the head is produced by the punches and dies, and the base is subsequently formed by pressing in the metal to the desired shape. The shell is then completed as described above.

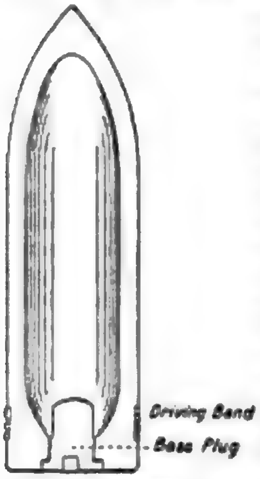


Fig. 6.—Pointed Common Shell (cast steel).

High-explosive shell (fig. 7), as used in the English service, are simply forged-steel common shell filled with lyddite and having a special nose fuze and exploder. The base end of lyddite shell is made solid to prevent the possibility of the gas pressure in the gun producing a premature explosion. In filling the shell great precautions are necessary to prevent the melted lyddite (picric acid) from coming in contact with certain materials such as combinations of lead, soda, &c., which produce sensitive picrates. The shell are consequently painted externally with a special non-lead paint and lacquered inside with special lacquer. The picric acid is melted in an oven, the temperature being carefully limited. The melted material is poured into the shell by means of a bronze funnel, which also forms the space for the exploder of picric powder. On cooling, the material solidifies into a dense, hard mass (density 1·6), in which state it is called *lyddite*. The fuze on striking ignites the exploder and in turn the lyddite. When properly detonated a dense black smoke is produced and the projectile is broken up into small pieces, some of which are almost of the fineness of grains of sand. The radius of the explosion is about 25 yds., but the local effect is intense, and hence on light structures in a confined space the destruction is complete. The shell is only of use against thin plates; against modern armour it is ineffective. When detonation has not been complete, as sometimes happens with small shells, the smoke is yellowish and the pieces of the exploded shell are as large as when a powder burster is used.

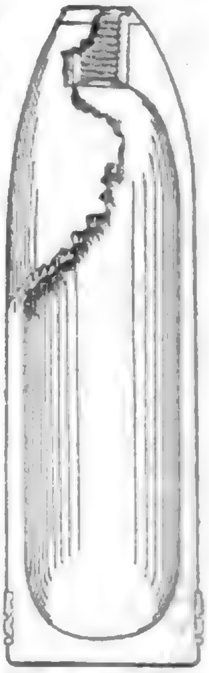


Fig. 7.—Lyddite Shell (forged steel).

The French high-explosive shell *obus torpille* or *obus à mélinite* was adopted in 1886. The *mélinite* was originally filled into the ordinary cast-iron common shell (*obus ordinaire*) with thick walls, but soon afterwards a forged-steel thin-walled shell (*obus allongé*) was introduced. To explode the shell a steel receptacle (called a *gaîne*) is screwed into the nose of the shell. It is filled with explosive and fitted with a detonator which is exploded by a percussion fuze. Except for the means adopted to ensure detonation this shell is practically the same as the lyddite shell.

Picric acid in some form or other is used in nearly all countries for filling high-explosive shell. In some the explosive is melted and poured into cardboard cases instead of being poured directly into the shell. The cases are placed in the shell either by the head of the shell unscrewing from the body or by a removable base plug. The French *mélinite* and the Italian *pertite* are believed to be forms of picric acid. Russia and the United States use compressed wet gun-cotton (density 1·2) as the charge for their high-explosive shell. The gun-cotton is packed in a thin zinc or copper case and is placed in the shell either by the head or base of the shell being removable. The gun-cotton is detonated by a powerful exploder, the form of which differs in each country. Ammonal is also used in high-explosive shell, but owing to its light density it is not in great favour. For field-gun and other small high-explosive shells, ordinary smokeless powder is often used.

Double shell is a term given to a common shell which was made abnormally long, so as to receive a large bursting charge. They were intended to be fired with a reduced charge at short range. They are now practically obsolete; their place with modern B.L. guns has been taken by high-explosive shell. *Star shell* are intended for illuminating the enemy's position. They are very similar to shrapnel shell, composition stars made up in cylindrical paper cases taking the place of the bullets. The shell on bursting, blows off the head and scatters the ignited stars. This shell is only supplied to mountain guns and howitzers, and takes the place of the older types of illuminating shell, viz. the *ground light ball* and the *parachute light ball*.

Hand grenades were used at the assault of entrenchments or in boat attacks. Although generally regarded as obsolete, they were much used by the Japanese at the siege of Port Arthur, 1904. In the British service they were small, thin, spherical common shell weighing 3 lb for land service and 6 lb for sea service, filled with powder. They were fitted with a small wood time fuze to burn 7·5 seconds. The grenade was held in the hand and the fuze lighted by a port-fire. It was then thrown some 20 to 30 yds. at the enemy's works or boats. Sometimes a number were fired from a mortar at an elevation of about 30° so that none should strike the ground too near the mortar. New types of grenades filled with high explosives detonated by a percussion fuze have been produced of late years, and it is probable that they will be again introduced into most countries.

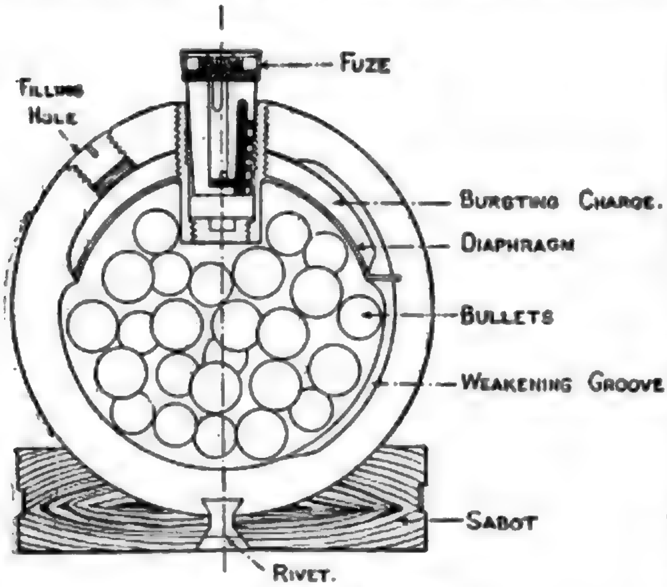


Fig. 8.—Boxer Shrapnel.

Shrapnel shell were invented by Lieutenant (afterwards Lieutenant-General) Henry Shrapnel, R.A. (1761–1842), in 1784. They were spherical common shell with lead bullets mixed with the bursting charge. Although far superior to common shell in man-killing effect, their action was not altogether satisfactory, as the shell on bursting projected the bullets in all directions, and there was a liability of premature explosion. In order to overcome these defects Colonel Boxer, R.A., separated the bullets from the bursting charge by a sheet-iron diaphragm—hence the name of "diaphragm shell" (fig. 8). The bullets were hardened by the addition of antimony, and, as the bursting charge was small, the shell was weakened by four grooves made inside the shell extending from the fuze hole to the opposite side.

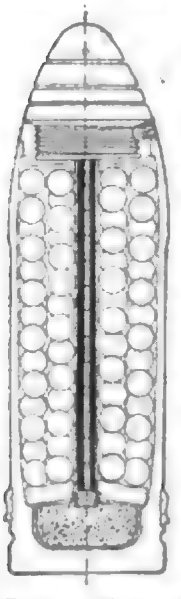


Fig. 9.—Shrapnel Shell.

With rifled guns the form of the shell altered, but its character remained. The body of the shell was still made of cast iron with a cavity at the base for the bursting charge; on this was placed a thick steel diaphragm with a hollow brass tube which communicated the flash from the nose fuze to the bursting charge. The body was filled with hard lead bullets, and a wood head covered with sheet iron or steel surmounted it and carried the fuze. By making the body of toughened steel (fig. 9) and by slightly reducing the diameter of the bullets, the number of bullets contained was much increased. In the older field shrapnel, bullets of 18 and 34 to the lb were used; for later patterns see table in Ordnance: *Field Equipments*. Thus with the cast-iron body the percentage of useful weight, *i.e.* the proportion of the weight of the bullets to the total weight of the shell, was from 26 to 28 %, while with modern steel shell it is from 47 to 53 %. The limit of the forward effect of shrapnel at effective range is about 300 yds. and the extent of front covered 25 yds.

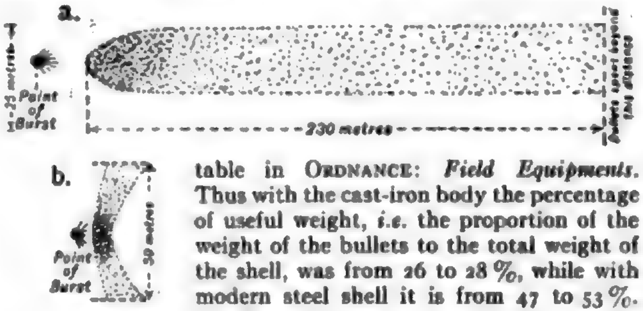


Fig. 10.

[Fig. 10 shows in plan the different effects of (*a*) shrapnel and of (*b*) high-explosive, burst in the air with a time fuze in the usual way. It will be seen that the shrapnel bullets sweep an area of about 250 yds. by 30 yds., half the bullets falling on the first 50 yds. of the beaten zone. With the high-explosive shell, however, the fragments strike the ground closer to the point of burst and beat a shallow, but broad, area of ground (about 7 yds. by 55 yds.). These areas show the calculated performance of the German field gun (96 N.A.), firing at a range of 3300 yds. In the case of the high-explosive shell, the concussion of the burst is highly dangerous, quite apart from the actual distribution of the fragments of the shell.]

The term "*shooting shrapnel*" is given to certain howitzer shrapnel, which are designed to contain a large bursting charge for the purpose of considerably augmenting the velocity of the bullets when the shell bursts.

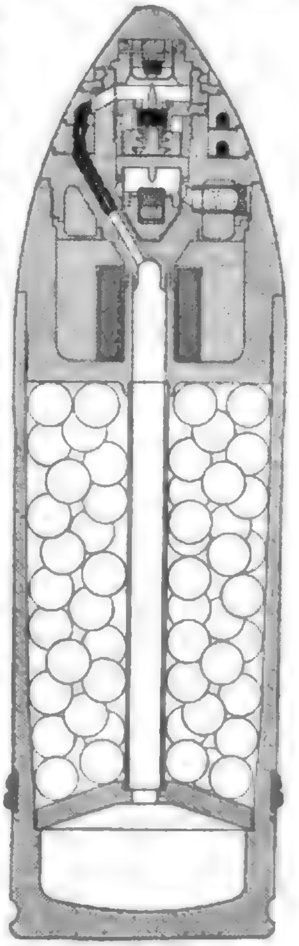


Fig. 11.—High-Explosive Shrapnel (Ehrhardt).

High-explosive shell of a compound type have also lately appeared. Messrs Krupp have made a kind of ring shell with a steel body; a central tube conveys the flash from the fuze to a base magazine containing a smoke-producing charge, while surrounding the central tube is a bursting charge of ordinary smokeless nitro-powder. A shrapnel on somewhat similar lines has been made by Ehrhardt; in form (fig. 11) it is an ordinary shrapnel with base burster, but near the head is a second magazine filled with a high-explosive charge; this is attached to the end of the fuze and is so arranged that when the shell is burst as time shrapnel the flash from the fuze passes clear of the high-explosive magazine and ignites only the base magazine, the bullets being blown out in the usual manner. When, however, the fuze acts on graze, the percussion part detonates the high-explosive charge and the bullets are blown out sideways and thus reach men behind shields, &c. (fig. 10). There is some loss of bullet capacity in this shell, and it appears likely that the bullets will be materially deformed when detonation occurs; the advantages may, however, counterbalance their objections.

Segment and *ring shell* are varieties of shrapnel, the interior of the shell being built up of cast-iron segments or rings (which break up into segments) about a tinned-iron cylinder which formed the magazine of the shell. The shell was completed by a cast-iron body formed around the segments or rings. The German army in 1870 employed ring shell almost exclusively against the French. The French found that common shell (*obus ordinaire*) when made of cast iron broke up on bursting into a small number of irregularly shaped pieces, and in order to obtain a systematic fragmentation for small shells they adopted a variety of projectiles of the segment and shrapnel types. With the improvements made latterly these have become obsolete, and the French system does not now materially differ from that employed in England and other countries. The old shell are, however, of sufficient interest to be enumerated; thus the "double-walled shell" (*obus à double paroi*) was built up of two shells, the internal portion had a cylindrical chamber for the bursting charge, but on the outside it was so shaped as to break up into well-defined pieces; the external portion of the shell was cast around the internal part, and also broke up into a number of pieces; this shell was liable to premature explosion. The *obus à couronnes de balles* (1879) was practically a segment shell with cast-iron balls in lieu of segments; thin iron partitions separated each layer, and the balls were flattened where they came in contact with the plates. The *obus à balles libres*, adopted in 1880, were of the same type, but there were no separating plates. The *obus à anneaux* was simply a ring shell of the same type as used in England. The *obus à mitraille* adopted in 1883 for field and siege guns had a cast-iron disc for its base with the body built up of segments and steel balls; a hollow ogival head surmounted this and a thin steel envelope bound all together. The head was filled with powder and fitted with a fuze; on explosion the head burst and rupturing the envelope set free the balls and segments.

It is of importance in firing shrapnel shell that the position of the burst shall be plainly seen. With the larger patterns of shell this presents no difficulty, but with the shrapnel for field guns which contain a small bursting charge only, and at long range in certain states of the atmosphere, the difficulty becomes pronounced. The problem has been solved in some cases by packing the bullets in fine grain black powder (instead of resin) and compressing both bullets and powder in order to prevent the generation of heat when the bullets set back on the discharge of the gun. In Germany a mixture of red amorphous phosphorus and fine grain powder is used for the same purpose and produces a dense white cloud of smoke. In Russia a mixture of magnesium and antimony sulphide is used.

Fuzes.—The fuzes first used were short iron or copper tubes filled with slow-burning composition. They were roughly screwed on the exterior to fit a similar thread in the fuze hole of the shell. There was no means of regulating the length of time of burning, but later, about the end of the 17th century, the fuze case was made of paper or wood, so that, by boring a hole through the outer casing into the composition, the fuze could be made to burn approximately for a given time before exploding the shell—or the fuze could be cut to the correct length for the same purpose.

Early attempts to produce percussion fuzes were unsuccessful, but the discovery of fulminate of mercury in 1799 finally afforded the means of attaining this object. Some fifty years, however, elapsed before a satisfactory fuze was made. This was the Pettman fuze, in which a roughened ball covered with detonating composition was released by the discharge of the gun. When the shell hit any object, the ball struck against the interior walls of the fuze, the composition was exploded and thence the bursting charge of the shell. At present there are three types of percussion fuzes—(1) those which depend on the gas pressure in the gun setting the pellet of the fuze free—this type is necessarily a base fuze; (2) those which rely on the shock of discharge or the rotation of the shell setting the pellet free, as in various kinds of nose and base fuzes; (3) those relying on direct impact with the object.

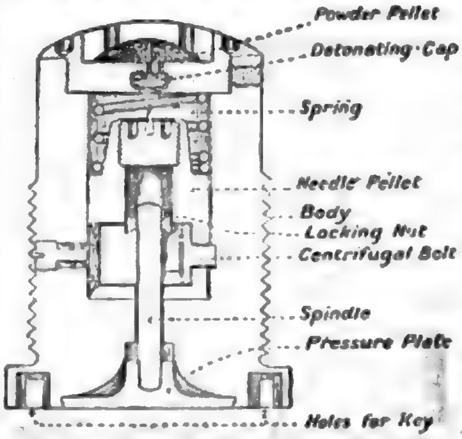


FIG. 12.—Base Percussion Fuze (scale ½).

The British base percussion fuze (fig. 12) illustrates type (1). In this, before firing, thei needle pellet is held back by a central spindle with a pressure plate attached to its rear end. For additional safety a centrifugal bolt is added which is released by the rotation of the shell. On discharge, the gas pressure pushes the pressure plate in, the central spindle is carried forward with it and unlocks the centrifugal bolt; this is withdrawn by the rotation of the shell, and the needle pellet is then free to move forward and explode the detonating cap when the shell strikes.

Type (2) is that usually adopted in small base fuzes and in the percussion part of "time and percussion" fuzes. Here the ferrule, on shock of discharge, moves back relatively to the percussion pellet by collapsing the stirrup spring; this leaves the pellet free to move forward, on the shell striking, and its detonator to strike the needle fixed in the fuze body. A spiral spring prevents any movement of the pellet during flight.

The direct-action or impact fuzes of type (3) are very simple (see fig. 13 of direct-action fuze). They are made of such a strength that during discharge nothing happens, but on striking an object the needle disc is crushed in and the needle explodes the detonating composition and thence the powder.

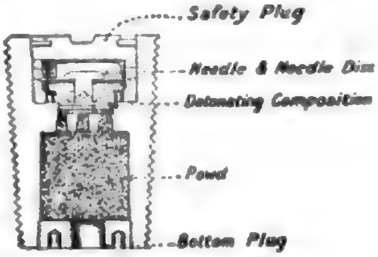


FIG. 13.—Direct-Action Percussion Fuze (scale ½).

The action of all time fuzes is started by the discharge of the gun. By this the pellet strikes the detonator and so ignites a length of slow-burning composition which is pressed into a wood tube or into a channel formed in a metal ring. To regulate the time of burning of the wood fuze, a hole is bored through into the composition as before stated, so that when it has burnt down to this hole one of the side channels filled with powder is ignited and explodes the shell. Wood fuzes are now only used for R.M.L. guns.

With modern long-burning fuzes (fig. 14), two composition time rings are used. The lower of these rings is made movable so that it can be turned to bring any desired place over a hole in the body of the fuze, which is filled with powder and communicates with the magazine. On the gun being fired the detonator is exploded and its flash ignites the upper time ring. This burns round to a passage made in the lower ring, when the lower ring begins to burn and continues to do so until the channel to the magazine is reached. The gases from the ignited composition escape from an external hole made in each time ring.

Mechanical time fuzes depending on the rotation of the shell to give a regular motion to clockwork have been tried, but so far no practicable form of these fuzes has been found.

It is important that all fuzes should be rigidly guarded against dampness, which tends to lengthen their time of burning; hence they are protected either by being kept in hermetically sealed tins holding one or more fuzes, or by some similar means.

Tubes and Primers.—In ancient times various devices were adopted to ignite the charge. Small guns were fired by thrusting a hot wire down the vent into the charge, or slow-burning powder was poured down the vent and ignited by a hot wire.

Later the priming powder was ignited by a piece of slow match held in a lint-stock (often called linstock). About A.D. 1700 this was effected by means of a port-fire (this was a paper case about 16 in. long filled with slow-burning composition which burnt rather more than 1 in. per minute). Later again the charge was exploded by paper tubes (sometimes called Dutch tubes) filled with powder and placed in the vent and ignited by a port-fire. In comparatively modern times friction tubes have been used, while in the latest patterns percussion or electric tubes are employed.

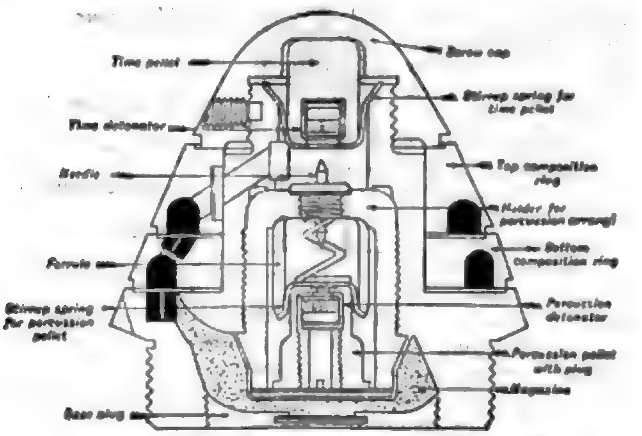

Time pellet
Screw cap
Stirrup spring for time pellet
Time detonator
Needle
Top composition ring
Holder for percussion arrangt
Bottom composition ring
Ferrule
Stirrup spring for percussion pellet
Percussion detonator
Percussion pellet with plug
Magazine
Base plug

FIG. 14.—Fuze, Time and Percussion, No. 80, Mk. I.

In most B.L. guns it is essential to stop the erosion of the metal of the vent by preventing the escape of gas through it when the gun is fired. For this purpose the charges in such guns are ignited by "vent-sealing tubes." For M.L. guns and small B.L. guns radially vented, especially those using black powder, the amount of erosion in the vent is not so serious. The charge is fired by ordinary friction tubes, which are blown away by the escape of gas through the vent. In all guns axially vented, vent-sealing tubes, which are not blown out, must be employed so that the men serving the gun may not be injured.

The common friction tube is a copper tube, driven with powder, having at the upper end a short branch (called a nib piece) at right angles. This branch is filled with friction composition in which a friction bar is embedded. On the friction bar being sharply pulled out, by means of a lanyard, the composition is ignited and sets fire to the powder in the long tube; the flash is conveyed through the vent and explodes the gun charge. For naval purposes, in order that the sailors should not be cut about the face or hurt their feet, tubes of quill instead of copper were used. If friction tubes are employed when cordite or other smokeless powder charges are used, the erosion of the vent is very rapid unless the escape of the gas is prevented; in this case T-headed tubes (fig. 15) are used. They are similar in action to the ordinary type, but are fixed to the vent by the head fitting a bayonet joint formed with the vent. The explosion blows a small ball upwards and blocks the coned hole at the top of the tube and so prevents any rush of gas.

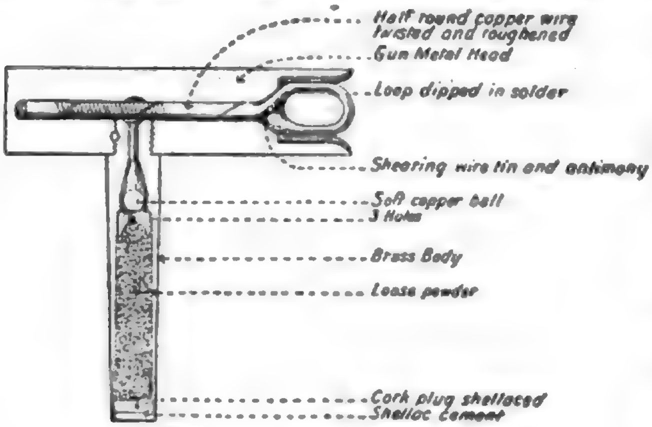

Half round copper wire twisted and toughened
Gun Metal Head
Loop dipped in solder
Sheering wire tin and antimony
Soft copper ball
3 Holes
Brass Body
Loose powder
Cork plug shellaced
Shellac cement

FIG. 15.—T-headed Friction Tube.

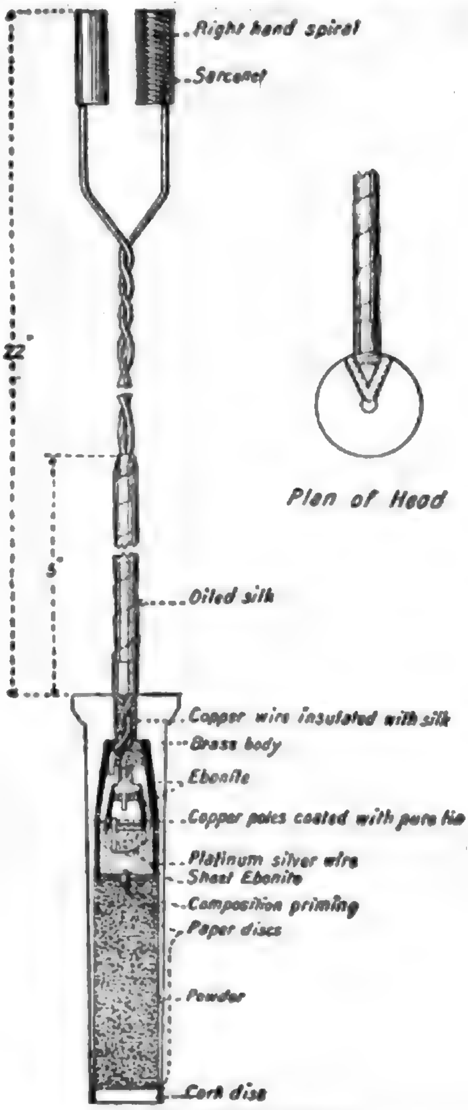

Right hand spiral
Sarcenet
22"
5"
Oiled silk
Copper wire insulated with silk
Brass body
Ebonite
Copper poles coated with pure tin
Platinum silver wire
Sheet Ebonite
Composition priming
Paper discs
Powder
Cork disc
Plan of Head

FIG. 16.—Electric Tube.

The vent-sealing tube accurately fits into a chamber formed at the end of the vent, and is held in place by the gun lock or some similar means. The force of the explosion expands the tube against the walls of its chamber, while the internal structure of the tube renders it gas-tight, any escape of gas through the vent being thus prevented.

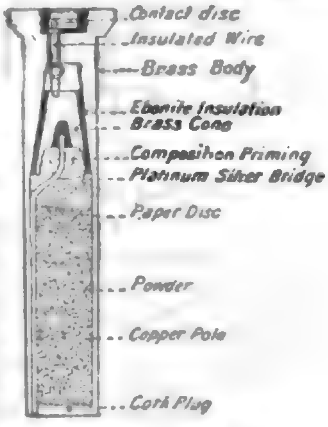

Contact disc
Insulated Wire
Brass Body
Ebonite Insulation
Brass Cone
Composition Priming
Platinum Silver Bridge
Paper Disc
Powder
Copper Pole
Cork Plug

FIG. 17.—Wireless Tube.

In the English service electric tubes (in the United States called "primers") are mostly used, but percussion or friction tubes are in most favour on the continent, and electric tubes are seldom or never used. There are two types of electric tube, one with long wires (fig. 16) for joining up with the electric circuit and the other without external wires. The first type has two insulated wires led into the interior and attached to two insulated brass cones which are connected by a wire "bridge" of platinum silver. This bridge is surrounded by a priming composition of gun-cotton dust and mealed powder and the remainder of the tube is filled with powder. On an electric current passing, the bridge is heated to incandescence and ignites the priming composition.

In the wireless tube (fig. 17) the lock of the gun makes the electric contact with an insulated disc in the head of the tube. This disc is connected by an insulated wire to a brass cone, also insulated, the bridge being formed from an edge of the cone to a brass wire which is soldered to the mouth of the tube. Priming composition surrounds the bridge and the tube is filled with powder. The electric circuit passes from the gun lock to the disc, thence through the bridge to the body of the tube, returning through the metal of the gun and mounting.

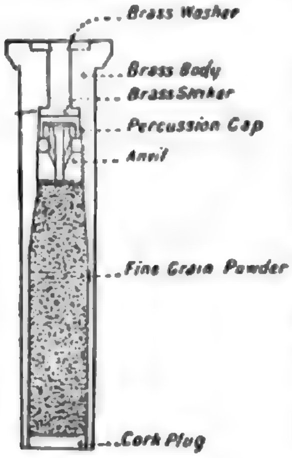
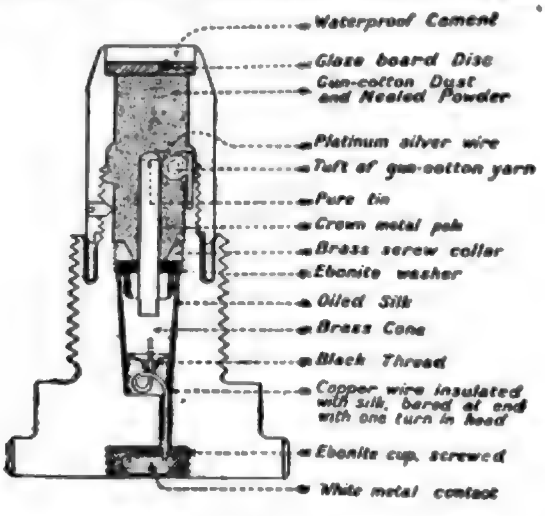

Brass Washer
Brass Body
Brass Striker
Percussion Cap
Anvil
Fine Grain Powder
Cork Plug

FIG. 18.—Primer.

The percussion tube (fig. 18) has a similarly shaped body to the wireless electric tube, but the internal construction differs; it is fitted with a striker, below which is a percussion cap on a hollow brass anvil, and the tube is filled with powder.

With Q.F. guns (that is, strictly, those using metallic cartridge cases) the case itself is fitted with the igniting medium; in England these are called primers. For small guns the case contains a percussion primer, usually a copper cap filled with a chlorate mixture and resting against an anvil. The striker of the gun strikes the cap and fires the mixture. For larger guns an electric primer (fig. 19) is used, the internal construction and action of which are precisely similar to the wireless tube already described; the exterior is screwed for the case. For percussion firing an ordinary percussion tube is placed in an adapter screwed into the case. In some foreign services a combined electric and percussion primer is used; the action of this will be understood from fig. 20.


Waterproof Cement
Glaze board Disc
Gun-cotton Dust and Mealed Powder
Platinum silver wire
Tuft of gun-cotton yarn
Pure tin
Crown metal pole
Brass screw collar
Ebonite washer
Oiled Silk
Brass Cone
Black Thread
Copper wire insulated with silk, bared at end with one turn in head
Ebonite cup, screwed
White metal contact

Section Full Size

FIG. 19.—Electric Primer.

Cartridges.

The first cartridges for cannon were made up of gunpowder packed in a paper bag or case. For many years after the introduction of cannon the powder was introduced into the bore by means of a scoop-shaped ladle fixed to the end of a long stave. The ladle was made of the same diameter as the shot, and it had a definite length so that it was filled once for the charging of small guns but for larger guns the ladle had to be filled twice or even thrice. The rule was to make the powder charge the same weight as that of the shot.

Cartridges made up in paper or canvas bags were afterwards used in forts at night-time or on board ship, so that the guns could be more rapidly loaded and with less risk than by using a ladle. Before loading, a piece of the paper or canvas covering had to be cut open immediately under the vent; after the shot had been rammed home the vent was filled with powder from a priming horn, and the gun was then fired by means of a hot iron, quick match or port-fire.

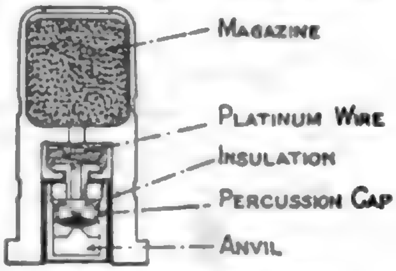

MAGAZINE
PLATINUM WIRE
INSULATION
PERCUSSION CAP
ANVIL

FIG. 20.—Combined Primer.

The ancient breech-loading guns were not so difficult to load, as the powder chamber of the gun was removable and was charged by simply filling it up with powder and ramming a wad on top to prevent the escape of the powder.

Paper, canvas and similar materials are particularly liable to smoulder after the gun has been fired, hence the necessity of well sponging the piece. Even with this precaution accidents often occurred owing to a cartridge being ignited by the still glowing débris of the previous round. In order to prevent this, bags of non-smouldering material, such as flannel, serge or silk cloth are used; combustible material such as woven gun-cotton cloth has also been tried, but there are certain disadvantages attending this.

All smokeless powders are somewhat difficult to ignite in a gun, so that in order to prevent hang-fires every cartridge has a primer or igniter, of ordinary fine grain gunpowder, placed so as to intercept the flash from the tube; the outside of the bag containing this igniter is made of shalloon, to allow the flash to penetrate with ease. The charge for heavy guns (above 6 in.) is made up in separate cartridges containing half and quarter charges, both for convenience of handling, and to allow of a reduced charge being used.

The cartridges are made of a bundle of cordite, or other smokeless powder, tightly tied with silk, placed in a silk cloth bag with the primer or igniter stitched on the unclosed end; the exterior is taped with silk cloth tape so as to form a stiff cartridge. For some of the longer guns, the exterior of the cartridge is conveniently made of a coned shape, the coned form being produced by building up layers outside a cylindrical core. In these large cartridges a silk cord becket runs up the centre with a loop at the top for handling (fig. 21).

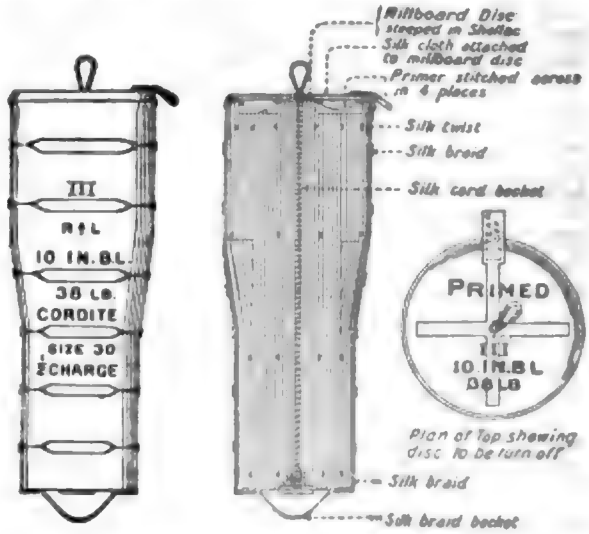

III
R L
10 IN. B.L.
38 LB.
CORDITE
SIZE 30
½ CHARGE
Millboard Disc steeped in Shellac
Silk cloth attached to millboard disc
Primer stitched across in 4 places
Silk twist
Silk braid
Silk cord becket
PRIMED
III
10 IN. B.L
38 LB
Plan of Top shewing disc to be torn off
Silk braid
Silk braid becket

FIG. 21.—10-inch B.L. Gun Cartridge.

For howitzers, variable charges are used, and are made up so that the weight can be readily altered. The following typical instance (fig. 22) will serve to show the general method of making up such charges, whether for B.L. or Q.F. howitzers. Small size cordite is used, and the charge is formed of a mushroom-shaped core, made up in a shalloon bag; on the stalk, so as to be easily removed, three rings of cordite are placed. The bottom of the core contains the primer, and the rings can be attached to the core by two silk braids. The weight of the rings is graduated so that by detaching one or more the varying charges required can be obtained.

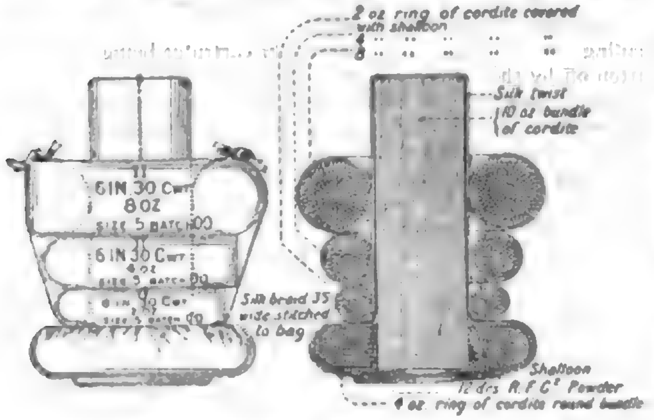

2 oz ring of cordite covered with shalloon
4 .. ..
6 .. ..
Silk twist
10 oz bundle of cordite
6 IN 30 Cwt 8 OZ SIZE 5 BATCH 00
6 IN 30 Cwt 4 OZ SIZE 5 BATCH 00
6 IN 30 Cwt SIZE 5 BATCH 00
Silk braid 35 wide stitched to bag
Shalloon
12 drs R.F.G² Powder
4 oz. ring of cordite round bundle

FIG. 22.—6-inch B.L. Howitzer Cartridge.

For quick-firing guns the charge is contained in a brass case to which is fitted a primer for igniting the charge. This case is inserted into the gun, and when fired slightly expands and tightly fits the chamber of the gun, thus acting as an obturator and preventing any escape of gas from the breech. This class of ammunition is especially useful for the smaller calibres of guns, such as 3-pr., 6-pr. and field guns, but Messrs Krupp also employ metallic cartridge cases for the largest type of gun, probably on account of the known difficulty of ensuring trustworthy obturation by any other means practicable with sliding wedge guns.

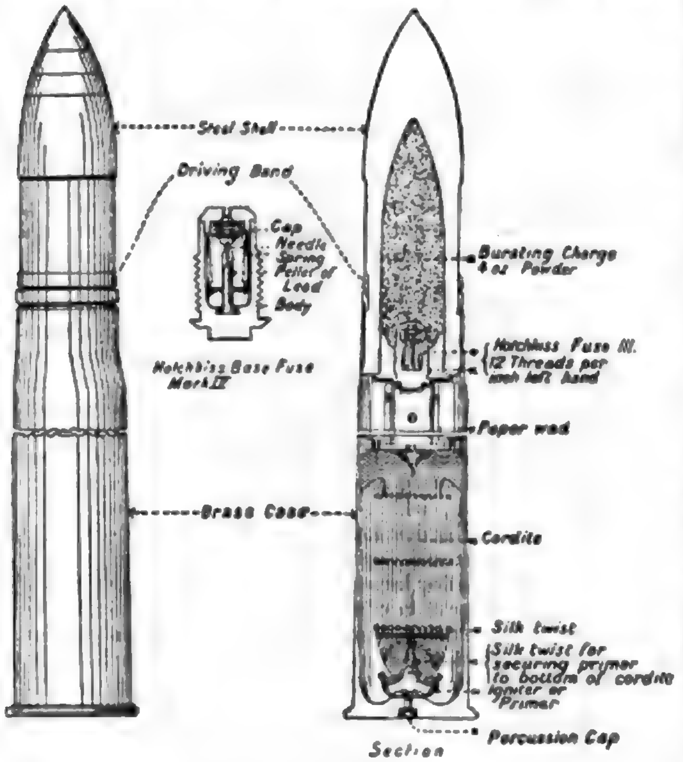

Steel Shell
Driving Band
Cap
Needle
Spring
Pellet of Lead
Body
Hotchkiss Base Fuse Mark IV
Bursting Charge 4 oz Powder
Hotchkiss Fuse III.
12 Threads per inch left hand
Paper wad
Brass Case
Cordite
Silk twist
Silk twist for securing primer to bottom of cordite
Igniter or Primer
Percussion Cap
Section

FIG. 23.—6-pr. Q.F. Cartridge (scale ¼).

The charges for these cases are made up in a very similar manner to those already described for B.L. guns. Where necessary, distance pieces formed of *papier-mâché* tubes and felt wads are used to fill up the space in the case and so prevent any movement of the charge. The mouth of the case is closed either by the base end of the projectile (fig. 23), in which case it is called "fixed ammunition" or "simultaneous loading ammunition," or by a metallic cap (fig. 24), when it is called "separate loading ammunition," the projectile and charge being thus loaded by separate operations. (A. G. H.)

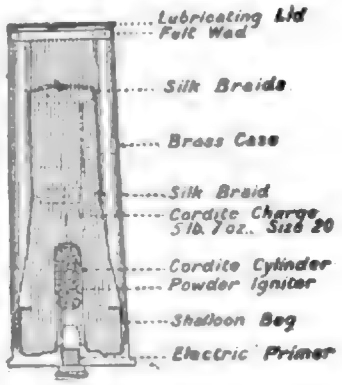

Lubricating Lid
Felt Wad
Silk Braids
Brass Case
Silk Braid
Cordite Charge 5 lb. 7 oz.. Size 20
Cordite Cylinder
Powder Igniter
Shalloon Bag
Electric Primer

FIG. 24.—4·7-inch Q.F. Cartridge (greatly reduced scale).

Small-arms ammunition.

The Bullet.— The original musket bullet was a spherical leaden ball two sizes smaller than the bore, wrapped in a loosely fitting paper patch which formed the cartridge. The loading was, therefore, easy with the old smooth-bore Brown Bess and similar military muskets. The original muzzle-loading rifle, on the other hand, with a closely fitting ball to take the grooves, was loaded with difficulty, particularly when foul, and for this reason was not generally used for military purposes.

In 1826 Delirque, a French infantry officer, invented a breech with abrupt shoulders on which the spherical bullet was rammed down until it expanded and filled the grooves. The objection in this case was that the deformed bullet had an erratic flight. The Brunswick rifle, introduced into the British army in the reign of William IV., fired a spherical bullet weighing 557 grs. with a belt to fit the grooves. The rifle was not easily loaded, and soon fouled. In 1835 W. Greener produced a new expansive bullet, an oval ball, a diameter and a half in length, with a flat end, perforated, in which a cast metallic taper plug was inserted. The explosion of the charge drove the plug home, expanded the bullet, filled the grooves and prevented windage. A trial of the Greener bullet in August 1835, at Tynemouth, by a party of the 60th (now King's Royal) Rifles, proved successful. The range and accuracy of the rifle were retained, while the loading proved as easy as with a smooth-bore musket. The invention was, however, rejected by the military authorities on the ground that the bullet was a compound one. In 1852 the government awarded Minié, a Frenchman, £20,000 for a bullet of the same principle, adopted into the British service. Subsequently, in 1857, Greener was also awarded £1000 for "the first public suggestion of the principle of expansion, commonly called the Minié principle, in 1836." The Minié bullet contained an iron cup in a cavity in the base of the bullet. The form of the bullet was subsequently changed from conoidal to cylindro-conoidal, with a hemispherical iron cup. This bullet was used in the Enfield rifle introduced into the British army in 1855. It weighed 530 grs., and was made up into cartridges and lubricated as for the Minié rifle. A boxwood plug to the bullet was also used. The bullet used in the breech-loading Martini-Henry rifle, adopted by the British government in 1871 in succession to the Snider-Enfield rifle, weighed 480 grs., and was fired from an Eley-Boxer cartridge-case with a wad of wax lubrication at the base of the bullet.

Between 1854 and 1857 Sir Joseph Whitworth conducted a long series of rifle experiments, and proved, among other points, the advantages of a smaller bore and, in particular, of an elongated bullet. The Whitworth bullet was made to fit the grooves of the rifle mechanically. The Whitworth rifle was never adopted by the government, although it was used extensively for match purposes and target practice between 1857 and 1866, when it was gradually superseded by Metford's system mentioned below.

The next important change in the history of the rifle bullet occurred in 1883, when Major Rubin, director of the Swiss Laboratory at Thun, invented the small-calibre rifle, one of whose essential features was the employment of an elongated compound bullet, with a leaden core in a copper envelope. About 1862 and later, W. E. Metford had carried out an exhaustive series of experiments on bullets and rifling, and had invented the important system of light rifling with increasing spiral, and a hardened bullet. The combined result of the above inventions was that in December 1888 the Lee-Metford small-bore ·303 rifle, Mark I., was finally adopted for the British army. The latest development of this rifle is now known as the ·303 Lee-Enfield, which fires a long, thin, nickel-covered, leaden-cored bullet 1·25 in. long, weighing only 215 grs., while the Martini-Henry bullet, 1·27 in. in length and ·45 in. in diameter, weighed 480 grs.

The adoption of the smaller elongated bullet, necessitated by the smaller calibre of the rifle, entailed some definite disadvantages. The lighter bullet is more affected by wind. Its greater relative length to diameter necessitates a sharper pitch of rifling in order properly to revolve the bullet (one turn in 10 in. for the ·303 rifle as compared with one turn in 22 in. for the Martini-Henry). This, in its turn, necessitates a hard nickel envelope for the leaden bullet in order to prevent its "stripping," or being forced through the barrel without rotation. The general result is that, while the enveloped bullet has a much higher penetrative power than one of lead only, it does not usually inflict so severe a wound, nor has it such a stunning effect as the old lead bullet. It cuts a small clean hole, but does not deform. This fact is of some military importance, as, for example, in warfare with savages, in which the chief danger is usually a rush of large numbers at close quarters. The advantages, however, of the smaller calibre and the lighter bullet and ammunition are considered to outweigh the disadvantages, and they have been universally adopted for all military rifles.

Bullets for target and sporting-rifles have, in the main, followed, or occasionally preceded, the line of progress of military rifle bullets. In 1861 Henry introduced a modification of the grooving of the cylindrical Whitworth bullet, and in 1864 and 1865 the Rigby mechanically fitting bullet was used with success at the National Rifle Association meeting, and in the second stage of the Queen's prize. The bullets of sporting rifles, and particularly those of Express rifles, are often lighter than military bullets, and made with hollow points to ensure the expansion of the projectile on or after impact. The size and shape of the hollow in the point vary according to the purpose required and the nature of the game hunted. If greater penetration is needed, the leaden bullet is hardened with mercury or tin, or the military nickel-coated bullet is used with the small-bore, smokeless-powder rifles. Explosive bullets filled with detonating powder were at one time used in Express and large-bore rifles for large game. The use of these bullets is now practically abandoned owing to their uncertainty of action and the danger involved in handling them. Their use in warfare is prohibited by international law.

The nickel-covered bullet, when used in a modern small-bore rifle for sporting purposes, is made into an expanding bullet, either by leaving the leaden core uncovered at the nose of the bullet, with or without a hollow point, or by cutting transverse or longitudinal nicks of varying depth in the point or circumference of the bullet.

A cone-shaped sharp-pointed bullet, named the Spitzer bullet, has been tried in the United States under the auspices of the Ordnance Department, in a Springfield rifle, which is practically identical with the British service ·303 Lee-Enfield. This bullet is lighter than the Lee-Enfield bullet (150 grs. as against 215 grs.), and when fired with a heavier charge of powder (51 grs. as against 31 grs.) gives, it is claimed, better results in muzzle-velocity, trajectory, deflexion from wind and wear and tear of rifling, than the present universally used cylinder-shaped bullet. In 1906 details of its prototype, the German "S" bullet (*Spitzgeschoss*), and of the French "D" bullet, were published.

The Cartridge.—The original cartridge for military small arms dates from 1586. It consisted of a charge of powder and a bullet in a paper envelope. This cartridge was used with the muzzle-loading military firearm, the base of the cartridge being ripped or bitten off by the soldier, the powder poured into the barrel, and the bullet then rammed home. Before the invention of the fire-lock or flint-lock, about 1635, the priming was originally put into the pan of the wheel-lock and anaphance muskets from a flask containing a fine-grained powder called serpentine powder. Later the pan was filled from the cartridge above described before loading. The mechanism of the flint-lock musket, in which the pan was covered by the furrowed steel struck by the flint, rendered this method of priming unnecessary, as, in loading, a portion of the charge of powder passed from the barrel through the vent into the pan, where it was held by the cover and hammer.

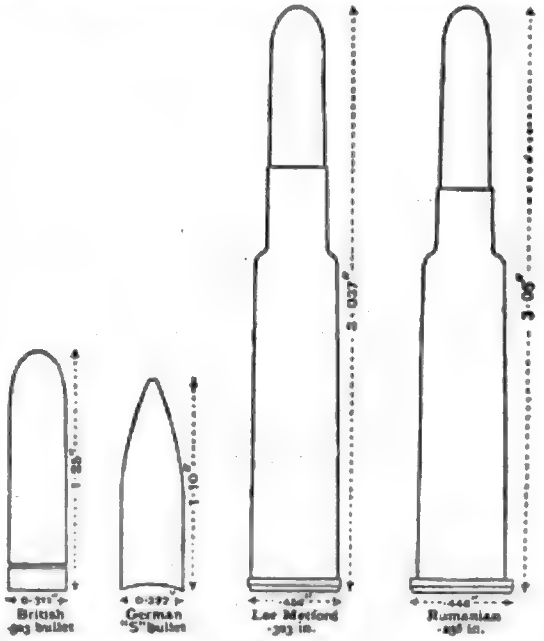


FIG. 25.

The next important advance in the method of ignition was the introduction of the copper percussion cap. This was only generally applied to the British military musket (the Brown Bess) in 1842, a quarter of a century after the invention of percussion powder and after an elaborate government test at Woolwich in 1834. The invention which made the percussion cap possible was patented by the Rev. A. J. Forsyth in 1807, and consisted of priming with a fulminating powder made of chlorate of potash, sulphur and charcoal, which exploded by concussion. This invention was gradually developed, and used, first in a steel cap, and then in a copper cap, by various gunmakers and private individuals before coming into general military use nearly thirty years later. The alteration of the military flint-lock to the percussion musket was easily accomplished by replacing the powder pan by a perforated nipple, and by replacing the cock or hammer which held the flint by a smaller hammer with a hollow to fit on the nipple when released by the trigger. On the nipple was placed the copper cap containing the detonating composition, now made of three parts of chlorate of potash, two of fulminate of mercury and one of powdered glass. The detonating cap thus invented and adopted, brought about the invention of the modern cartridge case, and rendered possible the general adoption of the breech-loading principle for all varieties of rifles, shot guns and pistols. Probably no invention connected with firearms has wrought such changes in the principle of gun construction as those effected by the expansive cartridge case. This invention has completely revolutionized the art of gunmaking, has been successfully applied to all descriptions of firearms, and has produced a new and important industry—that of cartridge manufacture.

Its essential feature is the prevention of all escape of gas at the breech when the weapon is fired, by means of an expansive cartridge case containing its own means of ignition. Previous to this invention shot guns and sporting rifles were loaded by means of powder flasks and shot flasks, bullets, wads and copper caps, all carried separately. The earliest efficient modern cartridge case was the pin-fire, patented, according to some authorities, by Houiller, a Paris gunsmith, in 1847; and, according to others, by Lefaucheux, also a Paris gunsmith, in or about 1850. It consisted of thin weak shell made of brass and paper which expanded by the force of the explosion, fitted perfectly into the barrel, and thus formed an efficient gas check. A small percussion cap was placed in the middle of the base of the cartridge, and was exploded by means of a brass pin projecting from the side and struck by the hammer. This pin also afforded the means of extracting the cartridge case. This cartridge was introduced in England by Lang, of Cockspur Street, London, about 1855.

The central-fire cartridge was introduced into England in 1861 by Daw. It is said to have been the invention of Pottet of Paris, improved upon by Schneider, and gave rise to much litigation in respect of its patent rights. Daw was subsequently defeated in his control of the patents by Eley Bros. In this cartridge the cap in the centre of the cartridge base is detonated by a striker passing through the standing breech to the inner face, the cartridge case being withdrawn, or, in the most modern weapons, ejected by a sliding extractor fitted to the breech end of the barrel, which catches the rim of the base of the cartridge.

This is practically the modern cartridge case now in universal use. In the case of shot guns it has been gradually inproved in small details. The cases are made either of paper of various qualities with brass bases, or entirely of thin brass. The wadding between powder and shot has been thickened and improved in quality; and the end of the cartridge case is now made to fit more perfectly into the breech chamber. These cartridges vary in size from 32 bore up to 4 bore for shoulder guns. They are also made as small as ·410 and ·360 gauge: their length varies from 1¾ in. to 4 in. Cartridges for punt guns are usually 1¼ in. in diameter and 9¾ in. in length.

In the case of military rifles the breech-loading cartridge case was first adopted in principle by the Prussians about 1841 in the needle-gun (*q.v.*) breech-loader. In this a conical bullet rested on a thick wad, behind which was the powder, the whole being enclosed in strong lubricated paper. The detonator was in the hinder surface of the wad, and fired by a needle driven forward from the breech, through the base of the cartridge and through the powder, by the action of a spiral spring set free by the pulling of the trigger.

In 1867 the British war office adopted the Eley-Boxer metallic central-fire cartridge case in the Enfield rifles, which were converted to breech-loaders on the Snider principle. This consisted of a block opening on a hinge, thus forming a false breech against which the cartridge rested. The detonating cap was in the base of the cartridge, and was exploded by a striker passing through the breech block. Other European powers adopted breech-loading military rifles from 1866 to 1868, with paper instead of metallic cartridge cases. The original Eley-Boxer cartridge case was made of thin coiled brass. Later the solid-drawn, central-fire cartridge case, made of one entire solid piece of tough hard metal, an alloy of copper, &c., with a solid head of thicker metal, has been generally substituted.

Central-fire cartridges with solid-drawn metallic cases containing their own means of ignition are now universally used in all modern varieties of military and sporting rifles and pistols. There is great variety in the length and diameter of cartridges for the different kinds and calibres of rifles and pistols. Those for military rifles vary from 2·2 in. to 2·25 in. in length, and from ·256 to ·315 gauge. For sporting rifles from 2¼ in. to 3¼ in. in length, and through numerous gauges from ·256 in. to ·600 in. For revolvers, pistols, rook and rabbit rifles, and for Morris tubes, cartridges vary from ·22 in. to ·301 in. in gauge. All miniature cartridges with light charges are made for breech adapters to enable ·303 military rifles to be used on miniature rifle ranges. All the above cartridges are central-fire. Rim-fire cartridges for rifles, revolvers and pistols vary from ·22 in. to ·56 in. gauge according to the weapon for which they are required. The cartridge for the British war office miniature rifle is ·22 calibre, with 5 grs. of powder and a bullet weighing 40 grs. Most modern military rifles are supplied with clip or charger loading arrangements, whereby the magazine is filled with the required number of cartridges in one motion. A clip is simply a case of cartridges which is dropped into the magazine; a charger is a strip of metal holding the bases of the cartridges, and is placed over the magazine, the cartridges being pressed out into the latter. Both clips and chargers, being consumable stores, may be considered as ammunition. (H. S.-K.)

AMNESTY (from the Gr. ἀμνηστία, oblivion), an act of grace by which the supreme power in a state restores those who may have been guilty of any offence against it to the position of innocent persons. It includes more than pardon, inasmuch as it obliterates all legal remembrance of the offence. Amnesties, which may be granted by the crown alone, or by act of parliament, were formerly usual on coronations and similar occasions, but are chiefly exercised towards associations of political criminals, and are sometimes granted absolutely, though more frequently there are certain specified exceptions. Thus, in the case of the earliest recorded amnesty, that of Thrasybulus at Athens, the thirty tyrants and a few others were expressly excluded from its operation; and the amnesty proclaimed on the restoration of Charles II. did not extend to those who had taken part in the execution of his father. Other celebrated amnesties are that proclaimed by Napoleon on the 13th of March 1815, from which thirteen eminent persons, including Talleyrand, were excepted; the Prussian amnesty of the 10th of August 1840; the general amnesty proclaimed by the emperor Francis Joseph of Austria in 1857; the general amnesty granted by President Johnson after the Civil War in 1868; and the French amnesty of 1905. The last act of amnesty passed in Great Britain was that of 1747, which proclaimed a pardon to those who had taken part in the second Jacobite rebellion.

AMOEBA, the Greek equivalent of the name "Amibe" given by Bery St Vincent to the Proteus animalcule of earlier naturalists, used as a quasi-popular term for any simple naked protist the sole external organs of which are pseudopodia, *i.e.* temporary outgrowths of the clearer outer layer of the soft protoplasmic body. It is also used as a generic name, and in its present limitations by E. Penard includes only those the pseudopodia of which are constantly changing, blunt outgrowths. In the former wider sense, amoebae are found in sluggish waters, fresh and salt, all over the world; they readily make their appearance in infusions putrefying after infection from aerially carried germs, and the leucocytes or colourless blood corpuscles of Metazoa are essentially amoebae in their structure and behaviour. The protoplasm of the individual is divided into a centrally placed body, the nucleus, of relatively stable shape, and the cytoplasm, itself divided into an outer, clearer ectoplasm ("ectosarc") and an inner, more granular endoplasm ("endosarc"), passing into one another. The movements of amoebae are of several kinds. (1) The amoeba may grow out irregularly into blunt lobes, the pseudopodia, some being emitted while others are retracted, and so may advance in any direction by the emission of pseudopodia thitherward, and the enlargement of these by the passage of the organism into them. (2) Again, it may advance by a sort of rolling: the lower surface, or that in contact with the substratum over or under which it is passing, is viscid and adheres to the substratum, the superficial dorsal layer passing forward and bending over to the ventral side; whilst the converse action takes place at the hinder end; (3) or again, the pseudopodia, when long, well marked and relatively permanent, may serve as actual limbs on which the body is supported and on which it moves. In the outgrowth of a pseudopod the process may take place gradually, the ectoplasm growing as it stretches, or it may take place by the limiting layer of the ectosarc bursting, as it were, and a rounded prominence of the endosarc protruding and at once forming a new "skin" or pellicle. This last mode, termed "eruptive," is common in the case of the enormous, multinucleate amoeba termed *Pelomyxa palustris*, which attains a diameter when contracted and spherical of as much as a line (over 2 mm.). From the ease with which amoebae are obtained and kept alive under the microscope, as well as from their identity in structure with the primitive elements of Metazoa, they have always been favourite objects of study for protoplasmic physiology under its simplest conditions. Among the investigators of protoplasmic movements we may cite F. Dujardin, O. Bütschli, L. Rhumbler and H. S. Jennings. The opening to the exterior of the contractile vesicle has been found here. *Pelomyxa* has yielded to A. E. Dixon and M. Hartog a peptic ferment, such as has been extracted by C. F. W. Krukenberg from the Myxomycete *Fuligo* (Flowers of Tan), which is the largest known naked mass of protoplasm without cellular differentiation.

Amoeba shows also the multiplication by fission, so characteristic of the cell: for the study of other modes of reproduction, spore formation and syngamic (or so-called fertilization) processes, fresh-water or salt-water amoebae are ill suited, and up to this date we do not know the life cycle of any free-living naked amoeba, though that of some parasitic forms and shell-bearers have been fully made out. Some amoebae are certainly young states of Myxomycetes. Encystment, the excretion of a membrane around the cell to tide over unfavourable circumstances, has been noted in almost all species.

Amoeba coli and *A. histolytica* are parasites in the gut of man, the former relatively harmless, the latter the cause of severe dysentery and hepatic abscess, common in India.

H. S. Jennings has recently made a full study of the movements of *Amoeba*, and of its general behaviour, and found therein many indications that these are on the whole such as we should expect of an organism working by "trial and error" rather than the uniform modes of non-living beings. Thus the operations of an amoeba ingesting a round, encysted *Euglena* are summed up thus: "One seems to see that the amoeba is trying to obtain this cyst for food, that it shows remarkable pertinacity in continuing its attempts to put forth efforts to accomplish this in various ways, and that it shows remarkable pertinacity in continuing its attempts to ingest the food when it meets with difficulties. Indeed the scene could be described in a much more vivid and interesting way by the use of terms still more anthropomorphic in tendency." (M. Ha.)

AMOL, or Amul, a town of Persia, in the province of Mazandaran, 23 m. W. of Barfurush, in 36° 28′ N. Lat. and 52° 23′ E. long. Pop. about 10,000. It is situated on both banks of the Heraz, or Herhaz river, which is crossed here by a very narrow stone bridge of twelve arches and flows into the Caspian Sea 12 m. lower down. Amol is not walled and is now a place of little importance, but in and around it there are ruins and ancient buildings which bear witness to its former greatness. Of these the most conspicuous is the mausoleum of Seyed Kavvam ud-din, king of Mazandaran, who died in 1379, and one old mosque dates from A.D. 793. The town has spacious and well-supplied bazaars and post and telegraph offices.

AMONTONS, GUILLAUME (1663–1705), French experimental philosopher, the son of an advocate who had left his native province of Normandy and established himself at Paris, was born in that city on the 31st of August 1663. He devoted himself particularly to the improvement of instruments employed in physical experiments. In 1687 he presented to the Academy of Sciences an hygrometer of his own invention, and in 1695 he published his only book, *Remarques et expériences physiques sur la construction d'une nouvelle clepsydre, sur les baromètres, les thermomètres et les hygromètres*. In 1699 he published some investigations on friction, and in 1702–1703 two noteworthy papers on thermometry. He experimented with an air-thermometer, in which the temperature was defined by measurement of the length of a column of mercury; and he pointed out that the extreme cold of such a thermometer would be that which reduced the "spring" of the air to nothing, thus being the first to recognize that the use of air as a thermometric substance led to the inference of the existence of a zero of temperature. In 1704 he noted that barometers are affected by heat as well as by the weight of the atmosphere, and in the following year he described barometers without mercury, for use at sea. Amontons, who through disease was rendered almost completely deaf in early youth, died at Paris on the 11th of October 1705.

'AMORA (Hebrew for "speaker" or "discourser"), a title applied to the rabbis of the 2nd to 5th centuries, *i.e.* to the compilers of the Talmud. Each *tana*—or rabbi of the earlier period—had a spokesman, who repeated to large audiences the discourses of the tana. But the 'amora soon ceased to be a mere repeater, and developed into an original expounder of scripture and tradition.

AMORITES, the name given by the Israelites to the earlier inhabitants of Palestine. They are regarded as a powerful people, giants in stature "like the height of the cedars," who had occupied the land east and west of the Jordan. The Biblical usage appears to show that the terms "Canaanites" and "Amorites" were used synonymously, the former being characteristic of Judaean, the latter of Ephraimite and Deuteronomic writers. A distinction is sometimes maintained, however, when the Amorites are spoken of as the people of the past, whereas the Canaanites are referred to as still surviving. The old name is an ethnic term, evidently to be connected with the terms Amurru and Amar, used by Assyria and Egypt respectively. In the spelling Mar-tu, the name is as old as the first Babylonian dynasty, but from the 15th century B.C. and downwards its syllabic equivalent Amurru is applied primarily to the land extending northwards of Palestine as far as Kadesh on the Orontes. The term "Canaan," on the other hand, is confined more especially to the southern district (from Gebal to the south of Palestine). But it is possible that the terms at an early date were interchangeable, Canaan being geographical and Amorite ethnical. The wider extension of the use of Amurru by the Babylonians and Assyrians is complicated by the fact that it was even applied to a district in the neighbourhood of Babylonia. If the people of the first Babylonian dynasty (about 21st century B.C.) called themselves "Amorites," as Ranke seems to have shown, it is possible that some feeling of common origin was recognized at that early date.

See Ranke, *Bab. Exped. Pennsylvania*, series D, iii. 33 sqq.; and for general information, W. M. Müller, *Asien u. Europa*, 217 sqq.; Pinches, *Old Testament*, Index (*s.v.*). The people of Amar are represented on the Egyptian monuments with yellow skin, blue eyes, red eyebrows and beard, whence it has been conjectured that they were akin to the Libyans (Sayce, *Expositor*, July 1888). Senir, the "Amorite" name of Hermon (Deut. iii. 9), appears to be identical with Saniru in the Lebanon, mentioned by Shalmaneser II. In the Old Testament the chief references may be classified as follows:—primitive inhabitants generally, Is. xvii. 9 (on text see comm.), Ezek. xvi. 3; a people W. of Jordan, Josh. x. 5; Judg. i. 34-36; Deut. i. 7, 44; Gen. xiv. 7; xlviii. 22; E. of Jordan, Num. xxi. 13, 21 sqq.; Josh. ii. 10, xxiv. 8; Judg. x. 8. See further Canaan, Palestine.

AMORPHISM (from *a*, privative, and μορφή, form), a term used in chemistry and mineralogy to denote the absence of regular or crystalline structure in a body; the adjective "amorphous," formless or of irregular shape, being also used technically in biology, &c.

AMORT, EUSEBIUS (1692–1775), German Catholic theologian, was born at Bibermühle, near Tölz, in Upper Bavaria, on the 15th of November 1692. He studied at Munich, and at an early age joined the Canons Regular at Polling, where, shortly after his ordination in 1717, he taught theology and philosophy. In 1733 he went to Rome as theologian to Cardinal Niccolo Maria Lercari (d. 1757). He returned to Polling in 1735 and devoted the rest of his life to the revival of learning in Bavaria. He died at Polling on the 5th of February 1775. Amort, who had the reputation of being the most learned man of his age, was a voluminous writer on every conceivable subject, from poetry to astronomy, from dogmatic theology to mysticism. His best known works are: a manual of theology in 4 vols., *Theologia* *eclectica, moralis et scholastica* (Augsburg, 1752; revised by Benedict XIV. for the 1753 edition published at Bologna); a defence of Catholic doctrine, entitled *Demonstratio critica religionis Catholicae* (Augsburg, 1751); a work on indulgences, which has often been criticized by Protestant writers, *De Origine, Progressu, Valore, et Fructu Indulgentiorum* (Augsburg, 1735); a treatise on mysticism, *De Revelationibus et Visionibus*, &c. (2 vols., 1744); and the astronomical work *Nova philosophiae planetarum et artis criticae systemata* (Nuremberg, 1723). The list of his other works, including his three erudite contributions to the question of authorship of the *Imitatio Christi*, will be found in C. Toussaint's scholarly article in A. Vacant's *Dict. de théologie* (1900, cols. 1115–1117).

AMORTIZATION (derived through the French from Lat. *ad*, and *mortem*, to death), literally an extinction or doing to death, a word formerly used of alienating lands in mortmain, and now for the paying off of a debt, particularly by means of a regular sinking-fund; thus "amortization" and "amortization fund" generally refer to the latter method of extinguishing some pecuniary liability.

AMORY, THOMAS (*c.* 1691–1788), British author, was born about 1691, his father being the secretary for the forfeited estates in Ireland. He was an eccentric character and seems to have lived a very secluded life. He published *Memoirs; containing the lives of several Ladies of Great Britain; a History of Antiquities &c.* (1755) and *Life of John Buncle Esq.* (1756 and 1766). Both books are an extraordinary mixture of fiction, autobiography, scenic description and theological discussion. Amory died on the 25th of November 1788.

AMOS, in the Bible, an Israelitish prophet of the 8th century B.C. He was a native of Tekoa, *i.e.* as most suppose, a place which still bears the same name 6 m. S. of Bethlehem. He was a shepherd, or perhaps a sheep-breeder, but combined this occupation with that of a tender of sycomore figs. It is true, the Tekoa just mentioned lies too high for sycomores; so it has been almost too ingeniously supposed that Amos may have owned a plantation of sycomores in the hill country leading down to Philistia, technically called the Shephēlah (*R.V.*, "lowland"). Here there were sycomores in abundance (1 Kings x. 27). That this was his usual occupation we learn from a better source than the heading (i. 1), viz. a narrative (vii. 10, 17), evidently of early origin, which interrupts the series of prophetic visions on the fall of the kingdom of Israel. Amos, it appears, though himself a Judahite, had been prophesying in the northern kingdom, when his activity was brought to an abrupt close by the head priest of the royal sanctuary at Bethel, Amaziah, who bade him escape to the land of Judah and get his living there. The reply of Amos is full of instruction. "No prophet am I; no prophet's son am I; a shepherd am I, and one who tends sycomore-figs. And Yahweh took me from behind the flock; and Yahweh said to me, Go, prophesy against my people Israel." The following words show that a prophet in ancient Israel had the utmost freedom of speech. It was far otherwise in the period of the fall of Judah. (See JEREMIAH.)

But what had Amos said that appeared so dangerous to the head priest? Amaziah summarizes it thus, "Jeroboam shall die by the sword, and Israel shall go away into captivity from his own land" (vii. 11; cf. vii. 9b, v. 27, vi. 7). He omits all the reasons for this stern prophecy. The reasons are that the good old Israelitish virtue of brotherliness is dying away, that oppression and injustice are rampant (ii. 6-8, iii. 9, 10, iv. 1, v. 11, 12, viii. 4-6), and that rites are practised in the name of religion which are abhorrent to Yahweh, because they either have no moral meaning at all, and are mere forms (v. 21-23), or else, judged from Amos's purified point of view, are absolutely immoral (ii. 7; cf. viii. 14). On the details of the captivity Amos preserves a mysterious vagueness. The fact, however, he puts forward with the confidence of one who is intimate with his God (iii. 7), and most probably it was at some great festival that he spoke the words which so perturbed Amaziah. The priest may not indeed himself have believed them, but he probably feared their effect on the moral courage of the people. And it is perhaps not arbitrary to suppose that the splendour of the ritual in Amos's time implies a tremulous anxiety that Israel's seeming prosperity under Jeroboam II. (see JEWS) may not be as secure as could be wished. For Amos cannot have been quite alone either in Israel or in Judah; there must have been a little flock of those who felt with Amos that there was small reason indeed to "desire the day of Yahweh" (v. 18; see Harper's note).

But why did Amos so emphatically decline to be called a prophet? A prophet in some true sense he certainly was, a prophet who, within his own range, has not been surpassed. He means this—that he is no mere ecstatic enthusiast or "dervish," whose primary aim is to keep up the warlike spirit of the people, taking for granted that Yahweh is on the people's side, and that he is perfectly free from the taint of selfishness, not having to support himself by his prophesying. He could not indeed tell Amaziah this, but it is nevertheless true that he was the founder, or one of the founders, of a new type of prophet. He was also either the first, or one of the first, to write down, or to get written down, the substance of his spoken prophecies, and perhaps also prophecies which he never delivered at all. This was the consequence of his ill success as a public preacher. The other prophets of the same order may be presumed to have been hardly less unsuccessful. Hence the new phenomenon of written prophecies. The literary skill of Amos leads one to suppose that he had prepared in advance for this, perhaps we may say, not altogether unfortunate necessity.

That there are many hard problems connected with the fascinating book of Amos cannot be denied. The one point on which we have indicated a doubt, viz. as to the situation of Tekoa, ought strictly to be accompanied by others. For instance, how came Amos to transfer himself to northern Israel? How hard it must have been to obtain a footing there while he was a mere student and observer! And how came he by his wide knowledge of people outside the limits of Israel? The most recent and elaborate commentator even calls him an "ethnologist." And lastly, whence came his mastery of the poetical and literary arts? Is he really the Columbus of written prophecy? And behind these questions is the fundamental problem of the text, which has been somewhat too slightly treated. The text of Hosea may be in a much worse condition, but a keen scrutiny discloses many an uncertainty, not to say impossibility, in the traditional form of Amos. That the text has been much adapted and altered is certain; not less obvious are the corruptions due to carelessness and accident.

The main divisions of the book are plain, viz. chaps. i.–ii., chaps. iii.–vi., and chaps. vii.–ix. This arrangement, however, is probably not due to Amos himself, or to his immediate disciples, but to some later redactor. A number of passages seem to have been inserted subsequently to the time of Amos, on which see *Ency. Bib.*, "Amos," and the introduction to Robertson Smith's *Prophets of Israel* (^{2}), though in some cases the final decision will have to be preceded by a more thorough examination of the traditional text. The most obvious non-Amosian passage in the book is the concluding passage, ix. 8-15, which has evidently supplanted the original close of the section. The meaning of the phrase "the tabernacle (booth) of David that is fallen" (ver. 11) is not perfectly clear. Beyond reasonable doubt, however, the writer seeks to take out the sting of the preceding passage in which Israel is devoted to utter destruction. The penitent and God-fearing Jews of the post-exilic age needed some softening appendix, and this the editor provided.

English readers are now well supplied with books on Amos. Driver's *Joel and Amos* (see JOEL) (1897) and G. A. Smith's *Twelve Prophets*, vol. i. (1896), supplement and illustrate each other. Harper's *Amos and Hosea* (see HOSEA) (1905) gives the cream of all the good things that have been said before, with a generally sound judgment; it is addressed to advanced students, and is perhaps less cautious than the two former. The German commentaries on the Minor Prophets by Nowack (2nd ed., 1903) and (especially) Marti (1904) must not, however, be neglected. Wellhausen's briefer work (3rd ed., 1898) is especially suggestive for textual criticism. Cheyne's *Critica Biblica* (1904), cf. his review of Harper in *Hibbert Journal*, iii. 824 ff., breaks new ground. (T. K. C.)

AMOS, SHELDON (1835–1886), English jurist, was educated at Clare College, Cambridge, and was called to the bar as a member of the Middle Temple in 1862. In 1869 he was appointed to the chair of jurisprudence in University College, London, and in 1872 became reader under the council of legal education and examiner in constitutional law and history to the university of London. Failing health led to his resignation of those offices, and he took a voyage to the South Seas. He resided for a short time at Sydney, and finally settled in Egypt, where he practised as an advocate. After the bombardment of Alexandria, and the reorganization of the Egyptian judicature, he was appointed judge of the court of appeal, but being without any previous experience of administrative work he found the strain too great for his health. He came to England on leave in the autumn of 1885, and on his return to Egypt he died suddenly at Alexandria on the 3rd of January 1886. His principal publications are: *Systematic View of the Science of Jurisprudence* (1872); *Lectures on International Law* (1873); *Science of Law* (1874); *Science of Politics* (1883); *History and Principles of the Civil Law of Rome as Aid to the Study of Scientific and Comparative Jurisprudence* (1883), and numerous pamphlets. His wife, Mrs Sheldon Amos (Sarah Maclardie Bunting), took a prominent part in Liberal Nonconformist politics and in movements connected with the position of women. She died at Cairo on the 21st of January 1908.

AMOY, a city and treaty-port in the province of Fuh-kien, China, situated on the slope of a hill, on the south coast of a small and barren island named Hiamen, in 24° 28′ N. and 118° 10′ E. It is a large and exceedingly dirty place, about 9 m. in circumference, and is divided into two portions, an inner and an outer town, which are separated from each other by a ridge of hills, on which a citadel of considerable strength has been built. Each of these divisions of the city possesses a large and commodious harbour, that of the inner town, or city proper, being protected by strong fortifications. There are dry-docks and an excellent anchorage. Amoy may be regarded as the port of the inland city of Chang-chow, with which it has river communication, and its trade, both foreign and coastwise, is extensive and valuable. The chief articles imported are sugar, rice, raw cotton and opium, as well as cotton cloths, iron goods and other European manufactures. The chief exports are tea, porcelain and paper. The trade carried on by means of Chinese junks is said to be large, and the native merchants are considered to be among the wealthiest and most enterprising in China. By other vessels the trade in 1870 was:—imports, £1,915,427; exports, £1,440,000. In 1904 the figures were:—imports, £2,081,494; exports, £384,494. The falling off of exports is due to the decreased demand for China tea, for which Amoy was one of the chief centres. The native population is now estimated at 300,000, and the foreign residents number about 280. A large part of the trade is that carried on with the neighbouring Japanese island of Formosa. The province of Fuh-kien is claimed by the Japanese as their particular sphere of influence. Amoy was captured by the British in 1841, after a determined resistance, and is one of the five ports that were opened to British commerce by the treaty of 1842; it is now open to the ships of all nations.

AMPELIUS, LUCIUS, possibly a tutor or schoolmaster, and author of an extremely concise summary—a kind of index—of universal history (*Liber Memorialis*) from the earliest times to the reign of Trajan. Its object and scope are sufficiently indicated in the dedication to a certain Macrinus: "Since you desire to know everything, I have written this 'book of notes,' that you may learn of what the universe and its elements consist, what the world contains, and what the human race has done." It seems to have been intended as a text-book to be learnt by heart. The little work, in fifty chapters, gives a sketch of cosmography, geography, mythology (chaps. i.–x.), and history (chap. x.–end). The historical portion, dealing mainly with the republican period, is untrustworthy, and the text in many places corrupt; the earlier chapters are more valuable, and contain some interesting information. In chap. viii. (*Miracula Mundi*) occurs the only reference in an ancient writer to the famous sculptures of Pergamum, discovered in 1871, excavated in 1878, and now at Berlin: "At Pergamum there is a great marble altar, 40 ft. high, with colossal sculptures, representing a battle of the giants." Nothing is known of the author or of the date at which he lived: the times of Trajan, Hadrian, Antoninus Pius, the beginning of the 3rd century, and the age of Diocletian and Constantine have all been suggested. The Macrinus to whom the work is dedicated may have been the emperor, who reigned 217–218, but the name is not uncommon, and it seems more likely that he was a young man with a thirst for universal knowledge, which the *Liber Memorialis* was compiled to satisfy.

There is no English edition or translation. The first edition of Ampelius was published in 1638 by Salmasius (Saumaise) from the Dijon MS., now lost, together with the Epitome of Florus; the latest edition is by Wölfflin (1854), based on Salmasius's copy of the lost codex.

See Gläser, *Rheinisches Museum*, ii. (1843); Zink, *Eos*, ii. (1866); Wölfflin, *De L. Ampelii Libro Memoriali* (1854).

AMPELOPSIS (from Gr. ἄμπελος, vine, and ὄψις, appearance, as it resembles the grape-vine in habit), a genus of the vine order *Ampelideae* and nearly allied to the grape-vine. The plants are rapidly-growing, hardy, ornamental climbers, which flourish in common garden soil, and are readily propagated by cuttings. They climb by means of tendrils. *A. quinquefolia*, Virginian creeper, a native of North America, introduced to Europe early in the 17th century, has palmately compound leaves with three to five leaflets. *A. tricuspidata*, better known as *A. Veitchii*, a more recent introduction (1868) from Japan, has smaller leaves very variable in shape; it clings readily to stone or brick work by means of suckers at the ends of the branched tendrils.

AMPÈRE, ANDRÉ MARIE (1775–1836), French physicist, was born at Polémieux, near Lyons, on the 22nd of January 1775. He took a passionate delight in the pursuit of knowledge from his very infancy, and is reported to have worked out long arithmetical sums by means of pebbles and biscuit crumbs before he knew the figures. His father began to teach him Latin, but ceased on discovering the boy's greater inclination and aptitude for mathematical studies. The young Ampère, however, soon resumed his Latin lessons, to enable him to master the works of Euler and Bernouilli. In later life he was accustomed to say that he knew as much about mathematics when he was eighteen as ever he knew; but his reading embraced nearly the whole round of knowledge—history, travels, poetry, philosophy and the natural sciences. When Lyons was taken by the army of the Convention in 1793, the father of Ampère, who, holding the office of *juge de paix*, had stood out resolutely against the previous revolutionary excesses, was at once thrown into prison, and soon after perished on the scaffold. This event produced a profound impression on his susceptible mind, and for more than a year he remained sunk in apathy. Then his interest was aroused by some letters on botany which fell into his hands, and from botany he turned to the study of the classic poets, and to the writing of verses himself. In 1796 he met Julie Carron, and an attachment sprang up between them, the progress of which he naïvely recorded in a journal (*Amorum*). In 1799 they were married. From about 1796 Ampère gave private lessons at Lyons in mathematics, chemistry and languages; and in 1801 he removed to Bourg, as professor of physics and chemistry, leaving his ailing wife and infant son at Lyons. She died in 1804, and he never recovered from the blow. In the same year he was appointed professor of mathematics at the lycée of Lyons. His small treatise, *Considérations sur la théorie mathématique du jeu*, which demonstrated that the chances of play are decidedly against the habitual gambler, published in 1802, brought him under the notice of J. B. J. Delambre, whose recommendation obtained for him the Lyons appointment, and afterwards (1804) a subordinate position in the polytechnic school at Paris, where he was elected professor of mathematics in 1809. Here he continued to prosecute his scientific researches and his multifarious studies with unabated diligence. He was admitted a member of the Institute in 1814. It is on the service that he rendered to science in establishing the relations between electricity and magnetism, and in developing the science of electromagnetism, or, as he called it, electrodynamics, that Ampère's fame mainly rests. On the 11th of September 1820 he heard of H. C. Oersted's discovery that a magnetic needle is acted on by a voltaic current. On the 18th of the same month he presented a paper to the Academy, containing a far more complete exposition of that and kindred phenomena. (See ELECTROKINETICS.) The whole field thus opened up he explored with characteristic industry and care, and developed a mathematical theory which not only explained the electromagnetic phenomena already observed but also predicted many new ones. His original memoirs on this subject may be found in the *Ann. Chim. Phys.* between 1820 and 1828. Late in life he prepared a remarkable *Essai sur la philosophie des sciences*. In addition, he wrote a number of scientific memoirs and papers, including two on the integration of partial differential equations (*Jour. École Polytechn.* x., xi.). He died at Marseilles on the 10th of June 1836. The great amiability and childlike simplicity of Ampère's character are well brought out in his *Journal et correspondance* (Paris, 1872).

AMPÈRE, JEAN JACQUES (1800–1864), French philologist and man of letters, only son of André Marie Ampère, was born at Lyons on the 12th of August 1800. He studied the folk-songs and popular poetry of the Scandinavian countries in an extended tour in northern Europe. Returning to France, he delivered in 1830 a series of lectures on Scandinavian and early German poetry at the Athenaeum in Marseilles. The first of these was printed as *De l'Histoire de la poésie* (1830), and was practically the first introduction of the French public to the Scandinavian and German epics. In Paris he taught at the Sorbonne, and became professor of the history of French literature at the Collège de France. A journey in northern Africa (1841) was followed by a tour in Greece and Italy, in company with Prosper Mérimée and others. This bore fruit in his *Voyage dantesque* (printed in his *Grèce, Rome et Dante*, 1848), which did much to popularize the study of Dante in France. In 1848 he became a member of the French Academy, and in 1851 he visited America. From this time he was occupied with his chief work, *L'Histoire romaine à Rome* (4 vols., 1861–1864), until his death at Pau on the 27th of March 1864.

The *Correspondance et souvenirs* (2 vols.) of A. M. and J. J. Ampère (1805–1854) was published in 1875. Notices of J. J. Ampère are to be found in Sainte-Beuve's *Portraits littéraires*, vol. iv., and *Nouveaux Lundis*, vol. xiii.; and in P. Mérimée's *Portraits historiques et littéraires* (2nd ed., 1875).

AMPEREMETER, or AMMETER, an instrument for the measurement of electric currents in terms of the unit called the ampere. (See ELECTROKINETICS; CONDUCTION, ELECTRIC; and UNITS, PHYSICAL.) Since electric currents may be either continuous, *i.e.* unidirectional, or alternating, and the latter of high or of low frequency, amperemeters may first be divided into those (1) for continuous or direct currents, (2) for low frequency alternating currents, and (3) for high frequency alternating currents. A continuous electric current of one ampere is defined to be one which deposits electrolytically 0·001118 of a gramme of silver per second from a neutral solution of silver nitrate.[1] An alternating current of one ampere is defined to be one which produces the same heat in a second in a wire as the unit continuous current defined as above to be one ampere. These definitions provide a basis on which the calibration of amperemeters can be conducted. Amperemeters may then be classified according to the physical principle on which they are constructed. An electric current in a conductor is recognized by its ability (*a*) to create heat in a wire through which it passes, (*b*) to produce a magnetic field round the conductor or wire. The heat makes itself evident by raising the temperature and therefore elongating the wire, whilst the magnetic field creates mechanical forces which act on pieces of iron or other conductors conveying electric currents when placed in proximity to the conductor in question. Hence we may classify ammeters into (1) Thermal; (2) Electromagnetic, and (3) Electrodynamic instruments.

1. *Thermal Ammeters*.—These instruments are also called hot-wire ammeters. In their simplest form they consist of a wire through which passes the current to be measured, some arrangement being provided for measuring the small expansion produced by the heat generated in the wire. This may consist simply in attaching one end of the wire to an index lever and the other to a fixed support, or the elongation of the wire may cause a rotation in a mirror from which a ray of light is reflected, and the movement of this ray over a scale will then provide the necessary means of indication. It is found most convenient to make use of the sag of the wire produced when it is stretched between two fixed points (K_1K_2, fig. 1) and then heated. To render the elongation evident, another wire is attached to its centre S_2, this last having a thread fixed to its middle of which the other end is twisted round the shaft of an index needle or in some way connected to it through a multiplying gear. The expansion of the working wire when it is heated will then increase or create a sag in it owing to its increase in length, and this is multiplied and rendered evident by the movement of the index needle. In order that this may take place, the heated wire must be flexible and must therefore be a single fine wire or a bundle of fine wires. In ammeters for small currents it is customary to pass the whole current through the heating wire. In instruments for larger currents the main current passes through a metallic strip acting as a bye-pass or shunt, and to the ends of this shunt are attached the ends of the working wire. A known fraction of the current is then indicated and measured. This shunt is generally a strip of platinoid or constantin, and the working wire itself is of the same metal. There is therefore a certain ratio in which any current passing through the ammeter is divided between the shunt and the working wire.

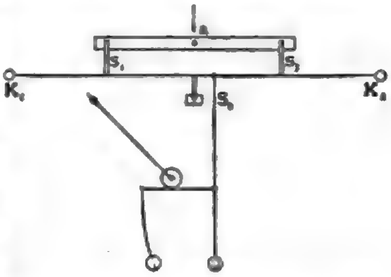


FIG. 1.—Diagram showing the arrangements of Hartmann and Braun's Hot-wire Ammeter.

Thermal ammeters recommend themselves for the following reasons:—(1) the same instrument can be used for continuous currents and for alternating currents of low frequency; (2) there is no temperature correction; (3) if used with alternating currents no correction is necessary for frequency, unless that frequency is very high. It is, however, requisite to make provision for the effect of changes in atmospheric temperature. This is done by mounting the working wire on a metal plate made of the same metal as the working wire itself; thus if the working wire is of platinoid it must be mounted on a platinoid bar, the supports which carry the ends of the working wire being insulated from this bar by being bushed with ivory or porcelain. Then no changes of external temperature can affect the sag of the wire, and the only thing which can alter its length relatively to the supporting bar is the passage of a current through it. Hot-wire ammeters are, however, liable to a shift of zero, and means are always provided by some adjusting screw for slightly altering the sag of the wire and so adjusting the index needle to the zero of the scale. Hot-wire ammeters are open to the following objections:—The scale divisions for equal increments of current are not equal in length, being generally much closer together in the lower parts of the scale. The reason is that the heat produced in a given time in a wire is proportional to the square of the strength of the current passing through it, and hence the rate at which the heat is produced in the wire, and therefore its temperature, increases much faster than the current itself increases. From this it follows that hot-wire ammeters are generally not capable of giving visible indications below a certain minimum current for each instrument. The instrument therefore does not begin to read from zero current, but from some higher limit which, generally speaking, is about one-tenth of the maximum, so that an ammeter reading up to 10 amperes will not give much visible indication below 1 ampere. On the other hand, hot-wire instruments are very "dead-beat," that is to say, the needle does not move much for the small fluctuations in the current, and this quality is generally increased by affixing to the index needle a small copper plate which is made to move in a strong magnetic field (see fig. 2). Hot-wire instruments working on the sag principle can be used in any position if properly constructed, and are very portable. In the construction of such an instrument it is essential that the wire should be subjected to a process of preparation or "ageing," which consists in passing through it a fairly strong current, at least the maximum that it will ever have to carry, and starting and stopping this current frequently. The wire ought to be so treated for many hours before it is placed in the instrument. It is also necessary to notice that shunt instruments cannot be used for high frequencies, as then the relative inductance of the shunt and wire becomes important and affects the ratio in which the current is divided, whereas for low frequency currents the inductance is unimportant. In constructing a hot-wire instrument for the measurement of high frequency currents it is necessary to make the working wire of a number of fine wires placed in parallel and slightly separated from one another, and to pass the whole of the current to be measured through this strand.

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[1] See J. A. Fleming, *A Handbook for the Electrical Laboratory and Testing Room*, vol. i. p. 341 (1901), also A. Gray, *Absolute Measurements in Electricity and Magnetism*, vol. ii. pt. ii. p. 412 (1893).

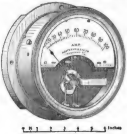

FIG. 2.—Hot-wire Ammeter.

In certain forms, hot-wire instruments are well adapted for the measurement of very small alternating currents. One useful form has been made as follows:—Two fine wires of diameter not greater than ·001 in. are stretched parallel to one another and 2 or 3 mm. apart. At the middle of these parallel wires, which are preferably about 1 m. in length, rests a very light metallic bridge to which a mirror is attached, the mirror reflecting a ray of light from a lamp upon a screen. If a small alternating current is passed through one wire, it sags down, the mirror is tilted, and the spot of light on the screen is displaced. Changes of atmospheric temperature affect both wires equally and do not tilt the mirror. The instrument can be calibrated by a continuous current. Another form of hot-wire ammeter is a modification of the electric thermometer originally invented by Sir W. Snow Harris. It consists of a glass bulb, in which there is a loop of fine wire, and to the bulb is attached a U-tube in which there is some liquid. When a current is passed through the wire, continuous or alternating, it creates heat, which expands the air in the bulb and forces the liquid up one side of the U-tube to a certain position in which the rate of loss of heat by the air is equal to the rate at which it is gaining heat. The instrument can be calibrated by continuous currents and may then be used for high frequency alternating currents.

2. *Electromagnetic Ammeters.*—Another large class of ammeters depend for their action upon the fact that an electric current create an electric field round its conductor, which varies in strength from point to point, but is otherwise proportional to the current. A small piece of iron placed in this field tends to move from weak to strong places in the field with a force depending on the strength of the field and the rate at which the field varies. In its simplest form an electromagnetic ammeter consists of a circular coil of wire in which is pivoted eccentrically an index needle carrying at its lower end a small mass of iron. The needle is balanced so that gravity compels it to take a certain position in which the fragment of iron occupies a position in the centre of the field of the coil where it is weakest. When a current is passed through the coil the iron tends to move nearer to the coil of the wire where the field is stronger and so displaces the index needle over the scale. Such an instrument is called a soft-iron gravity ammeter. Another type of similar instrument consists of a coil of wire having a fragment of iron wire suspended from one arm of an index needle near the mouth of a coil. When a current is passed through the wire forming the coil, the fragment of iron is drawn more into the aperture of the coil where the field is stronger and so displaces an index needle over a scale. In the construction of this soft-iron instrument it is essential that the fragment of iron should be as small and as well annealed as possible and not touched with tools after annealing; also it should be preferably not too elongated in shape so that it may not acquire permanent magnetization but that its magnetic condition may follow the changes of the current in the coil. If these conditions are not fulfilled sufficiently, the ammeter will not give the same indications for the same current if that current has been reached (*a*) by increasing from a smaller current, or (*b*) by decreasing from a larger current. In this case there is said to be hysteresis in the readings. Although therefore most simple and cheap to construct, such soft-iron instruments are not well adapted for accurate work. A much better form of electromagnetic ammeter can be constructed on a principle now extensively employed, which consists in pivoting in the strong field of a permanent magnet a small coil through which a part of the current to be measured is sent. Such an instrument is called a shunted movable coil ammeter, and is represented by a type of instrument shown in fig. 3. The construction of this instrument is as follows:—Within the instrument is a horseshoe magnet having soft-iron pole pieces so arranged as to produce a uniform magnetic field. In this magnetic field is pivoted a small circular or rectangular coil carried in jewelled bearings, the current being passed into and out of the movable coil by fine flexible conductors. The coil carries an index needle moving over a scale, and there is generally an iron core in the interior of the coil but fixed and independent of it. The coil is so situated that, in its zero position when no current is passing through it, the plane of the coil is parallel to the direction of the lines of force of the field. When a current is passed through the coil it rotates in the field and displaces the index over the scale against the control of a spiral spring like the hairspring of a watch. Such instruments can be made to have equidivisional scales and to read from zero upwards. It is essential that the permanent magnet should be subjected to a process of ageing so that its field may not be liable to change subsequently with time.

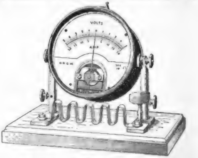

FIG. 3.—Shunted Movable Coil Ammeter, Isenthal & Co.

In the case of ammeters intended for very small currents, the whole current can be sent through the coil, but for larger currents it is necessary to provide in the instrument a shunt which carries the main current, the movable coil being connected to the ends of this shunt so that it takes a definite small fraction of the current passed through the instrument. Instruments of this type with a permanent magnetic field are only available for the measurement of continuous currents, but soft-iron instruments of the above-described gravity type can be employed with certain restrictions for the measurement of alternating currents. Direct reading equidivisional movable coil ammeters can be made in various portable forms, and are very much employed as laboratory instruments and also as ammeters for the measurement of large electric currents in electric generating stations. In this last case the shunt need not be contained in the instrument itself but may be at a considerable distance, wires being brought from the shunt which carries the main current to the movable coil ammeter itself, which performs the function simply of an indicator.

3. *Electrodynamic Ammeters.*—Instruments of the third class depend for their action on the fact discovered by Ampère, that mechanical forces exist between conductors carrying electric currents when those conductors occupy certain relative positions. If there be two parallel wires through which currents are passing, then these wires are drawn together if the currents are in the same direction and pressed apart if they are in opposite directions. (See Electrokinetics.) Instruments of this type are called Electrodynamometers, and have been employed both as laboratory research instruments and for technical purposes. In one well-known form, called a Siemens Electrodynamometer, there is a fixed coil (fig. 4), which is surrounded by another coil having its axis at right angles to that of the fixed coil. This second coil is suspended by a number of silk fibres, and to the coil is also attached a spiral spring the other end of which is fastened to a torsion head. If then the torsion head is twisted, the suspended coil experiences a torque and is displaced through an angle equal to that of the torsion head. The current can be passed into and out of the movable coil by permitting the ends of the coil to dip into two mercury cups. If a current is passed through the fixed coil and movable coil in series with one another, the movable coil tends to displace itself so as to bring the axes of the coils, which are normally at right angles, more into the same direction. This tendency can be resisted by giving a twist to the torsion head and so applying to the movable coil through the spring a restoring torque, which opposes the torque due to the dynamic action of the currents. If then the torsion head is provided with an index needle, and also if the movable coil is provided with an indicating point, it is possible to measure the torsional angle through which the head must be twisted to bring the movable coil back to its zero position. In these circumstances the torsional angle becomes a measure of the torque and therefore of the product of the strengths of the currents in the two coils, that is to say, of the square of the strength of the current passing through the two coils if they are joined up in series. The instrument can therefore be graduated by passing through it known and measured continuous currents, and it then becomes available for use with either continuous or alternating currents. The instrument can be provided with a curve or table showing the current corresponding to each angular displacement of the torsion head. It has the disadvantage of not being direct reading when made in the usual form, but can easily be converted into a direct reading instrument by appropriately dividing the scale over which the index of the torsion head moves.

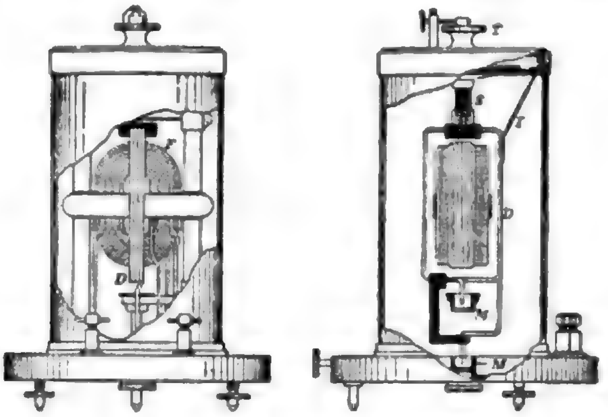

Fig. 4.—Siemens Electrodynamometer.
F, Fixed coil; *D*, Movable coil; *S*, Spiral spring; *T*, Torsion head; *MM*, Mercury cups; *I*, Index needle.

Ampere Balance.—Very convenient and accurate instruments based on the above principles have been devised by Lord Kelvin, and a large variety of these ampere balances, as they are called, suitable for measuring currents from a fraction of an ampere up to many thousands of amperes, have been constructed by that illustrious inventor. The difficulty which has generally presented itself to those who have tried to design instruments on the electrodynamometer principle for use with large currents has been that of getting the current into and out of the movable conductor, and yet permitting that conductor to remain free to move under very small force. The use of mercury cups is open to many objections on account of the fact that the mercury becomes oxidized, and such instruments are not very convenient for transportation. The great novelty in the ampere balances of Lord Kelvin was a joint or electric coupling, which is at once exceedingly flexible and yet capable of being constructed to carry with safety any desired current. This he achieved by the introduction of a device which is called a metallic ligament. The general principle of its construction is as follows:—Let + A, − A (fig. 5), be a pair of semi-cylindrical fixed trunnions which are carried on a supporting frame and held with flat sides downwards. Let + B, − B, be two smaller trunnions which project out from the sides of the two strips connecting together a pair of rings CC. The rings and the connecting strips constitute the circuit which is to be rendered movable. A current entering by the trunnion + B flows round the two halves of the circuit, as shown by the arrows, and comes out at the trunnion − B. In fig. 5 the current is shown dividing round the two rings; but in all the balances, except those intended for the largest currents, the current really circulates first round one ring and then round the other. To make the ligament, a very large number of exceedingly fine copper wires laid close together are soldered to the upper surface of the upper trunnion. The movable circuit CC thus hangs by two ligaments which are formed of very fine copper wires. This mode of suspension enables the conductor CC to vibrate freely like a balance, but at the same time very large currents can easily be passed through this perfectly flexible joint.

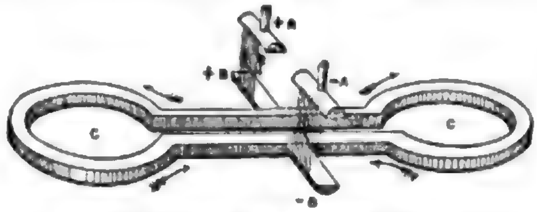

Fig. 5.—Kelvin Flexible Metallic Ligament.

Above and below these movable coils, which form as it were the two scale-pans of a balance, are fixed other stationary coils, and the connexions of all these six coils (shown in fig. 6) are such that when a current is passed through the whole of the coils in series, forces of attraction and repulsion are brought into existence which tend to force one movable coil upwards and the other movable coil downwards. This tendency is resisted by the weight of a mass of metal, which can be caused to slide along a tray attached to the movable coils. The appearance of the complete instrument is shown by fig. 7. When a current is passed through the instrument it causes one end of the movable system to tilt downwards, and the other end upwards; the sliding weight is then moved along the tray by means of a silk cord until equilibrium is again established. The value of the current in amperes is then

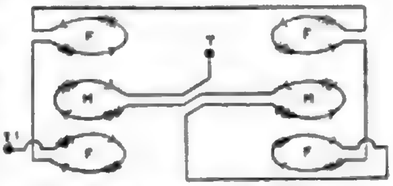

Fig. 6.—Connexions of Kelvin Ampere Balance.

obtained approximately by observing the position of the weight on the scale, or it may be obtained more accurately in the following manner:—The upper edge of the shelf on which the weights slide (see fig. 8) is graduated into equal divisions, and the weight is provided with a sharp tongue of metal in order that its position on the shelf may be accurately determined. Since the current passing through the balance when equilibrium is obtained with a given weight is proportional to the square root of the couple due to this weight, it follows that the current strength when equilibrium is obtained is proportional to the product of the square root of the weight used and the square root of the displacement distance of this weight from its zero position. Each instrument is accompanied by a pair of weights and by a square root table, so that the product of the square root of the number corresponding to the position of the sliding weight and the ascertained constant for each weight, gives at once the value of the current in amperes. Each of these balances is made to cover a certain range of reading. Thus the centi-ampere balance ranges from 1 to 100 centi-amperes, the deci-ampere balance from 1 to 100 deci-amperes, the ampere balance from 1 to 100 amperes, the deka-ampere balance from 1 to 100 amperes, the hecto-ampere balance from 6 to 600 amperes, and the kilo-ampere balance from 100 to 2500 amperes. They are constructed for the measurement not only of continuous or unvarying but also of alternating currents. In those intended for alternating currents, the main current through the movable coil, whether consisting of one turn or more than one turn, is carried by a wire rope, of which each component strand is insulated by silk covering, to prevent the inductive action from altering the distribution of the current across the transverse section of the conductor. To avoid the creation of induced currents, the coil frames and the base boards are constructed of slate. Kelvin ampere balances are made in two types—(1) a variable weight type suitable for obtaining the ampere value of any current within their range; and (2) a fixed weight type intended to indicate when a current which can be varied at pleasure has a certain fixed value. An instrument of the latter type of considerable accuracy was designed by Lord Kelvin for the British Board of Trade Electrical Laboratory, and it is there used as the principal standard ampere balance. A fixed weight is placed on one coil and the current is varied gradually until the balance is just in equilibrium. In these circumstances the current is known to have a fixed value in amperes determined by the weight attached to the instrument.

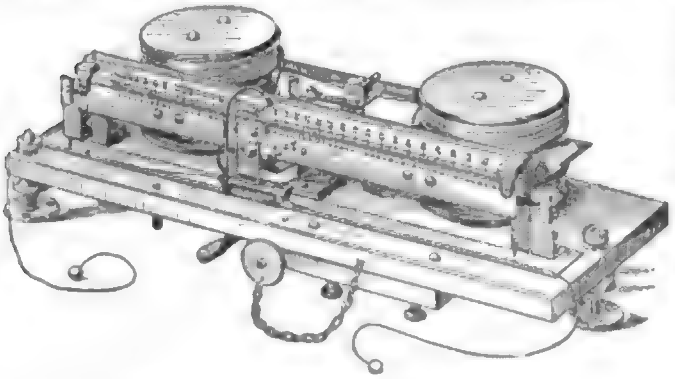

FIG. 7.—Lord Kelvin's Ampere Balance.

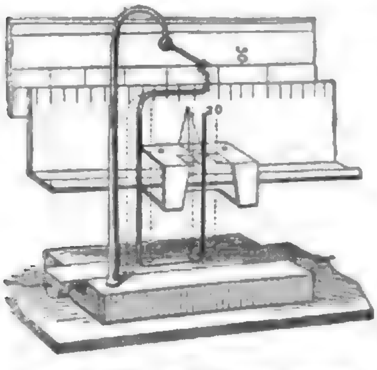

FIG. 8.—Slider of Kelvin Ampere Balance.

Calibration.—The calibration of ammeters is best conducted by means of a series of standard low resistances and of a potentiometer (*q.v.*). The ammeter to be calibrated is placed in series with a suitable low resistance which may be ·1 ohm, ·01 ohm, ·001 ohm or more as the case may be. A steady continuous current is then passed through the ammeter and low resistance, placed in series with one another and adjusted so as to give any required scale reading on the ammeter. The potential difference of the ends of the low resistance is at the same time measured on the potentiometer, and the quotient of this potential difference by the known value of the low resistance gives the true value of the current passing through the ammeter. This can be then compared with the observed scale reading and the error of the ammeter noted.[1]

A good ammeter should comply with the following qualifications:—(1) its readings should be the same for the same current whether reached by increasing from a lower current or decreasing from a higher current; (2) if used for alternating currents its indications should not vary with the frequency within the range of frequency for which it is likely to be used; (3) it should not be disturbed by external magnetic fields; (4) the scale divisions should, if possible, be equal in length and there should be no dead part in the scale. In the use of ammeters in which the control is the gravity of a weight, such as the Kelvin ampere balances and other instruments, it should be noted that the scale reading or indication of the instrument will vary with the latitude and with the height of the instrument above the mean sea-level. Since the difference between the acceleration of gravity at the pole and at the equator is about ½ %, the correction for latitude will be quite sensible in an instrument which might be used at various times in high and low latitudes. If G is the acceleration of gravity at the equator and g that at any latitude λ, then $g = G(1 + 0{\cdot}00513 \sin^2\lambda)$. In the case of an instrument with gravity control, the latitude at which it is calibrated should therefore be stated.

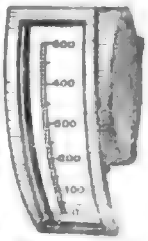

FIG. 9.—Edgewise Switchboard Ammeter, Kelvin & James White Ltd.

Switchboard Ammeters.—For switchboard use in electric supply stations where space is valuable, instruments of the type called edgewise ammeters are much employed. In these the indicating needle moves over a graduated cylindrically shaped scale, and they are for the most part electromagnetic instruments (see fig. 9).

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AMPERSAND (a corruption of the mixed English and Latin phrase, "and *per se* and," of which there are many dialect forms, as "ampussyand," or "amperseand"), the name of the sign & or &, which is a combination of the letters *e*, *t*, of the Lat. *et* = and. The sign is now usually called "short and." In old-fashioned primers and nursery books the name and sign were always added at the end of the alphabet.

AMPHIARAUS, in Greek mythology, a celebrated seer and prince of Argos, son of Oïcles (or Apollo) and Hypermestra, and through his father descended from the prophet Melampus (*Odyssey*, xv. 244). He took part in the voyage of the Argonauts and in the chase of the Calydonian boar; but his chief fame is in connexion with the expedition of the Seven against Thebes, organized by Adrastus, the brother of his wife Eriphyle, for the purpose of restoring Polyneices to the throne. Amphiaraus, foreseeing the disastrous issue of the war, at first refused to share in it; he had, however, promised Eriphyle when he married her that, in the event of any dispute arising between her brother and himself, she should decide between them; and now Eriphyle, bribed by Polyneices with the fatal necklace given by Cadmus to Harmonia, persuaded him against his better judgment to set out on the expedition. Knowing his doom, he bade his sons, Alcmaeon and Amphilochus, avenge his death upon their mother, upon whom, as he stepped into his chariot, he turned a look of anger. This scene was represented upon the chest of Cypselus described by Pausanias (v. 17).

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[1] See "The Electrolysis of Copper Sulphate in Standardizing Electrical Instruments," by A. W. Meikle, read before the Physical Society of Glasgow University on the 27th of January 1888, or J. A. Fleming, *A Handbook for the Electrical Laboratory and Testing Room*, vol. i. p. 343.

The assault on Thebes was disastrous for the Seven; and Amphiaraus, pursued by Periclymenus, would have been slain with his spear, had not Zeus with a thunderbolt opened a chasm into which the seer, with his chariot, horses and charioteer, disappeared. Henceforth he was numbered with the immortals and worshipped as a god. Near Oropus, on the supposed site of his passing, his sanctuary arose, with healing springs, and an oracle famous for its interpretation of dreams (Pausanias i. 34). The ruins of this temple, with inscriptions which identify it, have been discovered and preserved at Mavrodilisi, in the provinces of Boeotia and Attica. There was another temple dedicated to him on the road from Thebes to Potniae, and here was the oracle of Amphiaraus consulted by Croesus and Mardonius.

Homer, *Odyssey*, xi. 326; Herodotus viii. 134; Pindar, *Olympia*, vi., *Nemea*, ix.; Apollodorus iii. 6.

AMPHIBIA, a zoological term originally employed by Linnaeus to denote a class of the Animal Kingdom comprising crocodiles, lizards and salamanders, snakes and *Caeciliae*, tortoises and turtles and frogs; to which, in the later editions of the *Systema Naturae* he added some groups of fishes. In the *Tableau Elémentaire*, published in 1795, Cuvier adopts Linnaeus's term in its earlier sense, but uses the French word "Reptiles," already brought into use by Brisson, as the equivalent of *Amphibia*. In addition Cuvier accepts the Linnaean subdivisions of *Amphibia-Reptilia* for the tortoises, lizards (including crocodiles), salamanders and frogs; and *Amphibia-Serpentes* for the snakes, apodal lizards and *Caeciliae*.

In 1799[1] Alexandre Brongniart pointed out the wide differences which separate the frogs and salamanders (which he terms *Batrachia*) from the other reptiles; and in 1804 P. A. Latreille,[2] rightly estimating the value of these differences, though he was not an original worker in the field of vertebrate zoology, proposed to separate Brongniart's *Batrachia* from the class of *Reptilia* proper, as a group of equal value, for which he retained the Linnaean name of *Amphibia*.

Cuvier went no further than Brongniart, and, in the *Règne Animal*, he dropped the term *Amphibia*, and substituted *Reptilia* for it. J. F. Meckel,[3] on the other hand, while equally accepting Brongniart's classification, retained the term *Amphibia* in its earlier Linnaean sense; and his example has been generally followed by German writers, as, for instance, by H. Stannius, in that remarkable monument of accurate and extensive research, the *Handbuch der Zootomie* (2nd ed., 1856).

In 1816, de Blainville,[4] adopting Latreille's view, divided the Linnaean *Amphibia* into *Squamifères* and *Nudipellifères*, or *Amphibiens*; though he offered an alternative arrangement, in which the class *Reptiles* is preserved and divided into two sub-classes, the *Ornithoides* and the *Ichthyoides*. The latter are Brongniart's *Batrachia*, *plus* the *Caeciliae*, whose true affinities had, in the meanwhile, been shown by A. M. C. Duméril; and, in this arrangement, the name *Amphibiens* is restricted to *Proteus* and *Siren*.

B. Merrem's *Pholidota* and *Batrachia* (1820), F. S. Leuckart's *Monopnoa* and *Dipnoa* (1821), J. Müller's *Squamata* and *Nuda* (1832), are merely new names for de Blainville's *Ornithoides* and *Ichthyoides*, though Müller gave far better anatomical characters of the two groups than had previously been put forward. Moreover, following the indications already given by K. E. von Baer in 1828,[5] Müller calls the attention of naturalists to the important fact, that while all the *Squamata* possess an amnion and an allantois, these structures are absent in the embryos of all the *Nuda*. An appeal made by Müller for observations on the development of the *Caeciliae*, and of those *Amphibia* which retain gills or gill-clefts throughout life, has unfortunately yielded no fruits.

In 1825 P. A. Latreille[6] published a new classification of the *Vertebrata*, which are primarily divided into *Haematherma*, containing the three classes of *Mammifera*, *Monotremata* and *Aves*; and *Haemacryma*, also containing three classes—*Reptilia*, *Amphibia* and *Pisces*. This division of the *Vertebrata* into hot and cold blooded is a curiously retrograde step, only intelligible when we reflect that the excellent entomologist had no real comprehension of vertebrate morphology; but he makes some atonement for the blunder by steadily upholding the class distinctness of the *Amphibia*. In this he was followed by Dr J. E. Gray; but Duméril and Bibron in their great work,[7] and Dr Günther in his *Catalogue*, in substance, adopted Brongniart's arrangement, the *Batrachia* being simply one of the four orders of the class *Reptilia*. Huxley adopted Latreille's view of the distinctness of the *Amphibia*, as a class of the *Vertebrata*, co-ordinate with the *Mammalia*, *Aves*, *Reptilia* and *Pisces*; and the same arrangement was accepted by Gegenbaur and Haeckel. In the Hunterian lectures delivered at the Royal College of Surgeons in 1863, Huxley divided the *Vertebrata* into Mammals, Sauroids and Ichthyoids, the latter division containing the *Amphibia* and *Pisces*. Subsequently he proposed the names of *Sauropsida* and *Ichthyopsida* for the Sauroids and Ichthyoids respectively.

Sir Richard Owen, in his work on *The Anatomy of Vertebrates*, followed Latreille in dividing the *Vertebrata* into *Haematotherma* and *Haematocrya*, and adopted Leuckart's term of *Dipnoa* for the *Amphibia*. T. H. Huxley, in the ninth edition of this *Encyclopaedia*, treated of Brongniart's *Batrachia*, under the designation Amphibia, but this use of the word has not been generally accepted. (See BATRACHIA.) (T. H. H.; P. C. M.)

AMPHIBOLE, an important group of rock-forming minerals, very similar in chemical composition and general characters to the pyroxenes, and like them falling into three series according to the system of crystallization. They differ from the pyroxenes, however, in having an angle between the prismatic cleavage of 56° instead of 87°; they are specifically lighter than the corresponding pyroxenes; and, in their optical characters, they are distinguished by their stronger pleochroism and by the wider angle of extinction on the plane of symmetry.

They are minerals of either original or secondary origin; in the former case occurring as constituents (hornblende) of igneous rocks, such as granite, diorite, andesite, &c. Those of secondary origin have either been developed (tremolite) in limestones by contact-metamorphism, or have resulted (actinolite) by the alteration of augite by dynamo-metamorphism. Pseudomorphs of amphibole after pyroxene are known as uralite.

The name amphibole (from the Gr. ἀμφίβολος, ambiguous) was used by R. J. Haüy to include tremolite, actinolite and hornblende; this term has since been applied to the whole group. Numerous sub-species and varieties are distinguished, the more important of which are tabulated below in three series. The formulae of each will be seen to conform to the general metasilicate formula $R''SiO_3$.

	ORTHORHOMBIC SERIES.
Anthophyllite . .	$(Mg,Fe)SiO_3$.
	MONOCLINIC SERIES.
Tremolite . .	$CaMg_3(SiO_3)_4$.
Actinolite . .	$Ca(Mg,Fe)_3(SiO_3)_4$.
Cummingtonite .	$(Fe,Mg)SiO_3$.
Richterite . .	$(K_2,Na_2,Mg,Ca,Mn)SiO_3$.
Hornblende . .	$\left\{ \begin{array}{l} Ca(Mg,Fe)_3(SiO_3)_4 \text{ with} \\ NaAl(SiO_3)_2 \text{ and } (Mg,Fe)(Al,Fe)_2SiO_6. \end{array} \right.$

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[1] Brongniart's *Essai d'une classification naturelle des reptiles* was not published in full till 1803. It appears in the volume of the *Mémoires présentés à l'Institut par divers savans* for 1805.

[2] *Nouveau dictionnaire d'histoire naturelle*, xxiv., cited in Latreille's *Familles naturelles du règne animal*.

[3] *System der vergleichenden Anatomie* (1821).

[4] "Prodrome d'une Nouvelle Distribution du Règne Animal," *Bulletin des sciences par la Société Philomatique de Paris* (1816), p. 113.

[5] *Entwickelungs-Geschichte der Thiere*, p. 262.

[6] *Familles naturelles du règne animal*.

[7] *Erpétologie générale, ou histoire naturelle complète des reptiles* (1836).

Monoclinic Series—*continued.*

Glaucophane . .	$NaAl(SiO_3)_2 \cdot (Fe,Mg)SiO_3$.
Crocidolite . .	$NaFe(SiO_3)_2 \cdot FeSiO_3$.
Riebeckite . .	$2NaFe(SiO_3)_2 \cdot FeSiO_3$.
Arfvedsonite . .	$Na_8(Ca,Mg)_3(Fe,Mn)_{14}(Al,Fe)_2Si_{21}O_{45}$.

Anorthic Series.

Aenigmatite . .	$Na_4Fe''_9Al\,Fe'''(Si,Ti)_{12}O_{38}$.

Of these, tremolite, hornblende and crocidolite, as well as the important varieties, asbestos and jade, are treated under their own headings. Brief mention only need be here made of some of the others. Naturally, on account of the wide variations in chemical composition, the different members vary considerably in characters and general appearance; the specific gravity, for example, varies from 2·9 in tremolite to 3·8 in aenigmatite.

Anthophyllite occurs as brownish, fibrous or lamellar masses with hornblende in mica-schist at Kongsberg in Norway and some other localities. An aluminous variety is known as gedrite, and a deep green, Russian variety containing little iron as kupfferite.

Actinolite is an important member of the monoclinic series, forming radiating groups of acicular crystals of a bright green or greyish-green colour. It occurs frequently as a constituent of crystalline schists. The name (from ἀκτίς, a ray, and λίθος, a stone) is a translation of the old German word *Strahlstein*, radiated stone.

Glaucophane, crocidolite, riebeckite and arfvedsonite form a somewhat special group of alkali-amphiboles. The two former are blue fibrous minerals occurring in crystalline schists, and are the result of dynamo-metamorphic processes; the two latter are dark green minerals which occur as original constituents of igneous rocks rich in soda, such as nepheline-syenite and phonolite.

Aenigmatite and its variety cossyrite are rare minerals forming constituents of igneous rocks of the nepheline-syenite and phonolite groups. (L. J. S.)

AMPHIBOLITE, the name given to a rock consisting mainly of amphibole (hornblende), the use of the term being restricted, however, to metamorphic rocks. Holocrystalline plutonic igneous rocks composed essentially of hornblende are known as hornblendites. As is the case with most petrological terms the exact connotation is not very strictly defined; most authors allow that accessory minerals such as felspar, garnet, augite and quartz may be present in variable and often considerable amount. A foliated or schistose structure, though often developed in these rocks, is not universal. The hornblende is usually dark green (actinolite) but may be nearly black in the hand specimen; in the microscopic slide it is commonly green of various shades, but may be brown, blue or nearly colourless. It frequently occurs in elongated bladed prisms, but rarely shows good crystal faces. The term hornblende-schist is employed by many writers as nearly synonymous with amphibolite; most hornblende-schists contain felspar and iron oxides, while sphene, rutile, quartz and apatite are rarely absent. Reddish garnets are often conspicuous in the rocks of this group (garnet-amphibolites), and when in addition a green-coloured augite occurs the rocks are intimately allied to the hornblende-eclogites. Epidote also, in yellow grains, is common (epidote-amphibolites), and in these rocks the hornblende may be of the blue and richly pleochroic variety known as glaucophane (glaucophane-epidote-schists). Hornblende-schists containing dark green ferriferous hornblende (grünerite-schists) are abundant in some parts of North America. Tremolite-schists consist essentially of white or very pale green amphibole; occasionally they are black from the presence of numerous minute grains of iron oxide or of graphite. Many tremolite-schists contain much talc and chlorite, and as these rocks have been derived from peridotites they not infrequently show residual grains of olivine. Nephrite (Gr. νεφρός, a kidney) is a very compact, hardly schistose amphibolite, consisting of fine interwoven fibres of hornblende. Among other accessory minerals biotite, chlorite, talc, scapolite and tourmaline may be mentioned; if abundant they give rise to special varieties such as biotite-amphibolite, &c.

The amphibolites are typical rocks of the metamorphic group and as such attain a large development in all regions of crystalline schists and gneisses such as the Alps, Ardennes, Harz, Scottish Highlands, and the Lakes district of North America. They occur in two ways, viz. as large circular or elliptical areas which mark the site of old plutonic stocks or bosses of basic rock, and as long narrow strips intercalated among outcrops of other metamorphic rocks. Regarded from the point of view of their origin they fall into two groups, the ortho-amphibolites, which are modified igneous rocks, and the para-amphibolites, which are altered sediments. The former are far the more common. Igneous rocks which contain much augite (*e.g.* dolerites, gabbros, diabases, pyroxenites and many peridotites) are usually converted into amphibolites when they are subjected to pressure and interstitial movements during earth-folding. If felspar be present also, epidote may form, while part of the felspar recrystallizes as a species of the same mineral richer in alkalies or as mica. Olivine and ilmenite, the other common constituents of these rocks, may, alone or in conjunction with the above-named minerals, yield garnet, talc, sphene, rutile, &c. There is little or no alteration in the bulk composition of the rock, but its component elements enter into new combinations. Chemical analysis, accordingly, will often enable us to identify an igneous rock (diabase, &c.) under the guise of an amphibolite. The transformation of the rock may be complete, so that no trace is left of the original structures or minerals. Very often, however, it is only partial, and by obtaining a sufficiently large number of specimens a series of intermediate or transitional stages may be studied; these prove conclusively the nature of the process, though its causes are less clearly understood. Green hornblende may be seen gradually replacing augite, at first in needle-like crystals, for which gradually more compact masses are substituted. The felspar breaks up into a mosaic in which albite, epidote or zoisite, quartz and garnet may often be identified. Biotite and primary hornblende suffer comparatively little change; olivine disappears, and garnet, talc and tremolite or anthophyllite take its place. The original structures of this group of rocks (ophitic, porphyritic, poikilitic, vesicular, &c.) gradually fade away, and merge into those of the metamorphic amphibolites. Even when the greater part of the rock mass has suffered complete reconstruction, kernels or phacoids may remain, showing the old igneous structures, though the minerals are greatly altered. The transitional stages from gabbro or diabase to amphibolite are so common that they form a widespread and important group of rocks, which have been described under the names greenstone, greenstone-schist, flaser-gabbro, saussurite-gabbro, meta-diabase, &c. The ortho-amphibolites also include a small group of igneous rocks, which have a foliated or banded structure due to movements and pressure during consolidation, *e.g.* foliated diorite or diorite-schist.

The sedimentary amphibolites or para-amphibolites, less common than those above described, are frequent in some districts, such as the northern Alps, southern highlands of Scotland, Green Mountains, U.S.A. Many of them have been ash-beds, and their conversion into hornblende-schists follows exactly similar stages to those exemplified by basic crystalline igneous rocks. Others have been greywackes of varied composition with epidote, chlorite, felspar, quartz, iron oxides, &c., and may have been mixed with volcanic materials, or may be partly derived from the disintegration of basic rocks. When they are most metamorphosed they are often very hard to distinguish from igneous hornblende-schists; yet they rarely fail to reveal signs of bedding, pebbly structure, sedimentary banding and gradual transition into undoubtedly sedimentary types of gneiss and schist. Deposits containing dolomite and siderite also readily yield amphibolites (tremolite-schists, grünerite-schists, &c.) especially where there has been a certain amount of contact metamorphism by adjacent granitic masses. (J. S. F.)

AMPHIBOLOGY, or Amphiboly (Gr. ἀμφιβολία), in logic, a verbal fallacy arising from ambiguity in the grammatical structure of a sentence (Aristot., *Organon*, *Soph.*, *El.*, chap. iv.).

It occurs frequently in poetry, owing to the alteration for metrical reasons of the natural order of words; Jevons quotes as an example Shakespeare, *Henry VI.*: "The duke yet lives that Henry shall depose."

AMPHICTYONY (Gr. ἀμφικτυονία, *i.e.* a body composed of ἀμφικτίονες, ἀμφικτύονες, "dwellers around"), an association of ancient Greek communities centring in a shrine. As the extant sources do not define the term, and as they apply it to but five or six associations, the majority of which are little known, modern scholars are in doubt as to the essential character of the institution, and hesitate therefore to extend the name beyond this limited list. The word itself indicates that the association primarily comprised neighbours, though the Delphic amphictyony came in time to include relatively distant communities (Strabo ix. 3, 7). For the origin of the institution it is safe to assume that neighbouring communities, whether tribes (ἔθνη) or cities, desiring friendly intercourse with one another chose the sanctuary of some deity conveniently situated, at which to hold their periodical festival for worship and their fair for the interchange of goods. If the limited use of the word according to our sources is not purely accidental, at all events there were many Greek leagues, not expressly termed amphictyonies, which had the characteristics here stated.

The Delian amphictyony probably reached the height of its splendour early in the 7th century B.C. The *Hymn to the Delian Apollo*, composed about that time, celebrates the gathering of the Ionians with their wives and children at the shrine of their god on the island of Delos, to worship him with music, dancing and gymnastic contests (vv. 146-164; cf. Thuc. iii. 104). The later misfortunes of the Ionians caused a decline of the festival. Peisistratus, taking possession of Delos, seems to have used the sanctuary as a means of extending his political influence. When after the great war with Persia the Aegean cities under the leadership of Athens united in a political league (477 B.C.), they chose as its centre the temple of the Delian Apollo, doubtless through a desire to connect the new alliance with the associations of the old amphictyony. How far the council and other institutions of the Delian confederacy were based upon the amphictyonic organization cannot be determined. The removal of the treasury to Athens in 454 B.C. deprived Delos of political importance, though the amphictyony continued. The council gradually dwindled, and probably came to an end without formal abolition. In 426 B.C. the Athenians purified the island and instituted a great festival to be held under their presidency every four years (Thuc. iii. 104). In 422 they expelled the Delians (Thuc. v. 1). At the end of the Peloponnesian War Athens was deprived of Delos along with her other possessions, but she appears to have regained control of the island after the victory of Cnidus (394). An inscription of 390 B.C. proves that at this date Athenian authority had been restored. The affairs of the temple were managed by a board of five Athenian amphictyons, assisted by some Delian officials (inscrr. in *Bull. Hell.* viii. 284, 304, 307 f.); and in the 4th century we again hear of a council in addition to the board (*CIG.* i. 158). At this time the amphictyony is known to have embraced both the Athenians and the inhabitants of the Cyclades; but a strong Delian party bitterly opposed Athenian rule (cf. inscr. in *Bull. Hell.* iii. 473 f.), which came to an end with the supremacy of Macedon. The dissolution of the amphictyony soon followed.

Far more famous is the Delphic, or more strictly, the Pylaeic-Delphic, amphictyony. It was originally composed of twelve tribes dwelling round Thermopylae—the Thessalians, Boeotians, Dorians, Ionians, Perrhaebians, Magnetes, Locrians, Oetaeans, Phthiotes, Malians, Phocians (Aeschin. ii. 116), and Dolopians (Paus. x. 8. 2). The name of the council (*pylaea*) and of one set of deputies (*pylagori*), together with the important place held in the amphictyony by the temple of Demeter at Anthela, near Thermopylae, suggests that this shrine was the original centre of the association. How and when Delphi became a second centre is quite uncertain. The council of the league included deputies of two different kinds—*pylagori* and *hieromnemones*. The latter were twenty-four in number, two from each tribe. As the league was originally made up of neighbours, the Dorian tribe must have comprised simply the inhabitants of Doris; the Locrians were probably the eastern (Opuntian) branch; and the Ionians were doubtless limited to the adjacent island of Euboea. Afterwards, by affiliating themselves to Doris, the Peloponnesian Dorians gained admission, and Athens must have entered as an Ionian city before the first Sacred War. Henceforth Athens monopolized one of the two Ionian votes, while the other passed in rotation among the remaining Ionic, perhaps only among the Euboeic, cities. In the same way Doris held one Dorian vote and the other passed in rotation among the Dorian cities of Peloponnesus; and the east and west Locrians came to have one each. When after the second Sacred War the Phocians were expelled, Macedon received their two votes (346 B.C.). About the same time the Perrhaebians and the Dolopians were deprived of half their representation, and the two votes were transferred to the Delphians (inscrr. in *N. Jahrb. f. cl. Philol.* clv. 742, cf. 743, 753; *Bull. Hell.* xxi. 322, cf. 325; Bourguet, *Sanct. Pyth.* 145, 147). In the following century the Aetolians gained such dominance in the amphictyony as to convert the council into an organ of their league. Recent research has made it appear certain (cf. Pomptow, *ib.* 754 ff.) that they were never formally admitted to membership, but that they maintained their supremacy in the council (Livy xxxi. 32. 3; Polyb. iv. 25. 8) by controlling the votes of their allies, who—called Aetolians in the inscriptions—were often in the majority. They made no material change in its composition, which, accordingly, after the dissolution of their league by the Romans is found to be nearly as it was after the second Sacred War. A few minor changes came in under the supremacy of the Roman republic; and finally Augustus increased the number of votes to thirty, and distributed them according to his pleasure. In the age of the Antonines the association was still in existence (Paus. x. 8. 4 f.).

Although the hieromnemones of the Thessalians, who held the presidency, and perhaps of a few other communities, must have been elected, the office was ordinarily, as at Athens, filled by lot. As a rule they were renewed annually (Aristoph. *Clouds*, 623 f.; Foucart, in *Bull. Hell.* vii. 411, 413 f.). Each hieromnemon was accompanied by two pylagori, elected semi-annually (Demosth. xviii. 149; Aeschin. iii. 115; Tim. *Lex. Plat.*, *s.v.* Ἀμφικτύονες), and representing the same tribe, though not necessarily the same city. On one occasion Athens is known to have sent three. The hieromnemones were formally superior, but because of the method of appointment they were necessarily men of mediocre ability, inexperienced in speaking and public business, and for that reason they readily became the tools of the pylagori, who were orators and statesmen. In the literary sources, accordingly, the latter are rightly given credit for the acts of the council; it was the pylagori who set a price on the head of the traitor Ephialtes (Herod. vii. 213), and who on the motion of Themistocles rejected the proposition of Lacedaemon for the expulsion of the states which had sided with Persia (Plut. *Them.* 20). The pylagori had a right to propose measures and to take part in the deliberations; they as well as the hieromnemones were required to take the juror's oath; and the acts of the council were inscribed officially as resolutions of the hieromnemones and pylagori conjointly. The hieromnemon, however, cast the vote of his community, though in the record his two pylagori were made equally responsible for it. The necessary inference from these facts is that the vote was determined by a majority of the three deputies (inscr. in *Bull. Hell.* xxvii. 106-111, A 20-33; B 1-10). The council decided all questions which fell within its competence. Matters of greater importance, as the levy of an extraordinary fine on a state or the declaration of a sacred war, it presented in the form of a resolution to an assembly (ἐκκλησία), composed of the deputies, the amphictyonic priests, and any other citizens of the league who chanced to be present (Aeschin. iii. 124; cf. Hyp. iv. 7, 26 f.). This assembly was relatively unimportant, however, and is mentioned only by the two authorities here cited.

It is now well established by epigraphic evidence (*Bull. Hell.*

vii. 412 f., 417; Pomptow, in *N. Jahrb. f. cl. Philol.* cxlix. 826-829) that the amphictyons met both in the spring and in the autumn at Delphi, and the literary sources should alone be sufficient authority for meetings in the same seasons at Thermopylae (Hyp. iv. 7, 25 ff.; Strabo ix. 3, 7, 4, 17; Harpocration, *s.v.* Πύλαι). It is known, too, that the meeting at Thermopylae followed that at Delphi (inscr. in *Bull. Hell.* xxiv. 136 f.).

The primary function of the council was to administer the temporal affairs of the two shrines, of which the sanctuary of Apollo at Delphi claimed by far the greater share of attention. The hieromnemones were required periodically to inspect the lands belonging to this god, to punish those who encroached, and to see that the tenants rendered their quota of produce; and the council held the states responsible for the right performance of such duties by their respective deputies (*CIA.* ii. 545; inscr. in *Bull. Hell.* vii. 428 f.). Another task of the council was to supervise the treasury, to protect it from thieves, and by investments to increase the capital (Strabo ix. 3, 7; Isoc. xv. 232; Demosth. xxi. 144; Plut. *Sull.* 12). Naturally, too, it controlled the expenditure. We find it, accordingly, in the 6th century B.C. contracting for the rebuilding of the Delphic temple after it had been destroyed by fire (Herod. v. 62; Paus. x. 5. 13), and in the 4th century creating an Hellenic college of temple-builders for the purpose (inscrr. in *Bull. Hell.* xx. 202 f., 206, xxi. 478, xxiv. 464), adorning the interior with statues and pictures (Diod. xvi. 33), inscribing the proverbs of the Seven Sages on the walls (Paus. x. 24. 1), bestowing crowns on benefactors of the god (*CIG.* i. 1689 *b*), preparing for the Pythian games, awarding the prizes (Pind. *Pyth.* iv. 66, x. 8 f.), instituting a board of treasurers (inscr. in Bourguet, *Sanct. Pyth.* 175 ff.) and issuing coins. It was also in the material interest of Apollo that the council passed a law which forbade the Greeks to levy tolls on pilgrims to the shrine (Aeschin. iii. 107; Strabo ix. 3, 4), and another requiring the amphictyonic states to keep in repair their own roads which led towards Delphi (*CIA.* ii. 545). A law of great interest, dating from the beginning of the institution, imposed an oath upon the members of the league not to destroy an amphictyonic city or to cut it off from running water in war or peace; but to wage war upon those who transgressed this ordinance, to destroy their cities, and to punish any others who by theft or plotting sought to injure the god (Aeschin. ii. 115). In this regulation, which was intended to mitigate the usages of war amongst the members of the league, we have one of the origins of Greek interstate law. Though other regulations were made to secure peace at the time of the festival (Dion. Hal. iv. 25. 3), and though occasionally the council was called upon to arbitrate in a dispute (cf. Demosth. xviii. 135), no provision was made to compel arbitration.

For the enforcement of such laws and for administrative efficiency in general it was necessary that the council should have judicial power. As jurors the deputies took an oath to decide according to written law, or in cases not covered by law, according to their best will and judgment (*CIA.* ii. 545). The earliest known amphictyonic penalty was the destruction of Crisa for having levied tolls on pilgrims (Aeschin. iii. 107; Strabo ix. 3, 4; cf. Paus. x. 37. 5-8). This offence was the cause of the first Sacred War. The second and third Sacred Wars, fought in the 4th century B.C., were waged by the amphictyons against the Phocians and the Amphissaeans respectively for alleged trespassing on the sacred lands (Aeschin. iii. 124, 128; Diod. xvi. 23, 31 f.). In the 5th century the council fined the Dolopians for having disturbed commerce by their piracy (Plut. *Cim.* 8), and in the 4th century the Lacedaemonians for having occupied the citadel of Thebes in time of peace (Diod. xvi. 23, 29).

The judgments of the council were sometimes considered unfair, and were occasionally defied by the states affected. The Lacedaemonians refused to pay the fine above mentioned; the Athenians protested against the treatment of Amphissa, and were slow in accepting the decisions given under the influence of Macedon. The inability of the council to enforce its resolutions was chiefly due to its composition; the majority of the communities represented were even in combination no match for individual cities like Athens, Sparta or Thebes. The council was a power in politics only when manipulated by a great state, as Thebes, Macedon or Aetolia, and in such a case its decrees were most likely to give offence by their partisanship. Although the council sometimes championed the Hellenic cause, as could any association or individual, it never acquired a recognized authority over all Greece; and notwithstanding its frequent participation in political affairs, it remained essentially a religious convocation.

In addition to the three associations thus far mentioned there was an amphictyony of Onchestus (Strabo ix. 2, 33). It may be inferred from a comparison of Paus. iv. 5. 2 with Herod. vi. 92 that there was an amphictyony of Argos of which Epidaurus and Aegina were members. An amphictyony of Corinth has, with less justification, been assumed on the strength of a passage in Pindar (*Nem. Od.* vi. 40-42).

AUTHORITIES.—Foucart, "Amphictyones," in Daremberg and Saglio, *Dict. d. antiq. grecq. et rom.* (1873) i. 235-238; F. Cauer, "Amphiktyonia," in Pauly-Wissowa, *Realencycl. d. cl. Altertumswiss.* (1894) i. 1904-1935; Pomptow, *Fasti Delphici*, ii. in *Neue Jahrb. f. cl. Philol.* (1894) cxlix. 497-558, clv. (1897) 737-765, 785-848; E. A. Freeman, *History of Federal Government in Greece and Italy* (2nd ed., London and New York, 1895), 95-111; W. S. Ferguson, "Delian Amphictyony," in *Classical Review* (1901), xv. 38-40; Schömann-Lipsius, *Griechische Alterthümer* (1902), ii. 29-44; E. Bourguet, *L'Administration financière du sanctuaire pythique au IVᵉ siècle avant J.-C.* (Paris, 1905). The earlier literature has been deprived of a great part of its value by recent discoveries of inscriptions, many of which may be found in the *Bulletin de correspondance hellénique*, iii. vii. viii. x. xx. xxi. xxiv. xxvi. xxvii., edited with commentary chiefly by Bourguet, Colin, Foucart and Homolle. See also H. Collitz, *Sammlung d. griech. Dialekt-Inschriften*, ii. p. 643 ff. and Nos. 2508 ff., edited by Baunack. (G. W. B.)

AMPHILOCHUS, in Greek legend, a famous seer, son of Amphiaraus and Eriphyle and brother of Alcmaeon. According to some he assisted in the murder of Eriphyle, which, according to others, was carried out by Alcmaeon alone (Apollodorus iii. 6, 7). He took part in the expedition of the Epigoni against Thebes and in the Trojan War. After the fall of Troy he founded, in conjunction with Mopsus, another famous seer, the oracle of Mallos in Cilicia. The two seers afterwards fought for its possession, and both were slain in the combat. Amphilochus is also said to have been killed by Apollo (Strabo xiv. 675, 676). According to another story, he returned to Argos from Troy, but, being dissatisfied with the condition of things there, left it for Acarnania, where he founded Amphilochian Argos on the Ambracian gulf. He was worshipped at Oropus, Athens and Sparta.

Strabo xiv. pp. 675, 676; Thucydides ii. 68; Pausanias i. 34, iii. 15.

AMPHION and **ZETHUS**, in ancient Greek mythology, the twin sons of Zeus by Antiope. When children, they were exposed on Mount Cithaeron, but were found and brought up by a shepherd. Amphion became a great singer and musician, Zethus a hunter and herdsman (Apollodorus iii. 5). After punishing Lycus and Dirce for cruel treatment of Antiope (*q.v.*), they built and fortified Thebes, huge blocks of stone forming themselves into walls at the sound of Amphion's lyre (Horace, *Odes*, iii. 11). Amphion married Niobe, and killed himself after the loss of his wife and children (Ovid, *Metam.* vi. 270). The brothers were buried in one grave and worshipped as the Dioscuri "with white horses" (Eurip. *Phoen.* 609).

AMPHIOXUS, or LANCELET, the name of small, fish-like, marine creatures, forming the class Cephalochorda, of the phylum Vertebrata. Lancelets are found in brackish or salt water, generally near the coast, and have been referred to several genera and many species. They were first discovered by P. S. Pallas in 1778, who took them to be slugs and described them under the name *Limax lanceolatus*. The true position in the animal kingdom was first recognized in 1834 by O. G. Costa, who named the genus *Branchiostoma*, and it has since been dealt with by many writers.

The theoretical interest of Amphioxus depends upon a variety of circumstances. In its manner of development from the egg, and in the constitution of its digestive, vascular, respiratory (branchial), excretory, skeletal, nervous and muscular systems it exhibits what appears to be a primordial condition of vertebrate organization, a condition which is, in fact, partly recapitulated in the course of the embryonic stages of craniate vertebrates. In comparative morphology it provides many illustrations of important biological principles (such, for example, as substitution and change of function of organs), and throws new light upon, or at least points the way to new ideas of, the primitive relations of different organic systems in respect of their function and topography. One of the most puzzling features in its structure, and, at the same time, one of the greatest obstacles to the view that it is essentially primitive and not merely a degenerate creature, is the entire absence of the paired organs of special sense, olfactory, optic and auditory, which are so characteristic of the higher vertebrates. Although it is true that there is a certain amount of gradation in the degree of development to which these organs have attained in the various orders, yet it is hardly sufficient to enable the imagination to bridge over the gap which separates Amphioxus from the lowest fishes in regard to this feature of organization.

Classification.—On account of the absence of anything in the nature of a skull, Amphioxus has been regarded as the type of a division, Acrania, in contrast with the Craniata which comprise all the higher Chordata. The ordinal name for the genera and species of Amphioxus is Cephalochorda, the term referring to the extension of the primary backbone or *notochord* to the anterior extremity of the body; the family name is *Branchiostomidae*. The amount of generic divergence exhibited by the members of this family is not great in the mass, but is of singular interest in detail. There are two principal genera—1. *Branchiostoma* Costa, having paired sexual organs (gonadic pouches); 2. *Heteropleuron* Kirkaldy, with unilateral gonads. Of these, the former includes two subgenera, *Amphioxus* (s. str.) Yarrell and *Dolichorhynchus* Willey. The species belonging to the genus *Heteropleuron* are divided among the three subgenera *Paramphioxus* Haeckel, *Epigonichthys* Peters, and *Asymmetron* Andrews. The generic characters are based upon definite modifications of form which affect the entire facies of the animals, while the specific diagnoses depend upon minor characters, such as the number of *myotomes* or muscle-segments.

Habits and Distribution.—With regard to its habits, all that need be said here is that while Amphioxus is an expert swimmer when occasion requires, yet it spends most of its time burrowing in the sand, in which, when at rest, it lies buried with head protruding and mouth wide agape. Its food consists of microscopic organisms and organic particles; these are drawn into the mouth together with currents of water induced by the action of the vibratile cilia which are abundant along special tracts on the sides and roof of the vestibule of the mouth and in the walls of the perforated pharynx ("ciliary ingestion"). Amphioxus favours a littoral habitat, and rarely if ever descends below the 50-fathom line. Species occur in all seas of the temperate, tropical and subtropical zones. The European species, *A. lanceolatus*, is found in the Black and Mediterranean Seas, and on the coasts of France, Great Britain and Scandinavia, while a closely allied species or subspecies, *A. caribaeus*, frequents the Caribbean region from Chesapeake to La Plata. *A. californiensis* occurs on the coast of California, and *A. belcheri* extends its area of distribution from Queensland through Singapore to Japan. A recently described species, *Dolichorhynchus indicus*, characterized by the great length of the praeoral lobe or snout, has been dredged in the Indian Ocean. *Paramphioxus bassanus* occurs on the coast of Australia from Port Phillip to Port Jackson; *P. cingalensis* at Ceylon. *Epigonichthys cultellus* (fig. 1) inhabits Torres Strait, and has also been

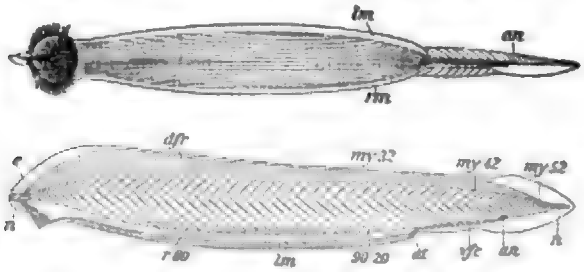

FIG. 1.—*Epigonichthys cultellus* from below and from the left side. (Slightly altered from Kirkaldy.) *rm* and *lm*, Right and left metapleur; *at*, atriopore; *an*, anus; *e*, "eyespot" at anterior end of neurochord projecting beyond the myotomes (*my*); *n*, notochord; *rgo*, gonads of right side only showing through by transparency; *go* 20, the last gonad; *dfr*, dorsal fin with fin chambers and fin rays; *vfc*, ventral fin chambers.

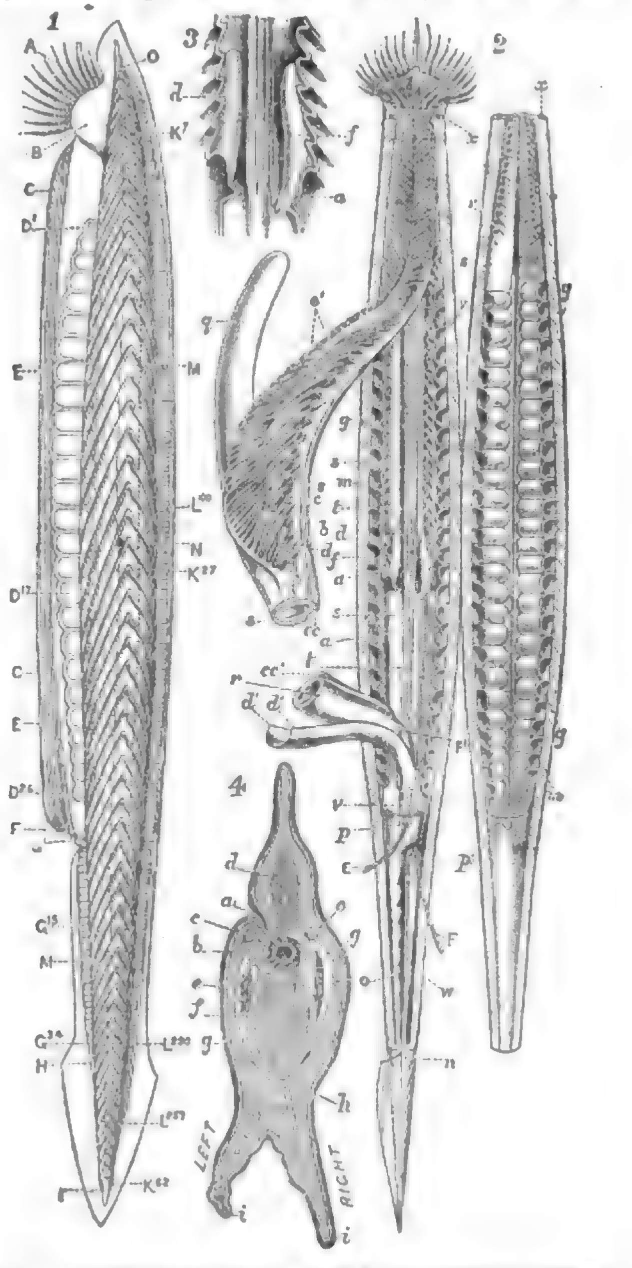

FIG. 2.—*Amphioxus lanceolatus*, Yarrell (*Branchiostoma lubricum*, Coste). (Original drawings.) (1) Lateral view of adult, to show general form, the myomeres, fin rays and gonads. A, Oral tentacles (28 to 32 in full-grown animals, 20 to 24 in half-grown specimens); B, praeoral hood or praeoral epipleur; C, plicated ventral surface of atrial chamber; D^1, D^{17}, D^{26}, gonads, twenty-six pairs, coincident with myotomes 10 to 36; E, metapleur or lateral ridge on atrial epipleur; F, atripore, coincident with myotome 36; G^1, G^{15}, G^{34}, double ventral fin rays, extending from myotomes 37 to 52, but having no numerical relation to them; H, position of anus, between myotomes 51 and 52; I, notochord, projecting beyond myotomes; K^7, K^{27}, K^{62}, myotomes or muscular segments of body-wall, 62 in number; L^{100}, L^{200}, L^{257}, dorsal fin rays, about 250 in number, the hard substance of the ray being absent at the extreme ends of the

body (these have no constant numerical relation to the myomeres); M, notochord as seen through the transparent myotomes, the thin double-lined spaces being the connective-tissue septa and the broader spaces the muscular tissue of the myotomes; N, position of brown funnel of left side (atrio-coelomic canal); O, nerve tube resting on notochord.

(2) Dissection of *Amphioxus*. By a horizontal incision on each side of the body a large ventral area has been separated and turned over, as it were on a hinge, to the animal's left side. The perforated pharyngeal region has then been detached from the adherent epipleura or opercular folds (wall of atrial or branchial chamber) by cutting the fluted pharyngo-pleural membrane *d*, and separated by a vertical cut from the intestinal region. *a*, Edge of groove formed by adhesion of median dorsal surface of alimentary canal to sheath of notochord; *b*, median dorsal surface of alimentary canal; *c*, left dorsal aorta; *cc*, single dorsal aorta, formed by union of the two anterior vessels; *cc'*, same vessel resting on intestine; *d*, cut edge of pharyngo-pleural folds of atrial tunic, really the original outer body-wall before the downgrowth of epipleura; *d'*, atrial tunic (original body-wall) at non-perforate region, cut and turned back so as to expose peri-enteric coelom and intestine *r*; *e'*, upstanding folds of body-wall (pharyngo-pleural folds) on alternate bars of perforate region of body; *f*, atrio-coelomic canals or brown funnels (collar-pores of *Balanoglossus*); *g*, cavity of a gonad-sac; *m*, cut musculature of body-wall; *n*, anus; *o*, post-atrioporal extension of atrial chamber in form of a tubular caecum; *p*, atriopore; *q*, hepatic caecum; *r*, intestine; *s*, coelom; *t*, area of adhesion between alimentary canal and sheath of notochord; *v*, atrial chamber or branchial cavity; *w*, post-atrioporal portion of intestine; *x*, canals of metapleura exposed by cutting; E, probe passing through atriopore into atrial or branchial chamber; FF', probe passing from coelom, where it expands behind the atriopore, into narrower peri-enteric coelom of praeatrioporal region.

(3) Portion of (2) enlarged to show atrio-coelomic canals ("brown funnels" of Lankester). Lettering as in (2).

(4) Section taken transversely through praeoral region near termination of nerve tube. *a*, Olfactory ciliated pit on animal's left side, its wall confluent with substance of nerve tube; *b*, pigment spot (rudimentary eye) on anterior termination of nerve tube; *c*, first pair of nerves in section; *d*, fin ray; *e*, myotome; *f*, notochord; *g*, space round myotome (?artifact or coelom); *h*, subchordal canal (? blood-vessel); *i*, a symmetrical epipleura of praeoral hood.

found at Ternate. *Asymmetron lucayanum* is the Bahaman representative of the family, with a subspecies, *A. caudatum*, in the South Pacific from New Guinea to the Loyalty Islands. The Peruvian species, *Branchiostoma elongatum*, with nearly eighty myotomes, cannot at present be assigned to its proper subgenus.

External Form.—The following description, unless otherwise stated, refers to *A. lanceolatus*. Amphioxus is a small fish-like creature attaining a maximum length of about 3 in., semi-transparent in appearance, showing iridescent play of colour. The body is narrow, laterally compressed and pointed at both ends. The main musculature can be seen through the thin skin to be divided into about sixty pairs of muscle-segments (myotomes) by means of comma-shaped dissepiments, the myocommas, which stretch between the skin and the central skeletal axis of the body. These myotomes enable it to swim rapidly with characteristic serpentine undulations of the body, the movements being effected by the alternate contraction and relaxation of the longitudinal muscles on both sides. Apparently correlated with this peculiar locomotion is the anatomical fact of the alteration of the myotomes on the two sides. Symmetrical at their first appearance in the embryo, the somites (from which the myotomes are derived) early undergo a certain distortion, the effect of which is to carry the somites of the left side forwards through the length of one half-segment. For example, the twenty-seventh myotome of the left side is placed opposite to the twenty-sixth myocomma of the right side. The back of the body is occupied by a crest, called the dorsal fin, consisting of a hollow ridge, the cavity of which is divided into about 250 compartments or fin chambers, into each of which, with the exception of those near the anterior and posterior end of the body, projects a stout pillar composed of characteristic laminar tissue, the fin ray. The dorsal crest is continued round both extremities, becoming expanded to form the rostral fin in front and the caudal fin behind. Even in external view, careful inspection will show that the body is divisible into four regions, namely, cephalic, atrial, abdominal and caudal. The cephalic region includes the rostrum or praeoral

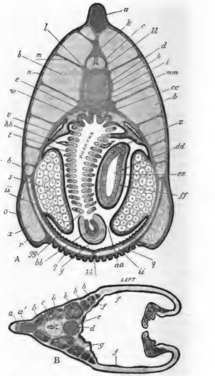

FIG. 3.—Transverse sections of *Amphioxus*. (Original.) A. Section through region of atrio-coelomic canals, *v*. B. Section in front of mouth; the right and left sides are transposed. *a*, Cavity surrounding fin ray; *a'*, fin ray; *b*, muscular tissue of myotome; *c*, nerve-cord; *d*, notochord; *e*, left aorta; *f*, thickened ridges of epithelium of praeoral chamber (Rader organ); *g*, coiled tube lying in a coelomic space on right side of praeoral hood, apparently an artery; *h*, cuticle of notochord; *i*, connective-tissue sheath of notochord; *k*, median ridge of skeletal canal of nerve-cord; *l*, skeletal canal protecting nerve-cord; *m*, inter-segmental skeletal septum of myotome; *n*, subcutaneous skeletal connective tissue; *o*, ditto of metapleur (this should be relatively thicker than it is); *q*, subcutaneous connective tissue of ventral surface of atrial wall (not a canal, as supposed by Stieda and others); *r*, epiblastic epithelium; *s*, gonad-sac containing ova; *t*, pharyngeal bar in section, one of the "tongue" bars alternating with the main bars and devoid of pharyngo-pleural fold and coelom; *v*, atrio-coelomic funnel; *w*, so-called "dorsal" coelom; *x*, lymphatic space or canal of metapleur; *y*, sub-pharyngeal vascular trunk; *z*, blood-vessel (portal vein) on wall of hepatic caecum; *aa*, space of atrial or branchial chamber; *bb*, ventral groove of pharynx (anteriorly this takes the form of a ridge); *cc*, hyperbranchial groove of pharynx; *dd*, lumen or space of hepatic caecum; *ee*, narrow coelomic space surrounding hepatic caecum; *ff*, lining cell-layer of hepatic caecum; *gg*, inner face of a pharyngeal bar clothed with hypoblast, the outer face covered with epiblast (represented black); *hh*, a main pharyngeal bar with projecting pharyngeal fold (on which the reference line rests) in section, showing coelomic space beneath the black epiblast; *ii*, transverse ventral muscle of epipleura; *kk*, raphe or plane of fusion of two down-grown epipleura; *ll*, space and nucleated cells on dorsal face of notochord; *mm*, similar space and cells on its ventral face.

lobe and the mouth. As already stated, the notochord extends beyond the mouth to the tip of the rostrum. The mouth consists of two portions, an outer vestibule and an inner *apertura oris*; the latter is surrounded by a sphincter muscle, which forms the so-called *velum*. The vestibule of the mouth is the space bounded by the oral hood; this arises by secondary downgrowth of lid-like folds over the true oral aperture, and is provided with a fringe of tentacular cirri, each of which is supported by a solid skeletal axis. The oral hood with its cirri has a special nerve supply and musculature by which the cirri can be either spread out, or bent inwards so that those of one side may interdigitate with those of the other, thus completely closing the entrance to the mouth. The velum is also provided with a circlet of twelve tantacles (in some species sixteen) which hang backwards into the pharynx; these are the velar tentacles. The atrial region extends from the mouth over about two-thirds of the length of the body, terminating at a large median ventral aperture, the atriopore; this is the excurrent orifice for the respiratory current of water and also serves for the evacuation of the generative products. This region is really the branchiogenital region, although the fact is not apparent in external view. The ventral side of the body in the atrial region is broad and convex, so that the body presents the appearance of a spherical triangle in transverse section, the apex being formed by the dorsal fin and the angles bordered by two hollow folds, the metapleural folds, each of which contains a continuous longitudinal lymph-space, the metapleural canal. In the genus *Branchiostoma* the metapleural folds terminate symmetrically shortly behind the atriopore, but in *Heteropleuron* the right metapleur passes uninterruptedly into the median crest of the ventral fin (fig. 1). In this connexion it may also be mentioned that in all cases the right half of the oral hood is directly continuous with the rostral fin (fig. 2). The abdominal region comprises a short stretch of body between atriopore and anus, the termination of the alimentary canal. It is characterized by the presence of a special development of the lophioderm or median fin-system, namely, the ventral fin, which is composed of two portions, a lower keel-like portion, which underlies an upper chambered portion, each chamber containing typically a pair of gelatinous fin rays. Finally, the caudal region comprises the post-anal division of the trunk. The keel of the ventral fin is continued past the anus into the expanded caudal fin, and so it happens that the anal opening is displaced from the middle line to the left side of the fin. In *Asymmetron* the caudal region is remarkable for the curious elongation of the notochord, which is produced far beyond the last of the myotomes.

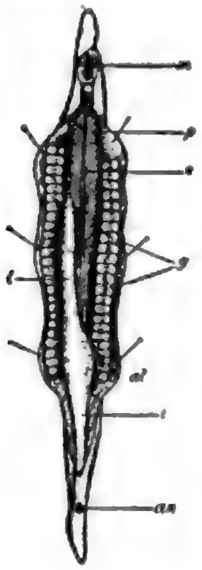

FIG. 4.—*Amphioxus lanceolatus* laid open ventrally. (After Rathke, slightly altered.) *m*, Mouth appearing as an elongated slit when relaxed (as in the lamprey); *p*, perforated pharynx; *e*, endostyle; *g*, gonads; *l*, liver; *at*, level of atriopore; *i*, intestine; *an*, anus. In this species the atrium is produced as an asymmetrical blind pouch behind the atriopore as far as the anus.

Alimentary, Respiratory and Excretory Systems.—Although the function of the two latter systems of organs is the purification of the blood, they are not usually considered together, and it is therefore the more remarkable that their close association in *Amphioxus* renders it necessary to treat them in common. The alimentary canal is a perfectly straight tube lined throughout by ciliated epithelium. As food particles pass in through the mouth they become enveloped in a slimy substance (secreted by the endostyle) and conveyed down the gut by the action of the vibratile cilia as a continuous food-rope, the peristaltic movements of the gut-wall being very feeble. The first part of the alimentary canal consists of the pharynx or branchial sac, the side walls of which are perforated by upwards of sixty pairs of elongated slits, the gill-clefts. Each primary gill-cleft becomes divided into two by a tongue-bar which grows down secondarily from the upper wall of the cleft and fuses with the ventral wall. New clefts continue to form at the posterior end of the pharynx during the adult life of the animal. The gill-clefts open directly from the cavity of the pharynx into that of the atrium, and so give egress to the respiratory current which enters the mouth with the food (fig. 4). The atrium or atrial chamber is a peripharyngeal cavity of secondary origin effecting the enclosure of the gill-clefts, which in the larva opened directly to the exterior. The atrium is thus analogous to the opercular cavity of fishes and tadpoles, and, as stated above, remains in communication with the exterior by means of the atriopore. The primary and secondary bars which separate and divide the successive gill-clefts from one another are traversed by blood-vessels which run from a simple tubular contractile ventral branchial vessel along the bars into a dorsal aorta. The ventral branchial vessel lies below the hypobranchial groove or endostyle, and is the representative of a heart. As water for respiration streams through the clefts, gaseous interchange takes place between the circulating colourless blood and the percolating water. The pharynx projects freely into the atrium; it is surrounded at the sides and below by the continuous atrial cavity, but dorsally it is held in position in two ways. First, its dorsal wall (which is grooved to form the hyperpharyngeal groove) is closely adherent to the sheath of the notochord; and secondly, the pharynx is attached through the intermediation of the primary bars. These are suspended to the muscular body-wall by a double membrane, called the *ligamentum denticulatum*, which forms at once the roof of the atrial chamber and the floor of a persistent portion of the original body-cavity or coelom (the dorsal coelomic canal on each side of the pharynx). The *ligamentum denticulatum* is thus lined on one side by the epiblastic atrial epithelium, and on the other by mesoblastic coelomic epithelium. Now this ligament is inserted into the primary bars some distance below the upper limits of the gill-clefts, and it therefore follows that, corresponding with each tongue-bar, the atrial cavity is produced upward beyond the insertion of the ligament into a series of bags or pockets, which may be called the atrial pouches. At the top of each of these pouches there is a minute orifice, the aperture of a small tubule lying above each pouch in the dorsal coelom. These tubules are the excretory tubules or nephridia. They communicate with the coelom by several openings or nephrostomes, and with the atrium by a single opening in each case, the nephridiopore. It is important to emphasize the fact that in Amphioxus the excretory tubules are co-extensive with the gill-clefts. The perforated pharynx terminates some distance in front of the atriopore. At the level of its posterior end a pair of funnel-shaped pouches of the atrium are produced forwards into the dorsal coelom. These are the atrial coelomic funnels or brown funnels, so called on account of the characteristic pigmentation of their walls. There are reasons for supposing that these funnels are vestiges of an ancient excretory system, which has given way by substitution to the excretory tubules described above. In the same region of the body, namely, close behind the pharynx, a large diverticulum is given off from the ventral side of the gut. This is the hepatic caecum (fig. 2, 2, *q*, fig. 4, *l*), which is quite median at its first origin, but, as it grows in length, comes to lie against the right wall of the pharynx. Although within the atrial cavity, it is separated from the latter by a narrow coelomic space, bounded towards the atrium by coelomic and atrial epithelium. No food passes into the hepatic caecum, which has been definitely shown on embryological and physiological grounds to be the simplest persistent form of the vertebrate liver.

Nervous System.—As has already been indicated, a solid subcylindrical elastic rod, the notochord, surrounded by a sheath of laminar connective tissue, the cordal sheath, lies above the alimentary canal in contact with its dorsal wall, and extends beyond it both in front and behind to the obtusely pointed extremities of the body. This notochord represents the persistent primordial skeletal axis which, in the higher Craniata (though not so in the lower), gives way by substitution to the segmented vertebral column. Immediately above the notochord there lies another subcylindrical cord, also surrounded by a sheath of connective tissue. This cord is neither elastic nor solid, but consists of nerve tissue, fibres and ganglion cells, surrounding a small central canal. For the sake of uniformity in nomenclature this nerve-cord may be called the neurochord. It is the central nervous system, and contains within itself the elements of the brain and spinal marrow of higher forms. The neurochord tapers towards its posterior end, where it is coextensive with the notochord, but ends abruptly in front, some distance behind the tip of the snout. The neurochord attains its greatest thickness not at its anterior end but some way behind this region; but the central canal dilates at the anterior extremity to form a thin-walled cerebral vesicle, in the front wall of which there is an aggregation of dark pigment cells constituting an eyespot, visible through the transparent skin (fig. 1). There are two pairs of specialized cerebral nerves innervating the praeoral lobe, and provided with peripheral ganglia placed near the termination of the smaller branches. Corresponding with each pair of myotomes, and subject to the same alternation, two pairs of spinal nerves arise from the neurochord, namely, a right and left pair of compact dorsal sensory roots without ganglionic enlargement, and a right and left pair of ventral motor roots composed of loose fibres issuing separately from the neurochord and passing directly to their termination on the muscle-plates of the myotomes. The first dorsal spinal nerve coincides in position with the myocomma which separates the first myotome from the second on each side, and thereafter the successive dorsal roots pass through the substance of the myocommata on their way to the skin; they are therefore septal or intersegmental in position. The ventral roots, on the contrary, are myal or segmental in position. In addition to the cerebral eyespot there are large numbers of minute black pigmented bodies beside and below the central canal of the neurochord, commencing from the level of the third myotome. It has been determined that these bodies are of the nature of eyes (*Becheraugen*, R. Hesse), each consisting of two cells, a cup-shaped pigment cell and a triangular retinal cell. These may be called the spinal eyes, and it is said that they are disposed in such a way as to receive illumination preferentially from the right side, although this fact has no relation with the side upon which *Amphioxus* may lie upon the sand. When kept in captivity the animal often lies upon one side on the surface of the sand, but on either side indifferently. Over the cerebral eye there is a small orifice placed to the left of the base of the cephalic fin, leading into a pit which extends from the surface of the body to the surface of the cerebral vesicle; this is known as A. von Kölliker's olfactory pit.

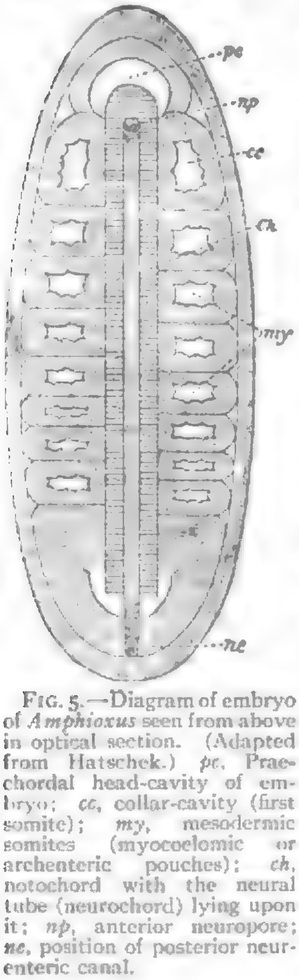

FIG. 5.—Diagram of embryo of *Amphioxus* seen from above in optical section. (Adapted from Hatschek.) *pc*, Praechordal head-cavity of embryo; *cc*, collar-cavity (first somite); *my*, mesodermic somites (myocoelomic or archenteric pouches); *ch*, notochord with the neural tube (neurochord) lying upon it; *np*, anterior neuropore; *ne*, position of posterior neurenteric canal.

Reproductive System.—The sexes are separate, and the male or female gonads, which are exactly similar in outward appearance, occur as a series of gonadic pouches projecting into the atrial cavity at the base of the myotomes (figs. 2, 3, 4). At the breeding season the walls of the pouches burst and the sexual elements pass into the atrium, whence they are discharged through the atriopore into the water, where fertilization takes place.

Development.—The development of *Amphioxus* possesses many features of interest, and cannot fail to retain its importance as an introduction to the study of embryology. The four principal phases in the development are: (1) Blastula, (2) Gastrula, (3) Flagellate Embryo, (4) Larva. The segmentation or cleavage of the ovum which follows upon fertilization terminates in the achievement of the blastula form, a minute sphere of cells surrounding a central cavity. Then follows the phenomenon of gastrulation, by which one-half of the blastula is invaginated into the other, so as to obliterate the segmentation cavity. The embryo now consists of two layers of cells, epiblast and hypoblast, surrounding a cavity, the archenteron, which opens to the exterior by the orifice of invagination or blastopore. One important fact should be noted with regard to the gastrula, in which it seems to differ from the gastrulae of invertebrata. After invagination is completed, the embryo begins to elongate, the blastopore becomes narrower, and the dorsal wall of the gastrula loses its convexity, and becomes flattened to form the dorsal plate, the outer layer of which is the primordium of the neurochord and the inner layer the primordium of the notochord. While still within the egg-membrane the epiblastic cells become flagellated, and the gastrula rotates within the membrane. About the eighth hour after commencement of development the membrane ruptures and the oval embryo escapes, swimming by means of its flagella at the surface of the sea for another twenty-four hours, during which the principal organs are laid down, although the mouth does not open until the close of this period. The primordium of the neurochord (neural or medullary plate) referred to above becomes closed in from the surface by the overgrowth of surrounding epiblast, and its edges also bend up, meet, and finally fuse to form a tube, the medullary or neural tube. An important fact to note is that the blastopore is included in this overgrowth of epiblast, so that the neural tube remains for some time in open communication with the archenteron by means of a posterior neurenteric canal. It is still longer before the neural tube completes its closure in front, exhibiting a small orifice at the surface, the anterior neuropore. It is thus possible that the neurenteric canal is due to the conjunction of a posterior neuropore with the blastopore, *i.e.* it is a complex and not a simple structure. Paired archenteric pouches

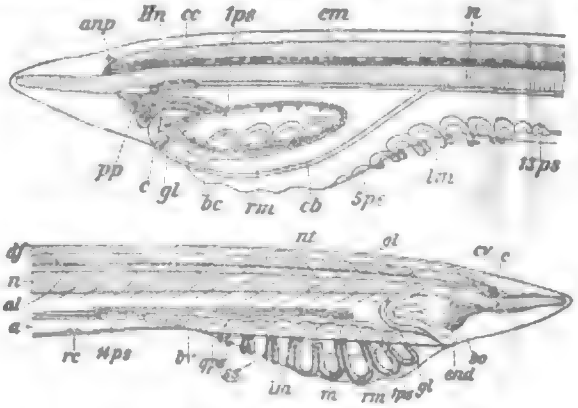

FIG. 6.—Anterior region of two pelagic larvae of *A. lanceolatus* obtained by the tow-net in 8–10 fathoms, showing the asymmetry of the large lateral sinistral mouth with its ciliated margin *cm* and the dextral series of simple primary gill-slits (*1ps*-*14ps*). The larvae swim normally like the adult or suspend themselves by their flagella (not shown in the figures) vertically in mid-water. There is nothing in their mode of life which will afford an explanation of the asymmetry which is a developmental phenomenon. *Lettering of upper figure.*—*anp*, Anterior neural pore; *bc*, rudiment of buccal skeleton; *c*, cilia; *cb*, ciliated band; *cc*, ciliated groove; *cm*, cilia at margin of mouth; *gl*, external opening of club-shaped gland; *Hn*, Hatschek's nephridium; *lm*, left metapleur; *n*, notochord; *pp*, praeoral pit; *ps*, primary gill-slits, 1, 5, and 13; *rm*, right metapleur showing through. *Lettering of lower figure.*—*a*, Atrium; *al*, alimentary canal; *bv*, blood-vessel; *cv*, cerebral vesicle; *df*, dorsal section of myocoel (=fin spaces); *e*, "eyespot"; *end*, endostyle; *gl*, club-shaped gland; *lm*, edge of left metapleur; *m*, lower edge of mouth; *n*, notochord; *nt*, pigmented nerve tube; *ps*, primary gill-slits, 1, 9, and 14; *rc*, renal cells on atrial floor; *rm*, edge of right metapleur; *so*, sense organ opening into praeoral pit; *ss*, thickenings, the rudiments of the row of secondary gill-slits.

meanwhile appear at the sides of the axial notochordal tract, the mesoblastic somites. The first of these differs in several respects from those which succeed, and has been called the collar cavity (MacBride). In front of the latter there remains a portion of the archenteron, which becomes constricted off as the head cavity. This becomes divided into two, the right half forming the cavity of the rostrum, while the left acquires an opening to the exterior, and forms the praeoral pit of the larva, which subsequently gives rise to special ciliated tracts in the vestibule of the mouth mentioned above. The larval period commences at about the thirty-sixth hour with the perforation of the mouth, first gill-cleft and anus. The larva is curiously asymmetrical, as many as fourteen gill-clefts appearing in an unpaired series on the right side, while the mouth is a large orifice on the left side, the anus being median. The adult form is achieved by metamorphosis, which cannot be further described here. One point must not be omitted, namely, the homogeny of the endostyle of Amphioxus and the thyroid gland of Craniata.

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AMPHIPOLIS (mod. *Yeni Keui*), an ancient city of Macedonia, on the east bank of the river Strymon, where it emerges from Lake Cercinitis, about 3 m. from the sea. Originally a Thracian town, known as Ἐννέα Ὁδοί ("Nine Roads"), it was colonized by Athenians with other Greeks under Hagnon in 437 B.C., previous attempts—in 497, 476 (Schol. Aesch. *De fals. leg.* 31) and 465—having been unsuccessful. In 424 B.C. it surrendered to the Spartan Brasidas without resistance, owing to the gross negligence of the historian Thucydides, who was with the fleet at Thasos. In 422 B.C. Cleon led an unsuccessful expedition to recover it, in which both he and Brasidas were slain. The importance of Amphipolis in ancient times was due to the fact that it commanded the bridge over the Strymon, and consequently the route from northern Greece to the Hellespont; it was important also as a depot for the gold and silver mines of the district, and for timber, which was largely used in shipbuilding. This importance is shown by the fact that, in the peace of Nicias (421 B.C.), its restoration to Athens is made the subject of a special provision, and that about 417, this provision not having been observed, at least one expedition was made by Nicias with a view to its recovery. Philip of Macedon made a special point of occupying it (357), and under the early empire it became the headquarters of the Roman propraetor, though it was recognized as independent. Many inscriptions, coins, &c., have been found here, and traces of the ancient fortifications and of a Roman aqueduct are visible.

AMPHIPROSTYLE (from the Gr. ἀμφί, on both sides, and πρόστυλος, a portico), the term for a temple (*q.v.*) with a portico both in the front and in the rear.

AMPHISBAENA (a Greek word, from ἀμφίς, both ways, and βαίνειν, to go), a serpent in ancient mythology, beginning or ending at both head and tail alike. Its fabled existence has been utilized by the poets, such as Milton, Pope and Tennyson. In modern zoology it is the name given to the main genus of a family of worm-shaped lizards, most of which inhabit the tropical parts of America, the West Indies and Africa. The commonest species in South America and the Antilles is the sooty or dusky *A. fuliginosa*. The body of the amphisbaena, from 18 to 20 in. long, is of nearly the same thickness throughout. The head is small, and there can scarcely be said to be a tail, the vent being close to the extremity of the body. The animal lives mostly underground, burrowing in soft earth, and feeds on ants and other small animals. From its appearance, and the ease with which it moves backwards, has arisen the popular belief that the amphisbaena has two heads, and that when the body is cut in two the parts seek each other out and reunite. From this has arisen another popular error, which attributes extraordinary curative properties to its flesh when dried and pulverized.

AMPHITHEATRE (Gr. ἀμφί, around, and θέατρον, a place for spectators), a building in which the seats for spectators surround the scene of the performance. The word was doubtless coined by the Greeks of Campania, since it was here that the gladiatorial shows for which the amphitheatre was primarily used were first organized as public spectacles. The earliest building of the kind still extant is that at Pompeii, built after 80 B.C. It is called *spectacula* in a contemporary inscription. The word *amphitheatrum* is first found in writers of the Augustan age.

In Italy, combats of gladiators at first took place in the forums, where temporary wooden scaffoldings were erected for the spectators; and Vitruvius gives this as the reason why in that country the forums were in the shape of a parallelogram instead of being squares as in Greece. Wild beasts were also hunted in the circus. But towards the end of the Roman republic, when the shows increased both in frequency and in costliness, special buildings began to be provided for them.

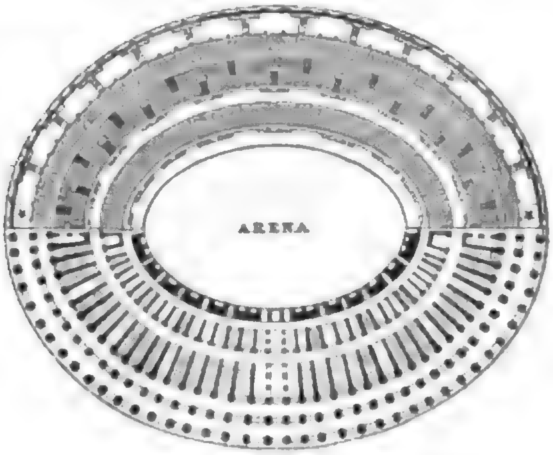
The first amphitheatre at Rome was that constructed, 59 B.C., by C. Scribonius Curio. Pliny tells us that Curio built two wooden theatres, which were placed back to back, and that after the dramatic representations were finished, they were turned round, with all the spectators in them, so as to make one circular theatre, in the centre of which gladiators fought; but the story is incredible, and must have arisen from the false translation of ἀμφιθέατρον by "double theatre." It is uncertain whether Caesar, in 46 B.C., constructed a temporary amphitheatre of wood for his shows of wild beasts; at any rate, the first permanent amphitheatre was built by C. Statilius Taurus in 29 B.C. Probably the shell only was of stone. It was burnt in the great fire of A.D. 64.

We hear of an amphitheatre begun by Caligula and of a wooden structure raised in the year A.D. 57 by Nero; but these were superseded by the *Amphitheatrum Flavium* (known at least since the 8th century as the Colosseum, from its colossal size), which was begun by Vespasian on the site of an artificial lake included in the Golden House of Nero, and inaugurated by Titus in A.D. 80 with shows lasting one hundred days. It was several times restored by the emperors, having been twice struck by lightning in the 3rd century and twice damaged by earthquake in the 5th. Gladiatorial shows were suppressed by Honorius in A.D. 404, and wild beast shows are not recorded after the reign of Theodoric (d. A.D. 526). In the 8th century Bede wrote *Quamdiu stabit Coliseus, stabit et Roma; quando cadet Coliseus, cadet et Roma*. A large part of the western arcades seem to have collapsed in the earthquake of A.D. 1349, and their remains were used in the Renaissance as a quarry for building materials (*e.g.* for the Palazzo di Venezia, the Cancelleria and the Palazzo Farnese).

Rome possesses the remains of a second amphitheatre on the Esquiline, called by the chronologist of A.D. 354 *Amphitheatrum Castrense*, which probably means the "court" or "imperial" amphitheatre. Its fine brickwork seems to date from Trajan's reign. It was included by Aurelian in the circuit of his wall. The remains of numerous amphitheatres exist in the various provinces of the empire. The finest are—in Italy, those of Verona (probably of the Flavian period), Capua (built under Hadrian) and Pozzuoli; in France, at Nîmes, Arles and Fréjus; in Spain, at Italica (near Seville); in Tunisia, at Thysdrus (El-Jem); and at Pola, in Dalmatia. The builders often took advantage of natural features, such as a depression between hills; and ruder structures, mainly consisting of banked-up earth, are found, *e.g.* at Silchester (Calleva). The amphitheatre at Pompeii (length 444 ft., breadth 342 ft., seating capacity 20,000) is formed by a huge embankment of earth supported by a retaining wall and high buttresses carrying arches. The stone seats (of which there are thirty-five rows in three divisions) were only gradually constructed as the means of the community allowed. Access to the highest seats was given by external staircases, and there was no system of underground chambers for wild beasts, combatants, &c.

In contrast to this simple structure the Colosseum represents the most elaborate type of amphitheatre created by the architects of the empire. Its external elevation consisted of four storeys. The three lowest had arcades whose piers were adorned with engaged columns of the three Greek orders. The arches numbered eighty. Those of the basement storey served as entrances; seventy-six were numbered and allotted to the general body of spectators, those at the extremities of the major axis led into the arena, and the boxes reserved for the emperor and the presiding magistrate were approached from the extremities of the minor axis. The higher arcades had a low parapet with (apparently) a statue in each arch, and gave light and air to the passages which surrounded the building. The openings of the arcades above the principal entrances were larger than the rest, and were adorned with figures of chariots. The highest stage was composed of a continuous wall of masonry, pierced by forty small square windows, and adorned with Corinthian pilasters. There was also a series of brackets to support the poles on which the awning was stretched.

The interior may be naturally divided into the *arena* and the *cavea* (see annexed plan, which shows the Colosseum at two different levels).



The *arena* was the portion assigned to the combatants, and derived its name from the sand with which it was strewn, to absorb the blood and prevent it from becoming slippery. Some of the emperors showed their prodigality by substituting precious powders, and even gold dust, for sand. The *arena* was generally of the same shape as the amphitheatre itself, and was separated from the spectators by a wall built perfectly smooth, that the wild beasts might not by any possibility climb it. At Rome it was faced inside with polished marble, but at Pompeii it was simply painted. For further security, it was surrounded by a metal railing or network, and the arena was sometimes surrounded also by a ditch (*euripus*), especially on account of the elephants. Below the arena were subterranean chambers and passages, from which wild beasts and gladiators were raised on movable platforms (*pegmata*) through trap-doors. Such chambers have been found in the amphitheatres of Capua and Pozzuoli as well as in the Colosseum. Means were also provided by which the arena could be flooded when a sea-fight (*naumachia*) was exhibited, as was done by Titus at the inauguration of the Colosseum.

The part assigned to the spectators was called *cavea*. It was divided into several galleries (*maeniana*) concentric with the outer walls, and therefore, like them, of an elliptical form. The place of honour was the lowest of these, nearest to the arena, and called the *podium*. The divisions in it were larger, so as to be able to contain movable seats. At Rome it was here that the emperor sat, his box bearing the name of *suggestus*, *cubiculum* or *pulvinar*. The senators, principal magistrates, vestal virgins, the provider (*editor*) of the show, and other persons of note, occupied the rest of the *podium*. At Nîmes, besides the high officials of the town, the *podium* had places assigned to the principal gilds, whose names are still seen inscribed upon it, with the number of places reserved for each. In the Colosseum there were three *maeniana* above the *podium*, separated from each other by terraces (*praecinctiones*) and walls (*baltei*), and divided vertically into wedge-shaped blocks (*cunei*) by stairs. The lowest was appropriated to the equestrian order, the highest was covered in with a portico, whose roof formed a terrace on which spectators found standing room. Numerous passages (*vomitoria*) and small stairs gave access to them; while long covered corridors, behind and below them, served for shelter in the event of rain. At Pompeii each place was numbered, and elsewhere their extent is defined by little marks cut in the stone. The spectators were admitted by tickets (*tesserae*), and order preserved by a staff of officers appointed for the purpose.

The height of the Colosseum is about 160 ft.; but the fourth storey in its present form is not earlier in date than the 3rd century A.D. It seems to have been originally of wood, since an inscription of the year A.D. 80 mentions the *summum maenianum in ligneis*. It is stated in the *Notitia Urbis Romae* (4th century) that the Colosseum contained 87,000 places; but Huelsen calculates that the seats would accommodate 45,000 persons at most, besides whom 5000 could find standing room. The exaggerated estimate is due to the fact that space was allotted to corporate bodies, whose numbers were taken as data. The greatest length is about 615 ft., and the length of the shorter axis of the ellipse about 510 ft. The dimensions of the arena were 281 ft. by 177 ft.

The following table, giving the dimensions of some of the principal amphitheatres, is based mainly on the figures given by Friedländer (*l.c.*):—

	ENTIRE BUILDING.		ARENA.	
	Greater Axis.	Shorter Axis.	Greater Axis.	Shorter Axis.
Rome (Colosseum)	615	510½	281	177
Capua	557	458	250	148
Julia Caesarea	551	289	459	197
Italica (Seville)	514	439½	. .	. .
Verona	502½	403	248	145½
Thysdrus	488	406	308	197
Tarraco	486	390	277	181
Pozzuoli	482	383	236½	137½
Tours	472	406	223	98½
Pola	449½	367½	230	144½
Arles	448	352	229	129
Pompeii	444	342	218½	115
Nîmes	440	336	227	126½

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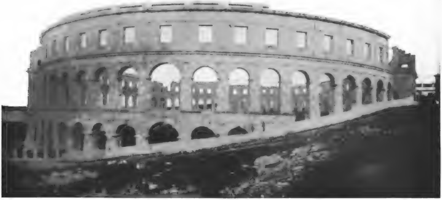
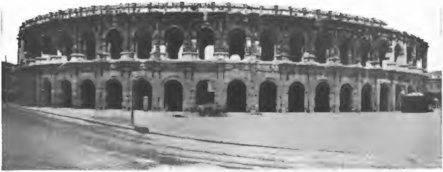


Photo, Dr. T. Ashby.

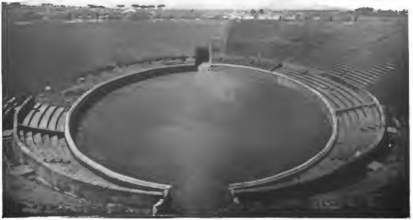
EXTERIOR OF THE AMPHITHEATRE AT POLO (*Pietas Julia*), ISTRIA.



Photo, Neurdein.

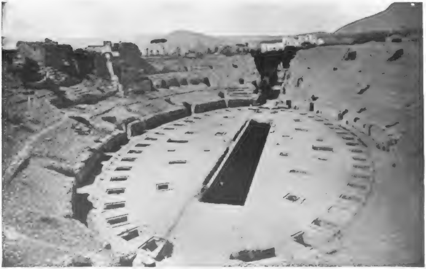
EXTERIOR OF THE AMPHITHEATRE AT NÎMES (NEMAUSUS).

AMPHITHEATRE



INTERIOR OF THE AMPHITHEATRE AT POMPEII.

Photo, Brogi.



INTERIOR OF THE AMPHITHEATRE AT POZZUOLI (PUTEOLI).

Photo, Brogi.

Pompeii, its Life and Art (2nd ed. 1904), chap. 30; for the Colosseum, Middleton, *Remains of Ancient Rome*, ii. pp. 78-110, and Huelsen's art. "Flavium Amphitheatrum" in Pauly-Wissowa, *Realencyclopädie*. (H. S. J.)

AMPHITRITE, in ancient Greek mythology, a sea-goddess, daughter of Nereus (or Oceanus) and wife of Poseidon. She was so entirely confined in her authority to the sea and the creatures in it, that she was never associated with her husband either for purposes of worship or in works of art, except when he was to be distinctly regarded as the god who controlled the sea. She was one of the Nereids, and distinguishable from the others only by her queenly attributes. It was said that Poseidon saw her first dancing at Naxos among the other Nereids, and carried her off (Schol. on *Od.* iii. 91). But in another version of the myth, she then fled from him to the farthest ends of the sea, where the dolphin of Poseidon found her, and was rewarded by being placed among the stars (Eratosthenes, *Catast.* 31). In works of art she is represented either enthroned beside him, or driving with him in a chariot drawn by sea-horses or other fabulous creatures of the deep, and attended by Tritons and Nereids. In poetry her name is often used for the sea.

AMPHITRYON, in Greek mythology, son of Alcaeus, king of Tiryns in Argolis. Having accidentally killed his uncle Electryon, king of Mycenae, he was driven out by another uncle, Sthenelus. He fled with Alcmene, Electryon's daughter, to Thebes, where he was cleansed from the guilt of blood by Creon, his maternal uncle, king of Thebes. Alcmene, who had been betrothed to Amphitryon by her father, refused to marry him until he had avenged the death of her brothers, all of whom except one had fallen in battle against the Taphians. It was on his return from this expedition that Electryon had been killed. Amphitryon accordingly took the field against the Taphians, accompanied by Creon, who had agreed to assist him on condition that he slew the Teumessian fox which had been sent by Dionysus to ravage the country. The Taphians, however, remained invincible until Comaetho, the king's daughter, out of love for Amphitryon cut off her father's golden hair, the possession of which rendered him immortal. Having defeated the enemy, Amphitryon put Comaetho to death and handed over the kingdom of the Taphians to Cephalus. On his return to Thebes he married Alcmene, who gave birth to twin sons, Iphicles being the son of Amphitryon, Heracles of Zeus, who had visited her during Amphitryon's absence. He fell in battle against the Minyans, against whom he had undertaken an expedition, accompanied by the youthful Heracles, to deliver Thebes from a disgraceful tribute. According to Euripides (*Hercules Furens*) he survived this expedition, and was slain by his son in his madness. Amphitryon was the title of a lost tragedy of Sophocles; the episode of Zeus and Alcmene forms the subject of comedies by Plautus and Molière. From Molière's line "Le véritable Amphitryon est l'Amphitryon où l'on dîne" (*Amphitryon*, iii. 5), the name Amphitryon has come to be used in the sense of a generous entertainer, a good host.

Apollodorus ii. 4; Herodotus v. 59; Pausanias viii. 14, ix, 10, 11, 17; Hesiod, *Shield*, 1-56; Pindar, *Pythia*, ix. 81.

AMPHORA (a Latin word from Gr. *ἀμφορεύς*, derived from ἀμφί, on both sides, and *φέρειν*, to bear), a large big-bellied vessel used by the ancient Greeks and Romans for preserving wine, oil, honey, and fruits; and in later times as a cinerary urn. It was so named from usually having an ear or handle on each side of the neck (*diōta*). It was commonly made of earthenware, but sometimes of stone, glass or even more costly materials. Amphorae either rested on a foot, or ended in a point so that they had to be fixed in the ground. The older amphorae were oval-shaped, such as the vases filled with oil for prizes at the Panathenaic festival, having on one side a figure of Athena, on the other a representation of the contest; the latter were tall and slender, with voluted handles. The first class exhibits black figures on a reddish background, the second red figures on a black ground. The amphora was a standard measure of capacity among both Greeks and Romans, the Attic containing nearly nine gallons, and the Roman about six. In modern botany it is a technical term sometimes denoting the lower part of the capsule called pyxidium, attached to the flower stalk in the form of an urn.

AMPLIATIVE (from Lat. *ampliare*, to enlarge), an adjective used mainly in logic, meaning "extending" or "adding to that which is already known." In Norman law an "ampliation" was a postponement of a sentence in order to obtain further evidence.

AMPLITUDE (from Lat. *amplus*, large), in astronomy, the angular distance of the rising or setting sun, or other heavenly body, from the east or west point of the horizon; used mostly by navigators in finding the variation of the compass by the setting sun. In algebra, if a be a real positive quantity and ω a root of unity, then a is the *amplitude* of the product $a\omega$. In elliptic integrals, the amplitude is the limit of integration when the integral is expressed in the form $\int_0^{\phi}\sqrt{1-N^2\sin^2\phi\,d\phi}$. The *hyperbolic* or *Gudermannian* amplitude of the quantity x is $\overset{-1}{\tan}$ (sinh x). In mechanics, the amplitude of a wave is the maximum ordinate. (See WAVE.)

AMPSANCTUS, or AMSANCTUS (mod. *Sorgente Mefita*), a small lake in the territory of the Hirpini, 10 m. S.E. of Aeclanum, close to the Via Appia. There are now two small pools which exhale carbonic acid gas and sulphuretted hydrogen. Close by was a temple of the goddess Mephitis, with a cave from which suffocating vapours rose, and for this reason the place was brought into connexion with the legends of the infernal regions. Virgil's description (*Aeneid*, vii. 563) is not, however, very accurate.

AMPTHILL, ODO WILLIAM LEOPOLD RUSSELL, 1ST BARON (1829–1884), British diplomatist and ambassador, was born in Florence on the 20th of February 1829. He was the son of Major-General Lord George William Russell, by Elizabeth Ann, niece of the marquess of Hastings, who was governor-general of India during the final struggle with the Mahrattas. His education, like that of his two brothers—Hastings, who became eventually 9th duke of Bedford, and Arthur, who sat for a generation in the House of Commons as member for Tavistock—was carried on entirely at home, under the general direction of his mother, whose beauty was celebrated by Byron in *Beppo*. Lady William Russell was as strong-willed as she was beautiful, and certainly deserved to be described as she was by Disraeli, who said in conversation, "I think she is the most fortunate woman in England, for she has the three nicest sons." If it had not been for her strong will it is as likely as not that all the three would have gone through the usual mill of a public school, and have lost half their very peculiar charm. In March 1849 Odo was appointed by Lord Malmesbury attaché at Vienna. From 1850 to 1852 he was temporarily employed in the foreign office, whence he passed to Paris. He remained there, however, only about two months, when he was transferred to Vienna. In 1853 he became second paid attaché at Paris, and in August 1854 he was transferred as first paid attaché to Constantinople, where he served under Lord Stratford de Redcliffe. He had charge of the embassy during his chief's two visits to the Crimea in 1855, but left the East to work under Lord Napier at Washington in 1857. In the following year he became secretary of legation at Florence, but was detached from that place to reside in Rome, where he remained for twelve years, till August 1870. During all that period he was the real though unofficial representative of England at the Vatican, and his consummate tact enabled him to do all, and more than all, that an ordinary man could have done in a stronger position. A reference, however, to his evidence before a committee of the House of Commons in 1871 will make it clear to any unprejudiced reader that those were right who, during the early 'fifties, urged so strongly the importance of having a duly accredited agent at the papal court. The line taken by him during the Vatican council has been criticized, but no fault can justly be found with it. Abreast as he was of the best thought of his time—the brother of Arthur Russell, who, more perhaps than any other man, was its most ideal representative in London society—he sympathized strongly with the views of those who laboured to prevent the extreme partisans of papal infallibility from having everything their own way. But in his capacity of clear-headed observer, whose business it was to reflect the actual truth upon the mind of his government, he was obliged to make it quite clear that they had no chance whatever, and in conversing with those whose opinions were quite unlike his own, such as Cardinal Manning, he seems to have shown that he had no illusions about the result of the long debate. In 1868 Odo Russell married Lady Emily Theresa Villiers, the daughter of Lord Clarendon. In 1870 he was appointed assistant under-secretary at the foreign office, and in November of that year was sent on a special mission to the headquarters of the German army, where he remained till 1871.

It was in connexion with this mission that an episode occurred which at the time threw much discredit upon Gladstone's government. Russia had taken advantage of the collapse of France and her own cordial relations with Prussia to denounce the Black Sea clauses of the treaty of Paris of 1856. Russell, in an interview with Bismarck, pointed out that unless Russia withdrew from an attitude which involved the destruction of a treaty solemnly guaranteed by the powers, Great Britain would be forced to go to war "with or without allies." This strong attitude was effective, and the question was ultimately referred to and settled by the conference which met at London in 1871. Though the result was to score a distinct diplomatic success for the Liberal government, the bellicose method employed wounded Liberal sentiment and threatened to create trouble for the ministry in parliament. On the 16th of February 1871, accordingly, Gladstone, in answer to a question, said that "the argument used by Mr Odo Russell was not one which had been directed by her Majesty's government," that it was used by him "without any specific instructions or authority from the government," but that, at the same time, no blame was to be attached to him, as it was "perfectly well known that the duty of diplomatic agents requires them to express themselves in that mode in which they think they can best support and recommend the propositions of which they wish to procure acceptance." This Gladstonian explanation was widely criticized as an illegitimate attack on Russell. What is certain is that the foreign office and the country profited by Russell's firmness. (See Morley's *Gladstone*, ii. 534.)

A little later in the same year he received the well-deserved reward of his labours by being made ambassador at Berlin.

During the months he passed at the foreign office he was examined before the committee of the House of Commons, already alluded to, and had an opportunity of stating very distinctly in public some of his views with regard to his profession. "If you could only organize diplomacy properly," he said, "you would create a body of men who might influence the destinies of mankind and ensure the peace of the world." In these words we have the key to the thought and habitual action of one of the best and wisest public servants of the time.

Russell remained at Berlin, with only brief intervals of absence, from the 16th of October 1871 till his death at Potsdam on the 25th of August 1884. He was third plenipotentiary at the Berlin congress, and is generally credited with having prevented, by his tact and good sense, the British prime minister from making a speech in French, which he knew very imperfectly and pronounced abominably. In 1874 Odo Russell received a patent of precedence raising him to the rank of a duke's son, and after the congress of Berlin he was offered a peerage by the Conservative government. This he naturally declined, but accepted the honour in 1881 when it was offered by the Liberals, taking the title of Baron Ampthill. He became a privy councillor in 1872 and was made a G.C.B. somewhat later. At the conference about the Greek frontier, which followed the congress of Berlin, he was the only British representative. During all his long sojourn in the Prussian capital, he did everything that in him lay to bring about close and friendly relations between Great Britain and Germany. He kept on the best of terms with Bismarck, carefully avoiding everything that could give any cause of offence to that most jealous and most unscrupulous minister, whom he, however, did not hesitate to withstand when his unscrupulousness went the length of deliberately attempting to deceive.

He was succeeded as 2nd baron by his son, ARTHUR OLIVER VILLIERS RUSSELL (b. 1869), who rowed in the Oxford eight (1889, 1890, 1891) and became a prominent Unionist politician. He was private secretary to Mr Chamberlain, 1895–1897, and governor of Madras, 1899–1906. In 1904 he acted temporarily as Viceroy of India. (M. G. D.)

AMPTHILL, a market town in the northern parliamentary division of Bedfordshire, England, 44 m. N.N.W. of London by the Midland railway. Pop. of urban district (1901) 2177. It lies on the southern slope of a low range of hills, in a well-wooded district. The church of St Andrew ranges in date from Early English to Perpendicular. It contains a monument to Richard Nicolls (1624–1672), who, under the patronage of the duke of York, brother to Charles II., to whom the king had granted the Dutch North American colony of New Netherland, received the submission of its chief town, New Amsterdam, in 1664, and became its first English governor, the town taking the name of New York. Nicolls perished in the action between the English and Dutch fleets at Solebay, and the ball which killed him is preserved on his tomb. Houghton Park, in the vicinity, contains the ruins of Houghton House, built by Mary, countess of Pembroke, in the time of James I. To this countess Sir Philip Sidney dedicated the *Arcadia*. Ampthill Park became in 1818 the seat of that Lord Holland in whose time Holland House, in Kensington, London, became famous as a resort of the most distinguished intellectual society. In the park a cross marks the site of Ampthill Castle, the residence of Catherine of Aragon while her divorce from Henry VIII. was pending. A commemorative inscription on the cross was written by Horace Walpole. Brewing, straw-plaiting and lace-making are carried on in Ampthill.

AMPULLA (either a diminutive of *amphora*, or from Lat. *ambo*, both, and *olla*, a pot), a small, narrow-necked, round-bodied vase for holding liquids, especially oil and perfumes. It is the Latin term equivalent to the Greek λήκυθος. It was used in ancient times for toilet purposes and anointing the bodies of the dead, being then buried with them. Gildas mentions the use of *ampullae* as established among the Britons in his time, and St Columba is said to have employed one in the coronation of King Aidan. Both the name and the function of the ampulla have survived in the Western Church, where it still signifies the vessel containing the oil consecrated by the bishop for ritual uses, especially in the sacraments of Confirmation, Orders and Extreme Unction. The word occurs repeatedly in the service of coronation of the English sovereign in connexion with the ancient ceremony of anointing by the archbishop of Canterbury, which is still observed. The ampulla of the regalia of England takes the form of a golden eagle with outspread wings. The most celebrated ampulla in history was that known as *la sainte ampoule*, in the abbey of St Remi at Reims, from which the kings of France were anointed. According to the legend it had been brought from heaven by a dove for the coronation of Clovis, and at one period the kings of France claimed precedence over all other sovereigns on account of it. It was destroyed at the Revolution. The word "ampulla" is used in biology, by analogy from the shape, for a certain portion of the anatomy of a plant or animal.

AMRAM (d. 875), a famous *gaon* or head of the Jewish Academy of Sura (Persia) in the 9th century. He was author of many "Responsa," but his chief work was liturgical. He was the first to arrange a complete liturgy for the synagogue, and his Prayer-Book (*Siddur Rab 'Amram*) was the foundation of most of the extant rites in use among the Jews. The *Siddur* was published in Warsaw in two parts (1865).

AMRAOTI, or UMRAWATTEE, a town and district of India, in Berar, Central Provinces. The district was reconstituted in 1905, when that of Ellichpur was incorporated with it. The town has a station 6 m. from Badnera junction on the Great Indian Peninsula line. Pop. (1901) 34,216, showing an increase of 22% in the decade. It is the richest town of Berar, with the most numerous and substantial commercial population. It possesses a branch of the Bank of Bombay, and has the largest cotton mart, where an average of 80,593 *bojas* of cotton are bought and sold annually. It has also a large grain market, cotton presses, ginning factories and oil mills. Amraoti raw cotton is quoted on the Liverpool Exchange.

The district of Amraoti has an area of 4754 sq. m. In 1901 the population was 630,245, showing a decrease of 4% in the decade; on the area as now constituted it was 809,499. The district is an extensive plain, about 800 ft. above sea-level, the general flatness being only broken by a small chain of hills, running in a north-westerly direction between Amraoti and Chandor, with an average height from 400 to 500 ft. above the lowlands. The principal towns, besides Amraoti, are Karinja, Kolapur, and Badnera, which lies on the Great Indian Peninsula railway, the main line of which crosses the district. Severe drought visited Amraoti in 1899–1900.

AMRAVATI, or Amaravati, a ruined city of India in the Guntur district of the Madras presidency, on the south bank of the Kistna river, 62 m. from its mouth. The town is of great interest for the antiquary as one of the chief centres of the Buddhist kingdom of Vengi, and for its *stupa* (sepulchral monument). Amravati has been identified with Hsüan Tsang's To-na-kie-tse-kia and with the Rahmi of Arab geographers. Subsequent to the disappearance of Buddhism from this region the town became a centre of the Sivaite faith. When Hsüan Tsang visited Amravati in A.D. 639 it had already been deserted for a century, but he speaks in glowing terms of its magnificence and beauty. Very careful and artistic representations of the *stupa* with its *daghoba* and interesting rail, pillars and sculptures will be found in Fergusson's *Tree and Serpent Worship*, and in his *History of Indian Architecture* (1876). Its elaborate carvings illustrate the life of Buddha. Some are preserved in the British Museum; others in the museum at Madras.

An account by Dr James Burgess was published in 1877 as one of the volumes of the Archaeological Survey of Southern India.

'AMR-IBN-EL-ASS, or 'Amr (strictly 'Amr b. 'Ās), one of the most famous of the first race of the Saracen leaders, was of the tribe of Koreish (Qureish). In his youth he was an antagonist of Mahomet. His zeal prompted him to undertake an embassy to the king of Ethiopia, in order to stimulate him against the converts whom he had taken under his protection, but he returned a convert to the Mahommedan faith and joined the fugitive prophet at Medina. When Abu Bekr resolved to invade Syria, he entrusted 'Amr with a high command. 'Amr soon perceived that his troops were not sufficient for a serious battle. Reinforced by Khālid b. al-Walīd, whom Abu Bekr sent in all haste from Irak to Syria, he defeated the imperial troops, commanded by Theodorus, the brother of Heraclius, not far from Ramleh in Palestine, on the 31st of July 634. When Omar became caliph he made Khālid chief commander of the Syrian armies, 'Amr remaining in Palestine to complete the submission of that province. It is not certain that 'Amr assisted Khālid in the siege of Damascus, but very probable that he took part in the decisive battle of Yarmūk, 20th of August 636. After this battle he laid siege to Jerusalem, in which enterprise he was seconded a year later by Abu Obeida, then chief commander. After the surrender of Jerusalem 'Amr began the siege of Caesarea, which, however, was brought to a successful end in September or October 640 by Moawiya, 'Amr having obtained Omar's sanction for an expedition against Egypt. Towards the end of 639 he led an army of 4000 Arabs into that country. During his march a messenger from Omar arrived with a letter containing directions to return if he should have received it in Syria, but if in Egypt to advance, in which case all needful assistance would be instantly sent to him. The contents of the letter were not made known to his officers until he was assured that the army was on Egyptian soil, so that the expedition might be continued under the sanction of Omar's orders. Having taken Farama (Pelusium), he advanced to Misr, north of the ancient Memphis, and besieged it and the strong fortress of Babylon for seven months. Although numerous reinforcements arrived, he would have found it very difficult to storm the place previous to the inundation of the Nile but for treachery within the citadel; the Greeks who remained there were either made prisoners or put to the sword. On the same spot 'Amr built a city named Fostat ("the encampment"), the ruins of which are known by the name of Old Cairo. The mosque which he erected and called by his own name is described in *Asiatic Journal* (1890), p. 759. 'Amr pursued the Greeks to Alexandria, but finding that it was impossible to take the place by storm, he contented himself with blockading it with the greater part of his army, and reducing the Delta to submission with the rest. At the end of twelve months Alexandria sued for peace, and a treaty was signed on the 8th of November 641. To 'Amr acting on Omar's command has been attributed the burning of the famous Alexandrian library. (See Libraries and Alexandria.) Not only is this act of barbarism inconsistent with the characters of Omar and his general, but the earliest authority for the story is Abulfaragius (Barhebraeus), a Christian writer, who lived six centuries later. After the conquest of Egypt 'Amr carried his conquests eastward along the North African coast as far as Barca and even Tripolis. His administration of Egypt was moderate and statesmanlike, and under his rule the produce of the Nile Valley was a constant source of supply to the cities of Arabia. He even reopened a canal at least 80 m. long from the Nile to the Red Sea with the object of renewing communication by sea. Removed from his office by Othman in 647, who replaced him by Ibn abi Sarh, he sided with Moawiya in the contest for the caliphate, and was largely responsible for the deposition of Ali (*q.v.*) and the establishment of the Omayyad dynasty. (See Caliphate, section B.) In 658 he reconquered Egypt in Moawiya's interest, and governed it till his death on the 6th of January 664. In a pathetic speech to his children on his deathbed, he bitterly lamented his youthful offence in opposing the prophet, although Mahomet had forgiven him and had frequently affirmed that "there was no Mussulman more sincere and steadfast in the faith than 'Amr."

Sir W. Muir, *The Caliphate* (London, 1891); E. Gibbon's *Decline and Fall*; M. J. de Goeje, *Mémoire sur la conquête de la Syrie* (Leiden, 1900); Butler, *Arab Conquest of Egypt* (Oxford, 1902); art. Egypt, *History*, Mahommedan Period.

'AMR IBN KULTHŪM, Arabian poet, author of one of the Mo'allaḳāt. Little or nothing is known of his life save that he was a member of the tribe of Taghlib and that he is said to have died of excessive wine-drinking. Some stories of him are told in the *Book of Songs* (see Abulfaraj), vol. ix. pp. 181-185.

AMRITSAR, or Umritsar, a city and district of British India, in the Lahore division of the Punjab. The city has a station on the North Western railway 32 m. E. of Lahore, its position on which has greatly assisted its development. Amritsar is chiefly notable as the centre of the Sikh religion and the site of the Golden Temple, the chief worshipping place of the Sikhs. Ram Das, the fourth *guru*, laid the foundations of the city upon a site granted by the emperor Akbar. He also excavated the holy tank from which the town derives its name of Amrita Turas, or Pool of Immortality. It is upon a small island in the middle of this tank that the Golden Temple is now situated. About two centuries afterwards, in the course of the struggle between the Sikhs and the Mahommedans, Ahmad Shah Durani routed the Sikhs at the great battle of Panipat, and on his homeward march he destroyed the town of Amritsar, blew up the temple with gunpowder, filled in the sacred tank with mud, and defiled the holy place by the slaughter of cows. But when Ahmad Shah returned to Kabul the Sikhs rose once more and re-established their religion. Finally the city and surrounding district fell under the sway of Ranjit Singh at Lahore, and passed with the rest of the Punjab into the possession of the British after the second Sikh war. The Golden Temple is so called on account of its copper dome, covered with gold foil, which shines brilliantly in the rays of the Indian sun, and is reflected back from the waters of the lake; but the building as a whole is too squat to have much architectural merit apart from its ornamentation. Marble terraces and balustrades surround the tank, and a marble causeway leads across the water to the temple, whose gilded walls, roof, dome and cupolas, with vivid touches of red curtains, are reflected in the still water. The temple was considerably enriched by the spoils taken by Ranjit Singh in his conquests. The population of Amritsar in 1901 was 162,429. A Sikh college for university education was opened in 1897. The other public buildings include two churches, a town hall and a hospital. Amritsar is famous for its carpet-weaving industry. It was the first mission station of the church of England in the Punjab.

The district is bounded on the N.W. by the river Ravi, on the S.E. by the river Beas, on the N.E. by the district of Gurdaspur, and on the S.W. by the district of Lahore. Amritsar district is a nearly level plain, with a very slight slope from east to west. The banks of the Beas are high, and on this side of the district well-water is not found except at 50 ft. below the surface; while towards the Ravi wells are less than 20 ft. in depth. The only stream passing through the district is the Kirni or Saki, which takes its rise in a marsh in the Gurdaspur district, and after traversing part of the district empties itself into the Ravi. Numerous canals intersect the district, affording ample means of irrigation. The Sind, Punjab and Delhi railway (North Western) and Grand Trunk road, which runs parallel with it, afford the principal means of land communication and traffic. The area of the district is 1601 sq. m.; pop. (1901) 1,023,828, showing an increase of 3% on the previous decade. It is the headquarters of the Sikh religion, containing 264,329 Sikhs as against 280,985 Hindus and 474,976 Mahommedans. The principal crops are wheat, pulse, maize, millet, with some cotton and sugar-cane. There are factories for ginning and pressing cotton.

AMROHA, a town of British India, in the Moradabad district of the United Provinces. It contains the tomb of a Mahommedan saint, Shaikh Saddu, and has been for many centuries a Mahommedan centre. Pop. (1901) 40,077.

AMRUM, or Amrom, a German island in the North Sea, off the coast of Schleswig-Holstein to the south of Sylt. Pop. (1900) 900. It is 6 m. long and 3 m. broad, with an area of 10½ sq. m., and is reached from the mainland by a regular steamboat service to Wittdün, a favourite sea-bathing resort; or at low water by carriage from Föhr. The larger part of Amrum consists of a treeless sandy expanse, but a fringe of rich marshes affords good pasture-land. The principal place is Nebel, connected by a light railway with Wittdün. (See also Frisian Islands.)

AMRU'-UL-QAIS, or Imru'-ul Qais, **IBN HUJR**, Arabian poet of the 6th century, the author of one of the Mo'allaḳāt (*q.v.*), was regarded by Mahomet and others as the most distinguished poet of pre-Islamic times. He was of the kingly family of Kinda, and his mother was of the tribe of Taghlib. While he was still young, his father was killed by the Bani Asad. After this his life was devoted to the attempt to avenge his father's death. He wandered from tribe to tribe to gain assistance, but his attempts were always foiled by the persistent following of the messengers of Mundhir of Hira (Ḥira). At last he went to the Jewish Arabian prince, Samu'āl, left his daughter and treasure with him, and by means of Hārith of Ghassān procured an introduction to the Byzantine emperor Justinian. After a long stay in Constantinople he was named phylarch of Palestine, and received a body of troops from Justin II. With these he started on his way to Arabia. It is said that a man of Asad, who had followed him to Constantinople, charged him before the emperor with the seduction of a princess, and that Justin sent him a poisoned cloak, which caused his death at Ancyra.

His poems are contained in W. Ahlwardt's *The Divans of the six ancient Arabic Poets* (London, 1870), and have been published separately in M'G. de Slane's *Le Diwan d'Amro'lkais* (Paris, 1837); a German version with life and notes in F. Rückert's *Amrilkais der Dichter und König* (Stuttgart, 1843). Many stories of his life are told in the *Kitāb ul-Aghānī*, vol. viii. pp. 62-77. (G. W. T.)

AMSDORF, NICOLAUS VON (1483–1565), German Protestant reformer, was born on the 3rd of December 1483 at Torgau, on the Elbe. He was educated at Leipzig, and then at Wittenberg, where he was one of the first who matriculated (1502) in the recently founded university. He soon obtained various academical honours, and became professor of theology in 1511. Like Andreas Carlstadt, he was at first a leading exponent of the older type of scholastic theology, but under the influence of Luther abandoned his Aristotelian positions for a theology based on the Augustinian doctrine of grace. Throughout his life he remained one of Luther's most determined supporters; was with him at the Leipzig conference (1519), and the diet of Worms (1521); and was in the secret of his Wartburg seclusion. He assisted the first efforts of the Reformation at Magdeburg (1524), at Goslar (1531) and at Einbeck (1534); took an active part in the debates at Schmalkalden (1537), where he defended the use of the sacrament by the unbelieving; and (1539) spoke out strongly against the bigamy of the landgrave of Hesse. After the death of the count palatine, bishop of Naumburg-Zeitz, he was installed there (January 20, 1542), though in opposition to the chapter, by the elector of Saxony and Luther. His position was a painful one, and he longed to get back to Magdeburg, but was persuaded by Luther to stay. After Luther's death (1546) and the battle of Mühlberg (1547) he had to yield to his rival, Julius von Pflug, and retire to the protection of the young duke of Weimar. Here he took part in founding Jena University (1548); opposed the "Augsburg Interim" (1548); superintended the publication of the Jena edition of Luther's works; and debated on the freedom of the will, original sin, and, more noticeably, on the Christian value of good works, in regard to which he held that they were not only useless, but prejudicial. He urged the separation of the High Lutheran party from Melanchthon (1557), got the Saxon dukes to oppose the Frankfort Recess (1558) and continued to fight for the purity of Lutheran doctrine. He died at Eisenach on the 14th of May 1565, and was buried in the church of St George there, where his effigy shows a well-knit frame and sharp-cut features. He was a man of strong will, of great aptitude for controversy, and considerable learning, and thus exercised a decided influence on the Reformation. Many letters and other short productions of his pen are extant in MS., especially five thick volumes of *Amsdorfiana*, in the Weimar library. They are a valuable source for our knowledge of Luther. A small sect which adopted his opinion on good works, was called after him; but it is now of mere historical interest.

Bibliography.—Life, in Th. Pressel, *Leben u. ausgewählte Schrift der Väter der luth. Kirche*, vol. viii. (published separately Elberfeld 1862, 8vo); J. Meier in *Das Leben der Altväter der luth. Kirche*, vol. iii. ed. M. Meurer (1863); art. by G. Kawerau in Herzog-Hauck *Realencyk. für prot. Theologie* (3rd ed., Leipzig, 1896).

AMSLER, SAMUEL (1791–1849), Swiss engraver, was born at Schinznach, in the canton of Aargau. He studied his art under Johan Heinrich Lips (1758–1817) and Karl Ernst Hess, at Munich, and from 1816 pursued it in Italy, and chiefly at Rome, till in 1829 he succeeded his former master Hess as professor of copper engraving in the Munich academy. The works he designed and engraved are remarkable for the grace of the figures, and for the wonderful skill with which he retains and expresses the characteristics of the original paintings and statues. He was a passionate admirer of Raphael, and had great success in reproducing his works. Amsler's principal engravings are: "The Triumphal March of Alexander the Great," and a full-length "Christ," after the sculptures of Thorwaldsen and Dannecker; the "Entombment of Christ," and two "Madonnas" after Raphael; and the "Union between Religion and the Arts," after Overbeck, his last work, on which he spent six years.

AMSTERDAM, the chief city of Holland, in the province of North Holland, on the south side of the Y or Ij, an arm of the Zuider Zee, in 52° 22′ N. and 4° 53′ E. Pop. (1900) 523,557. It has communication by railway and canal in every direction; steam-tramways connect it with Edam, Purmerend, Alkmaar and Hilversum, and electric railways with Haarlem and the seaside resort of Zandvoort. Amsterdam, the "dam or dyke of the Amstel," is so called from the Amstel, the canalized river which passes through the city to the Y. Towards the land the city is surrounded by a semicircular fosse or canal, and was at one time regularly fortified; but the ramparts have been demolished and are replaced by fine gardens and houses, and only one gateway, the Muiderpoort, is still standing. Within the city are four similar canals (*grachten*) with their ends resting on the Y, extending in the form of polygonal crescents nearly parallel to each other and to the outer canal. Each of these canals marks the line of the city walls and moat at different periods. Lesser canals intersect the others radially, thus virtually dividing the city into a number of islands; whence it has been compared with Venice. The nucleus of the town lies within the innermost crescent canal, and, with the large square, the Dam, in the centre, represents the area of Amsterdam about the middle of the 14th century. At one extremity of the enclosing canal is the Schreijerstoren (1482) or "Weepers' Tower," so called on account of its being at the head of the ancient harbour, and the scene in former days of sorrowful leave-takings. Between this and the next crescent of the Heeren Gracht sprang up, on the east, the labyrinthine quarter where for more than three centuries the large Jewish population has been located, and in the middle of which the painter Rembrandt lived (1640–1656) and the philosopher Spinoza was born (1632). Beyond the Heeren Gracht lie the Keizers Gracht and the Prinsen Gracht respectively, and these three celebrated canals, with their tree-bordered quays and plain but stately old-fashioned houses, form the principal thoroughfares of the city. West of the Prinsen Gracht lies the region called De Jordaan, a corruption of Le Jardin, the name which it acquired from the fact of its streets being called after various flowers. It was formed by the settlement of French refugees here after the revocation of the edict of Nantes. The outermost crescent canal is called the Singel Gracht (girdle canal), and marks the boundary of the city at the end of the 17th century. The streets in the oldest part of Amsterdam are often narrow and irregular, and the sky-line is picturesquely broken by fantastic gables, roofs and towers. The site of the city being originally a peat bog, the foundations of the houses have to be secured by driving long piles (4–20 yds.) into the firm clay below, the palace on the Dam being supported on nearly 14,000 piles. As late as 1822, however, an overladen corn magazine sank into the mud. Modern Amsterdam extends southward beyond the Singel Gracht, and here the houses are often very handsome, while the broad streets are planted with rows of large trees. In the middle of this new region lies the Vondel Park, named after the great national poet Joost van den Vondel (d. 1679), whose statue stands in the park. The Willems Park adjoining was added in later times. In the older part of the town the chief open space is the Zoological Gardens in the north-eastern corner. They belong to a private society called *Natura Artis Magistra*, and came into existence in 1838. They have, however, been much enlarged since then, and bear a high reputation. In connexion with the gardens there are an aquarium (1882), a library, and an ethnographical and natural history museum. Concerts are given here in summer as well as in the Vondel Park. Close to the Zoological Gardens are the Botanical Gardens, and a small park, also the property of a private society, in which there is a variety theatre. The public squares of the city include the Sophiaplein, with the picturesque old mint-tower; the Rembrandtplein, with a monument (1852) to the painter by Lodswyk Royer; the Thorbeckeplein, with a monument to the statesman, J. R. Thorbecke (1798–1872), and the Leidscheplein, with the large town theatre, rebuilt in 1890–1894 after a fire.

Buildings and Institutions.—The Dam is the vital centre of Amsterdam. All the tramways meet here, and some of the busiest streets, and here too are situated the Nieuwe Kerk and the palace. In the middle of the Dam stands a monument to those who fell in the Belgian revolution of 1830–1831, and called the Metal Cross after the war medals struck at that time. The palace is an imposing building in the classical style, originally built as a town-hall in 1648–1655 by the architect Jacob van Kempen. It was first given up to royalty on the occasion of the visit of the Stadtholder William V. in 1768, and forty years later was appropriated as a royal palace by Louis Bonaparte, king of Holland. But King William I. afterwards formally returned the palace to the city, and the sovereign is therefore actually the city's guest when residing in it. Beautifully decorated on the exterior with gable reliefs by Artus Quellinus (1609–1668) of Antwerp, its great external defect is the absence of a grand entrance. The architectural and ornamental sculpture of the interior is mostly by the same artist, and there are a few interesting pictures, as well as some realistic wall paintings by the 18th-century artist Jacob de Wit similar to those in the Huis ten Bosch near the Hague. The great hall is one of the most splendid of its kind in Europe. Like most of the lesser apartments, it is lined with white Italian marble, and in spite of its enormous dimensions the roof is unsupported by pillars. Ancient flags captured in war decorate the walls, and in the middle of the marble floor is a representation of the firmament inlaid in copper. The Nieuwe Kerk (St Catherine's), in which the sovereigns of Holland are crowned, is a fine Gothic building dating from 1408. Internally it is remarkable for its remains of ancient stained glass, fine carvings and interesting monuments, including one to the famous Admiral de Ruyter (d. 1676). A large stained-glass window commemorates the taking of the oath by Queen Wilhelmina in 1898. The new exchange (1901) is a striking building in red brick and stone, and lies a short distance away between the Dam and the fine central station (1889). The Oude Kerk (St Nicholaas), so called, was built about the year 1300, and contains some beautiful stained glass of the 16th and 17th centuries, by Pieter Aertsen of Amsterdam (1508–1575) and others. One window contains the arms of the burgomasters of Amsterdam from 1578 to 1767. Among the monuments are those to various naval heroes, including Admirals van Heemskerk (d. 1607), Sweers (d. 1673) and van der Hulst (d. 1666). The North Church was the last work of the architect Hendrik de Keyser (1565–1621) of Utrecht. The Roman Catholic church of St Nicholaas (1886) was built to replace the accommodation previously afforded by a common dwelling-house, now the Museum Amstelkring of ecclesiastical antiquities. Among the numerous Jewish synagogues, the largest is that of the Portuguese Jews (1670), which is said to be an imitation of the temple of Solomon. Other buildings of interest are the St Antonieswaag, built as a town gate in 1488–1585, and now containing the city archives; the Trippenhuis, built as a private house in 1662, and now the home of the Royal Society of Science, Letters and Fine Arts; the Netherlands Bank (1865–1869), built by the architect W. A. Froger; the new building (1860) of the Seamen's Institute, founded in 1785; the cellular prison; and the so-called Paleis van Volksvlijt, an immense building of iron and glass with a fine garden, built by Dr Samuel Sarphati, and used for industrial exhibitions, the performance of operas, &c. The museums and picture galleries of Amsterdam are of great interest. The Ryks Museum, or state museum, is the first in Holland. It is a large, handsome and finely situated building designed by Dr P. J. H. Cuyper in the Dutch Renaissance style, and erected in 1876–1885. The exterior is decorated with sculptures and tile-work, and internally it is divided, broadly speaking, into a museum of general antiquities below, and the large gallery of pictures of the Dutch and Flemish schools above. The nucleus of this unsurpassed national collection of pictures was formed out of the collections removed hither from the Pavilion at Haarlem, consisting of modern paintings, and from the town-hall, the van der Hoop Museum and the Trippenhuis in Amsterdam. The important van der Hoop collection arose out of bequests by Adrian van der Hoop and his widow in 1854 and 1880; but the most famous pictures in the Ryks Museum are perhaps the three which come from the Trippenhuis, namely, the so-called "Night-watch" and the "Syndics of the Cloth Hall" by Rembrandt, and the "Banquet of the Civic Guard," by van der Helst. The Trippenhuis gallery consisted of the pictures brought from the Hague by Louis Bonaparte, king of Holland, and belonging to the collection of the Orange family dispersed during the Napoleonic period. The municipal museum contains a collection of furniture, paintings, &c., bequeathed by Sophia Lopez-Suasso (1890), a medico-pharmaceutical collection, and the National Guard Museum. The Joseph Fodor Museum (1860) contains modern French and Dutch pictures. The private collection founded by Burgomaster Jan Six (d. 1702), the friend and patron of Rembrandt, was sold to the state in 1907; the pictures, except the family Rembrandts, are in the Ryks Museum. Close to this is the Willet-Holthuysen Museum (1895) of furniture, porcelain, &c.

Education and Charities.—There are two universities in Amsterdam: the Free University (1880), and the more ancient state university of Amsterdam, originally founded in 1632, but reconstructed in 1887. In addition to the numerous science laboratories the state university possesses a very fine library of about 100,000 volumes, including the Rosenthal collection of over 8000 books on Jewish literature. Modern educational institutions include a school of engineering (1879), a school for teachers (1878) and a school of industrial art(1879). Amsterdam is also remarkable for the number and high character of its benevolent institutions, which are to a large extent supported by voluntary contributions. Among others may be mentioned hospitals for the sick, the aged, the infirm, the blind, the deaf, the dumb, the insane, and homes for widows, orphans, foundlings and sailors. The costumes of the children educated at the different orphanages are varied and picturesque, those of the municipal orphanage being dressed in the city colours of red and black. In the Walloon orphanage are some interesting pictures by van der Helst and others. The Society for Public Welfare (*Maatschappij tot nut van het Algemeen*), founded in 1785, has for its object the promotion of the education and improvement of all classes, and has branches in every part of Holland. Among other Amsterdam societies are the *Felix Meritis* (1776), and the *Arti et Amicitiae* (1839), whose art exhibitions are of a high order.

Harbour and Commerce.—The first attempt which the city of Amsterdam made to overcome the evils wrought to its trade by the slow formation of the Pampus sandbank at the entrance to the Y from the Zuider Zee, was the construction of the North Holland canal to the Helder in 1825. But the route was too long and too intricate, and in 1876 a much larger and more direct ship canal was built across the isthmus to the North Sea at Ymuiden. The serious rivalry of Rotterdam, especially with regard to the transit trade, and the inadequacy of the Keulsche Vaart, which connected the city with the Rhine, led to the construction in 1892 of the Merwede canal to Gorinchem. Meanwhile a complete transformation took place on the Y to suit the new requirements of the city's trade. The three islands built out into the river serve to carry the railway across the front of the city, and form a long series of quays. On either side are the large East and West docks (1825–1834), and beyond these stretch the long quays at which the American and East Indian liners are berthed. On the west of the West dock is the timber dock, and east of the East dock is another series of islands joined together so as to form basins and quays, one of which is the State Marine dock (1790–1795) with the arsenal and admiralty offices. Opening out of one of the crescent canals which penetrate the city from the Y is the State Entrepôt dock (1900), the free harbour of Amsterdam, where the produce from the Dutch East Indies is stored. On the north side of the Y are the dry docks and the petroleum dock (1880–1890). The principal imports are timber, coal, grain, ore, petroleum and colonial produce. Under the last head fall tobacco, tea, coffee, cocoa, sugar, Peruvian bark and other drugs. Diamond-cutting has long been practised by the Jews and forms one of the most characteristic industries of the city. Other industries include sugar refineries, soap, oil, glass, iron, dye and chemical works; distilleries, breweries, tanneries; tobacco and snuff factories; shipbuilding and the manufacture of machinery and stearine candles. Although no longer the centre of the banking transactions of the world, the Amsterdam exchange is still of considerable importance in this respect. The celebrated Bank of Amsterdam, founded in 1609, was dissolved in 1796, and the present Bank of the Netherlands was established in 1814 on the model of the Bank of England. The money market is the headquarters of companies formed to promote the cultivation of colonial produce.

History.—In 1204, when Giesebrecht II. of Amstel built a castle there, Amsterdam was a fishing hamlet held in fee by the lords of Amstel of the bishops of Utrecht, for whom they acted as bailiffs. In 1240 Giesebrecht III., son of the builder of the castle, constructed a dam to keep out the sea. To these two, then, the origin of the city may be ascribed. The first mention of the town is in 1275, in a charter of Floris IV., count of Holland, exempting it from certain taxes.

In 1296 the place passed out of the hands of the lords of Amstel, owing to the part taken by Giesebrecht IV. in the murder of Count Floris V. of Holland. Count John (d. 1304), after coming to an understanding with the bishop of Utrecht, bestowed the fief on his brother, Guy of Hainaut. Guy gave the town its first charter in 1300. It established the usual type of government under a bailiff (*schout*) and judicial assessors (*scabini*, or *schoppenen*), the overlord's supremacy being guarded, and an appeal lying from the court of the *scabini*, in case of their disagreement, to Utrecht. In 1342 more extensive privileges were granted by Count William IV., including freedom from tolls by land and water in return for certain annual dues. In 1482 the town was surrounded with walls; and in the 16th century, during the religious troubles, it received a great increase of prosperity owing to the influx of refugees from Antwerp and Brabant. Amsterdam, influenced by its trading interests, did not join the other towns in revolt against Spain until 1578. In 1587 the earl of Leicester made an unsuccessful attempt to seize it. The great development of Amsterdam was due, however, to the treaty of Westphalia in 1648, by which its rival, Antwerp, was ruined, owing to the closing of the Scheldt. The city held out obstinately against the pretensions of the stadtholders, and in 1650 opened the dykes in order to prevent William II. from seizing it. The same device was successful against Louis XIV. in 1672; and Amsterdam, now reconciled with the stadtholder, was one of the staunchest supporters of William III. against France. After the revocation of the edict of Nantes in 1685 it opened its gates to numerous French refugees; but this hardly compensated it for its losses during the war. In 1787 Amsterdam was occupied by the Prussians, and in 1795 by the French under Pichegru. It was now made the capital of the Batavian Republic and afterwards of the kingdom of Holland. When, in 1810, this was united with the French empire, Amsterdam was recognized officially as the third town of the empire, ranking next after Paris and Rome.

See J. ter Gouw, *Geschiedeniss van Amsterdam* (3 vols., Amsterdam, 1879–1881), a full history with documents.

AMSTERDAM (NEW AMSTERDAM), an uninhabited and almost inaccessible island in the Indian Ocean, in 37° 47′ S., and 77° 34′ E., about 60 m. N. of St Paul Island, and nearly midway between the Cape of Good Hope and Tasmania. It is an extinct volcano, rising 2989 ft. from the sea. It was discovered by Anthony van Diemen in 1633, and annexed by France in 1893. It may have been sighted by the companions of Magellan returning to Europe in 1522, and by a Dutch vessel, the "Zeewolf," in 1617. In 1871 the British frigate "Megaera" was wrecked here, and most of the 400 persons on board had to remain upwards of three months on the island. The *Mémoires* of a Frenchman, Captain François Péron (Paris, 1824), who was marooned three years on the island (1792–1795), are of much interest.

AMSTERDAM, a city of Montgomery county, New York, U.S.A., on the north bank of the Mohawk river, about 33 m. N.W. of Albany. Pop. (1890) 17,336; (1900) 20,929, of whom 5575 were foreign-born; (1910) 31,267. It is served by the New York Central & Hudson River and the West Shore railways, and by the Erie Canal. Hills on both sides of the river command fine views of the Mohawk Valley. Amsterdam has two hospitals, a free public library and St Mary's Institute (Roman Catholic). Manufacturing is the most important industry, and carpets and rugs, hosiery and knit goods are the most important products. In 1905 the city's factory products were valued at $15,007,276 (an increase of 41 % over their value in 1900); carpets and rugs being valued at $5,667,742, and hosiery and knit goods (in the manufacture of which Amsterdam ranked third among the cities of the country) at $4,667,022, or 3·4 % of the total product of the United States. Among the other manufactures are brushes, brooms, buttons, silk gloves, paper boxes, electrical supplies, dyeing machines, cigars, and wagon and carriage springs. Amsterdam was settled about 1775, and was called Veedersburg until 1804, when its present name was adopted. It was incorporated as a village in 1830, and was chartered as a city in 1885.

AMUCK, RUNNING (or more properly AMOK), the native term for the homicidal mania which attacks Malays. A Malay will suddenly and apparently without reason rush into the street armed with a kris or other weapon, and slash and cut at everybody he meets till he is killed. These frenzies were formerly regarded as due to sudden insanity. It is now, however, certain that the typical *amok* is the result of circumstances, such as domestic jealousy or gambling losses, which render a Malay desperate and weary of his life. It is, in fact, the Malay equivalent of suicide. "The act of running *amuck* is probably due to causes over which the culprit has some amount of control, as the custom has now died out in the British possessions in the peninsula, the offenders probably objecting to being caught and tried in cold blood" (W. W. Skeat).

Though so intimately associated with the Malay there is some ground for believing the word to have an Indian origin, and the act is certainly far from unknown in Indian history. Some notable cases have occurred among the Rajputs. Thus, in 1634, the eldest son of the raja of Jodhpur ran amuck at the court of Shah Jahan, failing in his attack on the emperor, but killing five of his officials. During the 18th century, again, at Hyderabad (Sind), two envoys, sent by the Jodhpur chief in regard to a quarrel between the two states, stabbed the prince and twenty-six of his suite before they themselves fell.

In Malabar there were certain professional assassins known to old travellers as *Amouchi* or *Amuco*. The nearest modern equivalent to these words would seem to be the Malayalim *Amarkhan*, "a warrior" (from *amar*, "fight"). The Malayalim term *chaver* applied to these ruffians meant literally those "who devote themselves to death." In Malabar was a custom by which the zamorin or king of Calicut had to cut his throat in public when he had reigned twelve years. In the 17th century a variation in his fate was made. He had to take his seat, after a great feast lasting twelve days, at a national assembly, surrounded by his armed suite, and it was lawful for anyone to attack him, and if he succeeded in killing him the murderer himself became zamorin (see Alex. Hamilton, "A new Account of the East Indies," in Pinkerton's *Voyages and Travels*, viii. 374). In 1600 thirty would-be assassins were killed in their attempts. These men were called *Amar-khan*, and it has been suggested that their action was "running amuck" in the true Malay sense. Another proposed derivation for *amouchi* is Sanskrit *amokshya*, "that cannot be loosed," suggesting that the murderer was bound by a vow, an explanation more than once advanced for the Malay *amuck*; but *amokshya* in such a sense is unknown in Malayalim.

See Sir F. A. Swettenham, *Malay Sketches* (1895); H. Clifford, *Studies in Brown Humanity* (1898).

AMULET (Late Lat. *amuletum*, origin unknown; falsely connected with the Arab. *ḥimālah*, a cord used to suspend a small Koran from the neck), a charm, generally, but not invariably, hung from the neck, to protect the wearer against witchcraft, sickness, accidents, &c. Amulets have been of many different kinds, and formed of different substances,—stones, metals, and strips of parchment being the most common, with or without characters or legends engraved or written on them. Gems have often been employed and greatly prized, serving for ornaments as well as for charms. Certain herbs, too, and animal preparations have been used in the same way. In setting them apart to their use as amulets, great precautions have been taken that fitting times be selected, stellar and other magic influences propitious, and everything avoided that might be supposed to destroy or weaken the force of the charm. From the earliest ages the Oriental races have had a firm belief in the prevalence of occult evil influences, and a superstitious trust in amulets and similar preservatives against them. There are references to, and apparently correctives of, these customs in the Mosaic injunctions to bind portions of the law upon the hand and as frontlets between the eyes, as well as write them upon the door-posts and the gates; but, among the later Jews especially, the original design and meaning of these usages were lost sight of; and though it has been said that the phylacteries were not strictly amulets, there is no doubt that they were held in superstitious regard. Amulets were much used by the ancient Egyptians, and also among the Greeks and Romans. We find traces of them too in the early Christian church, in the emphatic protests of Chrysostom, Augustine and others against them. The fish was a favourite symbol on these charms, from the word ἰχθύς being the initials of Ἰησοῦς Χριστὸς Θεοῦ υἱὸς σωτήρ. A firm faith in amulets still prevails widely among Asiatic nations. *Talisman*, also from the Arabic, is a word of similar meaning and use, but some distinguish it as importing a more powerful charm. A talisman, whose "virtues are still applied to for stopping blood and in cases of canine madness," figures prominently in, and gives name to, one of Sir Walter Scott's novels.

See also Arpe, *De Prodigiis Naturae et Artis Operibus Talismanes et Amuleta dictis* (Hamburg, 1717); Ewele, *Ueber Amulete* (1827); and Koop's *Palaeographica Critica*, vols. iii. and iv. (1829).

AMUR (known also as the *Sakhalin-ula*), a river of eastern Asia, formed by the confluence of the Argun and the Shilka, at Ust-Stryelka, in 53° 19′ N. lat. and 120° 30′ E. long. Both these rivers come from the south-west: the Argun, or Kerulen as it is called above Lake Kulun (Dalai-nor), through which it flows about half way between its source and Ust-Stryelka, rises in 49° N. lat. and 109° E. long.; the Shilka is formed by the union of the Onon and the Ingoda, both of which have their sources a little farther north-east than the Kerulen (Argun). The Amur proper flows at first in a south-easterly direction for about 800 m., as far as long. 132′ E., separating Manchuria from the Amur government; it then turns to the north-east, cuts its way through the Little Khingan mountains in a gorge 2000 ft. wide and 140 m. long, and after a total course of over 1700 m. discharges into the Sea of Okhotsk, opposite to the island of Sakhalin. It is estimated to drain an area of 772,000 sq. m. Its principal tributaries from the south are the Sungari, which the Chinese consider to be the true head-river of the Amur, and the Usuri; from the north it receives the Oldoi, Zeya, Bureya, Kur, Gorin and Amgun. As the mouth is choked with sandbanks, goods are disembarked at Mariinsk and carried by train (9 m.) to Alexandrovsk at the head of the Gulf of Tartary. Navigation on the river is open from April to early in November.

See T. W. Atkinson, *Travels in the Region of the Amoor* (1860); Collins, *Exploration of the Amoor* (ed. 1864) and *Voyage down the Amoor* (1866); Andree, *Das Amurgebiet* (ed. 1876); and Grum-Grshimaylo, *Account of the Amur* (Russian, 1894).

AMUR, a government of East Siberia, stretching from the Stanovoi (Yablonoi) mountains southwards to the left bank of the Amur river. It includes the basins of the Oldoi, Zeya and Bureya, left-bank tributaries of the river Amur, and has the governments of Transbaikalia on the W., Irkutsk and Yakutsk on the N., the Maritime province on the E., and Manchuria on the S.W. and S. Area, 172,848 sq. m. Immense districts are quite uninhabited. All the north-western part is occupied by a high plateau, bordered by the Great Khingan range, whose exact position in the region is not yet definitely settled. Next comes a belt of fertile plateaus bounded on the east by the Little Khingan, or Dusse-alin, a picturesque well-wooded range, which stretches in a north-easterly direction from Kirin across Manchuria, is pierced by the Amur, and continues on its left bank, separating the Bureya from the Amgun. To the east of it stretches in the same direction a strip of marshy lowlands. In the ranges which rise above the high plateau in the north-west, in the vicinity of the Stanovoi watershed, gold mines of great richness are worked. Coal of inferior quality is known to exist on the Oldoi, Zeya and Bureya. The Russians are represented by the Amur Cossacks, whose villages, *e.g.* Albazin, Kumara, Ekaterino-Nikolsk and Mikhailo-Semenovsk, are strung at intervals of 17 to 20 m. along the whole course of the river; by peasant immigrants, chiefly nonconformists, who are the wealthiest part of the population; and by a floating population of gold miners. Nomadic Tungus (Orochons), Manegres and Golds hunt and fish along the rivers. Steamers ply regularly along the Amur for 6½ months, from Khabarovsk to Stryetensk, on the Shilka terminus of the Trans-Siberian railway; but only light steamers with 2 to 3 ft. draught can navigate the upper Amur and Shilka. In the winter the frozen river is the usual highway. Rough roads and bridle-paths only are found in the interior. The great engineering difficulties in building a railway along the Amur induced the Russian government to obtain from China permission to build a railway through Manchuria, but the project for a railway from Khabarovsk to Stryetensk received imperial sanction in the summer of 1906. The Amur government has a continental climate, the yearly average at Blagovyeshchensk (50° N. lat.) being 30° Fahr. (January, 17°; July, 70°). It benefits from the influence of the monsoons. Cold north-west winds prevail from October to March, while in July and August torrential rains fall, resulting in a sudden and very considerable rise in the Amur and its right-bank tributaries. The only town is Blagovyeshchensk, but the centre of the administration is Khabarovsk in the Maritime province. The settled population in 1897 was 119,909, of whom 31,515 lived in towns.

The governor-generalship of Amur includes this government and the Maritime province, the total area being 888,830 sq. m., and the total population in 1897, 339,127. This region became known to the Russians in 1639. In 1649–1651 a party of Cossacks, under Khabarov, built a fort at Albazin on the Amur river, but in 1689 they withdrew in favour of the Chinese. From 1847 onwards they once more turned their attention to this region, and began to make settlements, especially after 1854, when a powerful flotilla sailed from Ust-Stryelka down to the mouth of the river. Four years later China ceded to Russia the whole left bank of the Amur, and also the right bank below the confluence of the Ussuri, and in 1860 all the territory between the Ussuri and the Eastern Sea. (P. A. K.)

AMYGDALIN (from the Gr. ἀμυγδάλη, almond), $C_{20}H_{27}NO_{11}$, a glucoside isolated from bitter almonds by H. E. Robiquet and A. F. Boutron-Charlard in 1830, and subsequently investigated by Liebig and Wöhler, and others. It is extracted from almond cake by boiling alcohol; on evaporation of the solution and the addition of ether, amygdalin is precipitated as white minute crystals. Sulphuric acid decomposes it into *d*-glucose, benzaldehyde and prussic acid; while hydrochloric acid gives mandelic acid, *d*-glucose and ammonia. The decomposition induced by enzymes may occur in two ways. Maltase partially decomposes it, giving *d*-glucose and mandelic nitrile glucoside, $C_6H_5CH(CN)O{\cdot}C_6H_{11}O_5$; this compound is isomeric with sambunigrin, a glucoside found by E. E. Bourquelot and Danjou in the berries of the common elder, *Sambucus nigra*. Emulsin, on the other hand, decomposes it into benzaldehyde, prussic acid, and two molecules of glucose; this enzyme occurs in the bitter almond, and consequently the seeds invariably contain free prussic acid and benzaldehyde. An "amorphous amygdalin" is said to occur in the cherry-laurel. Closely related to these glucosides is dhurrin, $C_{14}H_{17}O_7N$, isolated by W. Dunstan and T. A. Henry from the common sorghum or "great millet," *Sorghum vulgare*; this substance is decomposed by emulsin or hydrochloric acid into *d*-glucose, prussic acid, and *p*-hydroxybenzaldehyde.

AMYGDALOID, a term meaning "almond-shaped," used in anatomy and geology.

AMYL ALCOHOLS ($C_5H_{11}OH$). Eight amyl alcohols are known: normal amyl alcohol $CH_3{\cdot}(CH_2)_4{\cdot}OH$, isobutyl carbinol or isoamyl alcohol $(CH_3)_2{\cdot}CH{\cdot}CH_2{\cdot}CH_2OH$, active amyl alcohol $(CH_3)(C_2H_5){:}CH{\cdot}CH_2OH$, tertiary butyl carbinol $(CH_3)_3C{\cdot}CH_2OH$, diethyl carbinol $(C_2H_5)_2CH{\cdot}OH$, methyl (n) propyl carbinol $(CH_3{\cdot}CH_2{\cdot}CH_2)(CH_3){:}CH{:}OH$, methyl isopropyl carbinol $(CH_3)_2{:}CH(CH_3){:}CHOH$, and dimethyl ethyl carbinol $(CH_3)_2{\cdot}(C_2H_5){:}C{\cdot}OH$. Of these alcohols, the first four are primary, the last one a tertiary, the other three secondary alcohols; three of them, viz. active amyl alcohol, methyl (n) propyl carbinol, and methyl isopropyl carbinol, contain an asymmetric carbon atom and can consequently each exist in two optically active, and one optically inactive form.

The most important is isobutyl carbinol, this being the chief constituent of fermentation amyl alcohol, and consequently a constituent of fusel (*q.v.*) oil. It may be separated from fusel oil by shaking with strong brine solution, separating the oily layer from the brine layer and distilling it, the portion boiling between 125° and 140°C. being collected. For further purification it may be shaken with hot milk of lime, the oily layer separated, dried with calcium chloride and fractionated, the fraction boiling between 128° and 132°C. only being collected. It may be synthetically prepared from isobutyl alcohol by conversion into isovaleryl-aldehyde, which is subsequently reduced to isobutyl carbinol by means of sodium amalgam.

It is a colourless liquid of specific gravity 0·8248 (0°C.), boiling at 131·6°C., slightly soluble in water, easily soluble in alcohol, ether, chloroform and benzene. It possesses a characteristic strong smell and a sharp burning taste. When perfectly pure, it is not a poison, although the impure product is. On passing its vapour through a red-hot tube, it undergoes decomposition with production of acetylene, ethylene, propylene, &c. It is oxidized by chromic acid mixture to isovaleryl-aldehyde; and it forms crystalline addition compounds with calcium and stannic chlorides.

The other amyl alcohols may be obtained synthetically. Of these, tertiary butyl carbinol has been the most difficult to obtain, its synthesis having only been accomplished in 1891, by L. Tissier (*Comptes Rendus*, 1891, 112, p. 1065) by the reduction of a mixture of trimethyl acetic acid and trimethylacetyl chloride with sodium amalgam. It is a solid which melts at 48°–50° C. and boils at 112·3° C.

AMYL NITRITE (isoamyl nitrite), $C_5H_{11}{\cdot}ONO$, a liquid prepared by passing nitrous fumes (from starch and concentrated nitric acid) into warm isoamyl alcohol; or by distilling a mixture of 26 parts of potassium nitrite in 15 parts of water with 30 parts of isoamyl alcohol in 30 parts of sulphuric acid (Renard, *Jahresb.*, 1874, p. 352). It is a yellow-coloured liquid of specific gravity 0·877, boiling at about 95°–96° C. It has a characteristic penetrating odour, and produces marked effects on the system when its vapour is inhaled. It is insoluble in water, but dissolves readily in alcohol, ether, glacial acetic acid, chloroform and benzene. On heating with methyl alcohol it is converted into isoamyl alcohol, methyl nitrite being produced at the same time; a similar reaction takes place with ethyl alcohol, but the change is less complete. It is readily decomposed by nascent hydrogen, with the formation of ammonia and isoamyl alcohol; and on hydrolysis with caustic potash it forms potassium nitrite and isoamyl alcohol. When the liquid is dropped on to fused caustic potash, it forms potassium valerate. Amyl nitrite finds application in medicine, and in the preparation of anhydrous diazonium salts (E. Knoevenagel, *Berichte*, 1890, 23, p. 2094).

AMYMONE, in ancient Greek legend, daughter of Danaus. With her sisters, she had been sent to look for water, the district of Argos being then parched through the anger of Poseidon. Amymone having thrown her spear at a stag, missed it, but hit a satyr asleep in the brake. The satyr pursued her, and she called for help on Poseidon, who appeared, and for love of her beauty caused a spring to well up, which received her name. Aeschylus wrote a satyric drama on the subject. By the god Amymone became the mother of Nauplius, the wrecker. Her meeting with Poseidon at the spring is frequently represented on ancient coins and gems.

Apollodorus ii. 1, 4; Hyginus, *Fab.* 169; Propertius ii. 26.

AMYNTAS I., king of Macedonia (*c.* 540–498 B.C.), was a tributary vassal of Darius Hystaspes. With him the history of Macedonia may be said to begin. He was the first of its rulers to have relations with other countries; he entered into an alliance with the Peisistratidae, and when Hippias was driven out of Athens he offered him the territory of Anthemus on the Thermaic Gulf, with the object of turning the Greek party feuds to his own advantage (Herodotus v. 17, 94; Justin vii. 2; Thucydides ii. 100; Pausanias ix. 40). See MACEDONIAN EMPIRE.

AMYNTAS II. (or III.), son of Arrhidaeus, great-grandson of Alexander I., king of Macedonia from 393 (or 389) to 369 B.C.

He came to the throne after the ten years of confusion which followed the death of Archelaus, the patron of art and literature, and showed the same taste for Greek culture and its representatives. But he had many enemies at home; in 383 he was driven out by the Illyrians, but in the following year, with the aid of the Thessalians, he recovered his kingdom. He concluded a treaty with the Spartans, who assisted him to reduce Olynthus (379). He also entered into a league with Jason of Pherae, and assiduously cultivated the friendship of Athens. By his wife, Eurydice, he had three sons, the youngest of whom was the famous Philip of Macedon.

Diodorus xiv. 89, xv. 19, 60; Xenophon, *Hellenica*, v. 2; Justin vii. 4.

AMYOT, JACQUES (1513–1593), French writer, was born of poor parents, at Melun, on the 30th of October 1513. He found his way to the university of Paris, where he supported himself by serving some of the richer students. He was nineteen when he became M.A. at Paris, and later he graduated doctor of civil law at Bourges. Through Jacques Colure (or Colin), abbot of St Ambrose in Bourges, he obtained a tutorship in the family of a secretary of state. By the secretary he was recommended to Marguerite de Valois, and through her influence was made professor of Greek and Latin at Bourges. Here he translated *Théagène et Chariclée* from Heliodorus (1547 fol.), for which he was rewarded by Francis I. with the abbey of Bellozane. He was thus enabled to go to' Italy to study the Vatican text of Plutarch, on the translation on whose *Lives* (1559; 1565) he had been some time engaged. On the way he turned aside on a mission to the council of Trent. Returning home, he was appointed tutor to the sons of Henry II., by one of whom (Charles IX.) he was afterwards made grand almoner (1561) and by the other (Henry III.) was appointed, in spite of his plebeian origin, commander of the order of the Holy Ghost. Pius I. promoted him to the bishopric of Auxerre, and here he continued to live in comparative quiet, repairing his cathedral and perfecting his translations, for the rest of his days, though troubled towards the close by the insubordination and revolts of his clergy. He was a devout and conscientious churchman, and had the courage to stand by his principles. It is said that he advised the chaplain of Henry III. to refuse absolution to the king after the murder of the Guise princes. He was, nevertheless, suspected of approving the crime. His house was plundered, and he was compelled to leave Auxerre for some time. He died on the 6th of February 1593, bequeathing, it is said, 1200 crowns to the hospital at Orleans for the twelve " deniers " he received there when " poor and naked " on his way to Paris. He translated seven books of Diodorus (1554), the *Daphnis et Chloe* of Longus (1559) and the *Opera Moralia* of Plutarch (1572). His vigorous and idiomatic version of Plutarch, *Vies des hommes illustres*, was translated into English by Sir Thomas North, and supplied Shakespeare with materials for his Roman plays. Montaigne said of him," I give the palm to Jacques Amyot over all our French writers, not only for the simplicity and purity of his language in which he surpasses all others, nor for his constancy to so long an undertaking, nor for his profound learning . . . but I am grateful to him especially for his wisdom in choosing so valuable a work." It was indeed to Plutarch that Amyot devoted his attention. His other translations were subsidiary. The version of Diodorus he did not publish, although the manuscript had been discovered by himself. Amyot took great pains to find and interpret correctly the best authorities, but the interest of his books to-day lies in the style. His translation reads like an original work. The personal method of Plutarch appealed to a generation addicted to memoirs and incapable of any general theory of history. Amyot's book, therefore, obtained an immense popularity, and exercised great influence over successive generations of French writers.

There is a good edition of the works of Amyot from the firm of Didot (25 vols., 1818–1821). See also Auguste de Blignières, *Essai sur Amyot et les traducteurs français au xvi*^{e} *siècle* (Paris, 1851).

AMYRAUT, MOSES (1596–1664), also known as AMYRALDUS, French Protestant theologian and metaphysician, was born at Bourgueil, in the valley of Anjou, in 1596. His father was a lawyer, and, designing Moses for his own profession, sent him on the completion of his study of the humanities at Orleans to the university of Poitiers. Here he took the degree of licentiate (B.A.) of laws. On his way home from the university he passed through Saumur, and, having visited the pastor of the Protestant church there, was introduced by him to Philippe de Mornay, governor of the city. Struck with young Amyraut's ability and culture, they both urged him to change from law to theology. His father advised him to revise his philological and philosophical studies, and read over Calvin's *Institutions*, before finally determining. He did so, and decided for theology. He thereupon removed to Saumur—destined to be for ever associated with his name—and studied under J. Cameron, who ultimately regarded him as his greatest scholar. He had a brilliant course, and was in due time licensed as a minister of the French Protestant Church. The contemporary civil wars and excitements hindered his advancement. His first church was in St Aignan, in the province of Maine. There he remained two years. The eminent theologian, Jean Daillé, being then removed to Paris, advised the church at Saumur to secure Amyraut as his successor, praising him "as above himself." The university of Saumur at the same time had fixed its eyes on him as professor of theology. The great churches of Paris and Rouen also contended for him, and to win him sent their deputies to the provincial synod of Anjou. Amyraut had left the choice to the synod. He was appointed to Saumur in 1633, and to the professor's chair along with the pastorate. On the occasion of his inauguration he maintained for thesis *De Sacerdotio Christi*. His co-professors were Louis Cappel and Josué de la Place, who also were Cameron's pupils. Very beautiful was the lifelong friendship of these three remarkable men, who collaborated in the *Theses Salmurienses*, a collection of theses propounded by candidates in theology prefaced by the inaugural addresses of the three professors. Full of energy, Amyraut very speedily gave to French Protestantism a new force. In 1631 he published his *Traité des religions*, a book that still lives; and from this year onward he was a foremost man in the church. Chosen to represent the provincial synod of Anjou, Touraine and Maine at the national synod held in 1631 at Charenton, he was appointed as orator to present to the king "The Copy of their Complaints and Grievances for the Infractions and Violations of the Edict of Nantes." Previous deputies had addressed the king on their bended knees, whereas the representatives of the Catholics had been permitted to stand. Amyraut consented to be orator only if the assembly authorized him to stand. There was intense resistance. Cardinal Richelieu himself, preceded by lesser dignitaries, condescended to visit Amyraut privately, to persuade him to kneel; but Amyraut held resolutely to his point and carried it. His " oration " on this occasion, which was immediately published in the French *Mercury*, remains a striking landmark in the history of French Protestantism. During his absence on this matter the assembly debated " Whether the Lutherans who desired it, might be admitted into communion with the Reformed Churches of France at the Lord's Table." It was decided in the affirmative previous to his return; but he approved with astonishing eloquence, and thereafter was ever in the front rank in maintaining intercommunication between all churches holding the main doctrines of the Reformation. P. Bayle recounts the title-pages of no fewer than thirty-two books of which Amyraut was the author. These show that he took part in all the great controversies on predestination and Arminianism which then so agitated and harassed all Europe. Substantially he held fast the Calvinism of his preceptor Cameron; but, like Richard Baxter in England, by his breadth and charity he exposed himself to all manner of misconstruction. In 1634 he published his *Traité de la prédestination*, in which he tried to mitigate the harsh features of predestination by his " Universalismus hypotheticus." God, he taught, predestines all men to happiness on condition of their having faith. This gave rise to a charge of heresy, of which he was acquitted at the national synod held at Alençon in 1637, and presided over by Benjamin Basnage (1580–1652). The charge was brought up again at the national synod of Charenton in 1644, when he was again acquitted. A third attack at the synod of Loudun in 1659 met with no better success. The university of Saumur became the university of French Protestantism. Amyraut had as many as a hundred students in attendance upon his prelections. Another historic part filled by Amyraut was in the negotiations originated by Pierre le Gouz de la Berchère (1600–1653), first president of the parlement of Grenoble, when exiled to Saumur, for a reconciliation and reunion of the Catholics of France with the French Protestants. Very large were the concessions made by Richelieu in his personal interviews with Amyraut; but, as with the Worcester House negotiations in England between the Church of England and nonconformists, they inevitably fell through. On all sides the statesmanship and eloquence of Amyraut were conceded. His *De l'élévation de la foy et de l'abaissement de la raison en la créance des mystères de la religion* (1641) gave him early a high place as a metaphysician. Exclusive of his controversial writings, he left behind him a very voluminous series of practical evangelical books, which have long remained the fireside favourites of the peasantry of French Protestantism. Amongst these are *Estat des fidèles après la mort*; *Sur l'oraison dominicale*; *Du mérite des œuvres*; *Traitè de la justification*; and paraphrases of books of the Old and New Testament. His closing years were weakened by a severe fall he met with in 1657. He died on the 18th of January 1664.

See Edm. Saigey, *Moses Amyraut, sa vie et ses écrits* (1849); Alex. Schweizer in *Tüb. theol. Jahrbb.*, 1852, pp. 41 ff. 155 ff., *Protestant. Central-Dogmen*(1854 ff.), ii. 225 ff., and in Herzog-Hauck, *Realencyklopädie*; Bayle, *s.v.*; *Biog. Univ.*, s.v.; John Quick's *Synod. in Gall. Reform.* pp. 352-357; Ibid. MS. *Icones Sacrae Gallicanae*: *Life of Cameron.*

ANA, a Latin neuter plural termination appropriated to various collections of the observations and criticisms of eminent men, delivered in conversation and recorded by their friends, or discovered among their papers after their decease. Though the term Ana is of comparatively modern origin, the introduction of this species of composition is not of recent date. It appears, from d'Herbelot's *Bibliothèque Orientale*, that from the earliest periods the Eastern nations were in the habit of preserving the maxims of their sages. From them the practice passed to the Greeks and Romans. Plato and Xenophon treasured up and recorded the sayings of their master Socrates; and Arrian, in the concluding books of his *Enchiridion*, now lost, collected the casual observations of Epictetus. The numerous apophthegms scattered in Plutarch, Diogenes Laertius and other writers, show that it was customary in Greece to preserve the colloquially expressed ideas of illustrious men. It appears that Julius Caesar compiled a book of apophthegms, in which he related the *bons mots* of Cicero; and Quintilian informs us that a freedman of that celebrated wit and orator composed three books of a work entitled *De Jocis Ciceronis*. We are told by Suetonius that Caius Melissus, originally the slave but afterwards the freedman and librarian of Maecenas, collected the sayings of his master; and Aulus Gellius has filled his *Noctes Atticae* with anecdotes which he heard from the eminent scholars and critics whose society he frequented in Rome.

But though vestiges of Ana may be traced in the classical ages, it is only in modern times that they have come to be regarded as constituting a distinct species of composition, comprising literary anecdotes, critical reflexions, and historical incidents, mingled with the detail of *bons mots* and ludicrous tales. The term Ana seems to have been applied to such collections as far back as the beginning of the 15th century. Francesco Barbaro, in a letter to Poggio, says that the information and anecdotes which Poggio and Bartolommeo of Montepulciano had picked up during a literary excursion through Germany will be called *Ana*: "Quemadmodum mala ab Appio e Claudia gente *Appiana*, et pira a Mallio *Malliana* cognominata sunt, sic haec literarum quae vestra ope et opera Germania in Italiam deferentur, aliquando et *Poggiana* et *Montepolitiana* vocabuntur."

Poggio Bracciolini, to whom this letter is addressed, and to whom the world is indebted for the preservation of so many classical remains, is the first eminent person of modern times whose jests and opinions have been transmitted to posterity. Poggio was secretary to five successive popes. During the pontificate of Martin V., who was chosen in 1417, Poggio and other members of the Roman chancery were in the habit of assembling in a common hall adjoining the Vatican, in order to converse freely on all subjects. Being more studious of wit than of truth, they termed this apartment *Buggiale*, a word which Poggio himself interprets *Mendaciorum Officina*. Here Poggio and his friends discussed the news and scandal of the day; communicated entertaining anecdotes; attacked what they did not approve (and they approved of little); and indulged in the utmost latitude of satiric remark, not sparing even the pope and cardinals. The jests and stories which occurred in these unrestrained conversations were collected by Poggio, and formed the chief materials of his *Facetiae*, first printed, according to de Bure, in 1470. This collection, which forms a principal part of the *Poggiana*, is chiefly valuable as recording interesting anecdotes of eminent men of the 14th and 15th centuries. It also contains a number of quibbles or *jeux de mots*, and a still greater number of *facetiae*, idle and licentious stories. These *Facetiae* form, upon the whole, the most amusing and interesting part of the *Poggiana* printed at Amsterdam in 1720; but this collection also comprehends additional anecdotes of Poggio's life, and a few extracts from his graver compositions.

Though Poggio was the first person whose remarks and *bons mots* were collected under the name of Ana, the *Scaligerana*, which contains the opinions of Joseph Scaliger, was the first worked *published* under that appellation, and accordingly may be regarded as having led the way to that class of publications. There are two collections of Scaligerana—the *Prima* and *Secunda*. The first was compiled by a physician named Francois Vertunien, sieur de Lavau, who attended a family with whom Joseph Scaliger resided. He, in consequence, had frequent opportunities of meeting the celebrated critic, and was in the custom of committing to writing the observations which dropped from him in the course of conversation, to which he occasionally added remarks of his own. This collection, which was chiefly Latin, remained in manuscript many years after the death of the compiler. It was at length purchased by M. de Sigogne, who published it in 1669, under the title of *Prima Scaligerana, nusquam antehac edita*, calling it *prima* in order to preserve its claim of priority over another *Scaligerana*, which, though published three years before, had been more recently compiled. This second work, known as *Secunda Scaligerana*, was collected by two brothers of the name of Vassan, students of the university of Leiden, of which Scaliger was one of the professors. Being particularly recommended to Scaliger, they were received in his house, and enjoyed his conversation. Writing down what they had heard, particularly on historical and critical subjects, they soon made up a large manuscript volume, in which, however, there was neither connexion nor arrangement of any description. After passing through various hands this manuscript came into the possession of M. Daillé, who for his own use arranged in alphabetical order the articles which it contained. Isaac Vossius, obtaining the manuscript in loan from M. Daillé, transcribed it and afterwards published it at the Hague, under the title of *Scaligerana, sive Excerpta ex Ore Josephi Scaligeri*. This edition was full of inaccuracies and blunders, and a more correct impression was afterwards published by M. Daillé, with a preface complaining of the use that Vossius had made of the manuscript, which he declares was never intended for publication, and was not of a nature to be given to the world. Indeed, most literary men in that age conceived that the *Scaligerana*, particularly the *second*, detracted considerably from the reputation of the great scholar. Joseph Scaliger, with more extensive erudition, but, as some think, less genius than his father Julius Caesar Scaliger, had inherited his vanity and dogmatical spirit. Conversing with two young students, he would probably be but little cautious in the opinions he expressed, as his literary errors could not be detected or exposed. Unfortunately the blind admiration of his pupils led them to regard his opinions as the responses of an oracle, and his most unmerited censures as just condemnations. The *Scaligerana*, accordingly, contains many falsehoods, with much unworthy personal abuse of the most distinguished characters of the age.

In imitation of the *Scaligerana*, a prodigious number of similar works appeared in France towards the end of the 17th and beginning of the 18th century. At first these collections were confined to what had fallen from eminent men in conversation; but they were afterwards made to embrace fragments found among their papers, and even passages extracted from their works and correspondence. Of those which merely record the conversations of eminent men, the best known and most valuable is the *Menagiana*. Gilles Ménage was a person of good sense, of various and extensive information and of a most communicative disposition. A collection of his oral opinions was published in 1693, soon after his death; and this collection, which was entitled *Menagiana*, was afterwards corrected and enlarged by Bernard de la Monnoye, in an edition published by him in 1715.

The *Perroniana*, which exhibits the opinions of Cardinal du Perron, was compiled from his conversation by C. Dupuy, and published by Vossius in 1666, by the same contrivance which put him in possession of the *Scaligerana*. The *Thuana*, or observations of the president de Thou, have usually been published along with the *Perroniana*, but first appeared in 1669.

The *Valesiana* is a collection of the literary opinions of the historiographer Adrien de Valois, published by his son. M. de Valois was a great student of history, and the *Valesiana* accordingly comprehends many valuable historical observations, particularly on the works of du Cange.

The *Fureteriana* (1696) contains the *bons mots* of Antoine Furetière, the Academician, the stories which he was in the habit of telling, and a number of anecdotes and remarks found in his papers after his decease.

The *Chevraeana* (1697), so called from Urbain Chevreau, is more scholarly than most works of a similar description, and probably more accurate, as it differs from the Ana proper, of which the works described above are instances, in having been published during the life of the author and revised by himself.

Parrhasiana (1699–1701) is the work of Jean le Clerc, a professor of Amsterdam, who bestowed this appellation on his miscellaneous productions with the view of discussing various topics of philosophy and politics with more freedom than he could have employed under his own name.

The *Huetiana* contains the detached thoughts and criticisms of P. D. Huet, bishop of Avranches, which he himself committed to writing when he was far advanced in life. Huet was born in 1630, and in 1712 he was attacked by a malady which impaired his memory, and rendered him incapable of the sustained attention necessary for the completion of a long or laborious work. In this situation he employed himself in putting his detached observations on paper. These were published by the Abbé d'Olivet the year after his death (1722).

The *Casauboniana* presents us with the miscellaneous observations, chiefly philological, of the celebrated Isaac Casaubon. During the course of a long life that eminent commentator was in the daily practice of committing to paper anything remarkable which he heard in conversation with his friends, especially if it bore on the studies in which he was engaged. He also made annotations from day to day on the works he read, with which he connected his judgments concerning the authors and their writings. This compilation was styled *Ephemerides*. His *Adversaria*, and materials amassed for a refutation of the *Ecclesiastical Annals of Baronius*, were bequeathed by his son Meric Casaubon to the Bodleian Library at Oxford. These were shown to J. C. Wolf during a visit which he paid to that university; and having been transcribed by him, were published in 1710 under the title of *Casauboniana*.

Besides the above a great many works under the title of Ana appeared in France about the same period. Thus, the opinions and conversation of Charpentier, Colomesius and St Evremond were recorded in the *Carpenteriana*, *Colomesiana* and *St Evremoniana*; and those of Segrais in the *Segraisiana*,—a collection formed by a person stationed behind the tapestry in a house where Segrais was accustomed to visit, of which Voltaire declared, "que de tous les Ana c'est celui qui mérite le plus d'être mis au rang des mensonges imprimés, et surtout des mensonges insipides." The Ana, indeed, from the popularity which they now enjoyed, were compiled in such numbers and with so little care that they became almost proverbial for inaccuracy.

In 1743 the Abbé d'Olivet spoke indignantly of "ces ana, dont le nombre se multiple impunément tous les jours à la honte de notre siècle." About the middle of the 18th century, too, they were sometimes made the vehicles of revolutionary and heretical opinions. Thus the evil naturally began to cure itself, and by a reaction the French Ana sank in public esteem as much below their intrinsic value as they had formerly been exalted above it.

Of the examples England has produced of this species of composition, perhaps the most interesting is the *Walpoliana*, a transcript of the literary conversation of Horace Walpole, earl of Orford. Most other works which in England have been published under the name of *Ana*, as *Baconiana*, *Atterburyana*, &c., are rather extracts from the writings and correspondence of eminent men than memorials of their conversation.

There are some works which, though they do not bear the title, belong more strictly to the class of Ana than many of the collections which are known under that appellation. Such are the *Mélanges d'histoire et de littérature*, published under the name of *Vigneul Marville*, though the work of a Benedictine, d'Argonne; and the *Locorum Communium Collectanea, ex Lectionibus Philippi Melanchthonis*,—a work of considerable reputation on account of its theological learning, and the information it communicates concerning the early state of the Reformed Church. But of those productions which belong to the class, though they do not bear the name, of Ana, the most celebrated are the *Colloquia Mensalia* of Luther and Selden's *Table-Talk*. The former, which comprehends the conversation of Luther with his friends and coadjutors in the great work of the Reformation, was first published in 1566. Captain H. Bell, who translated it into English in the time of the Commonwealth, informs us that, an edict having been promulgated commanding the works of Luther to be destroyed, it was for some time supposed that all the copies of the *Colloquia Mensalia* had been burned; but in 1626, on the foundation of a house being removed, a printed copy was found lying in a deep hole and wrapped up in a linen cloth. The book, translated by Bell, and again by the younger Hazlitt in 1847, was originally collected by Dr Anton Lauterbach (1502–1569) "out of the holy mouth of Luther." It consists chiefly of observations and discussions on idolatry, auricular confession, the mass, excommunication, clerical jurisdiction, general councils, and all the points agitated by the reformed church in those early periods. The *Table-Talk* of Selden contains a more genuine and undisguised expression of the sentiments of that eminent man than we find in his more studied productions. It was published after his death by Richard Milward, his amanuensis, who affirms that for twenty years he enjoyed the opportunity of daily hearing his discourse, and made it his practice faithfully to commit to writing "the excellent things that usually fell from him."

The most remarkable collection of Ana in the English language—and, indeed, in any language—is to be found in a work which does not correspond to the normal type either in name or in form. In his *Life of Samuel Johnson, LL.D.*, Boswell relates that to his remark, *à propos* of French literature, "Their Ana are good," Johnson replied, "A few of them are good; but we have one book of that kind better than any of them—Selden's *Table-Talk*." Boswell's own work, however, is incomparably superior to all.

J. C. Wolf has given a history of the Ana in a preliminary discourse to his edition of the *Casauboniana*, published in 1710. In the *Répertoire de bibliographies spéciales, curieuses, et instructives*, by Peignot, there is a *Notice bibliographique* of these collections; but many of the books there enumerated consist of mere extracts from the writings of popular authors.

ANABAPTISTS ("re-baptizers," from Gr. ἀνά and βαπτίζω), a name given by their enemies to various sects which on the occasion of Luther's revolt from Romanism denied the validity of infant baptism, and therefore baptized those whom they quite logically regarded as not having received any Christian initiation at all.

On the 27th of December 1521 three "prophets" appeared in Wittenberg from Zwickau, Thomas Münzer, Nicolas Storch and Mark Thomas Stübner. Luther's reform was not thorough enough for them. He professed to rest all upon Scripture, yet accepted from the Babylon of Rome a baptism neither scriptural nor primitive, nor fulfilling the chief conditions of admission into a visible brotherhood of saints, to wit, repentance, faith, spiritual illumination and free surrender of self to Christ. Melanchthon, powerless against the enthusiasts with whom his co-reformer Carlstadt sympathized, appealed to Luther, still concealed in the Wartburg. He had written to the Waldenses that it is better not to baptize at all than to baptize little children; now he was cautious, would not condemn the new prophecy off-hand; but advised Melanchthon to treat them gently and to prove their spirits, less they be of God. There was confusion in Wittenberg, where schools and university sided with the "prophets" and were closed. Hence the charge that Anabaptists were enemies of learning, which is sufficiently rebutted by the fact that the first German translation of the Hebrew prophets was made and printed by two of them, Hetzer and Denk, in 1527. The first leaders of the movement in Zürich—Grebel, Manz, Blaurock, Hubmaier—were men learned in Greek, Latin and Hebrew. On the 6th of March Luther returned, interviewed the prophets, scorned their "spirits," forbade them the city, and had their adherents ejected from Zwickau and Erfurt. Denied access to the churches, the latter preached and celebrated the sacrament in private houses. Driven from the cities they swarmed over the countryside. Compelled to leave Zwickau, Münzer visited Bohemia, resided two years at Alltstedt in Thuringia, and in 1524 spent some time in Switzerland. During this period he proclaimed his revolutionary doctrines in religion and politics with growing vehemence, and, so far as the lower orders were concerned, with growing success. The crisis came in the so-called Peasants' War in South Germany in 1525. In its origin a revolt against feudal oppression, it became, under the leadership of Münzer, a war against all constituted authorities, and an attempt to establish by force his ideal Christian commonwealth, with absolute equality and the community of goods. The total defeat of the insurgents at Frankenhausen (May 15, 1525), followed as it was by the execution of Münzer and several other leaders, proved only a temporary check to the Anabaptist movement. Here and there throughout Germany, Switzerland and the Netherlands there were zealous propagandists, through whose teaching many were prepared to follow as soon as another leader should arise. A second and more determined attempt to establish a theocracy was made at Münster, in Westphalia (1532–1535). Here the sect had gained considerable influence, through the adhesion of Rothmann, the Lutheran pastor, and several prominent citizens; and the leaders, Johann Matthyszoon or Matthiesen, a baker of Haarlem, and Johann Bockholdt, a tailor of Leiden, had little difficulty in obtaining possession of the town and deposing the magistrates. Vigorous preparations were at once made, not only to hold what had been gained, but to proceed from Münster as a centre to the conquest of the world. The town being besieged by Francis of Waldeck, its expelled bishop (April 1534), Matthiesen, who was first in command, made a sally with only thirty followers, under the fanatical idea that he was a second Gideon, and was cut off with his entire band. Bockholdt, better known in history as John of Leiden, was now supreme. Giving himself out as the successor of David, he claimed royal honours and absolute power in the new "Zion." He justified the most arbitrary and extravagant measures by the authority of visions from heaven, as others have done in similar circumstances. With this pretended sanction he legalized polygamy, and himself took four wives, one of whom he beheaded with his own hand in the market-place in a fit of frenzy. As a natural consequence of such licence, Münster was for twelve months a scene of unbridled profligacy. After an obstinate resistance the town was taken by the besiegers on the 24th of June 1535, and in January 1536 Bockholdt and some of his more prominent followers, after being cruelly tortured, were executed in the market-place. The outbreak at Münster was the crisis of the Anabaptist movement. It never again had the opportunity of assuming political importance, the civil powers naturally adopting the most stringent measures to suppress an agitation whose avowed object was to suppress them. It is difficult to trace the subsequent history of the sect as a religious body. The fact that, after the Münster insurrection the very name Anabaptist was proscribed in Europe, is a source of twofold confusion. The enforced adoption of new names makes it easy to lose the historical identity of many who really belonged to the Münster Anabaptists, and, on the other hand, has led to the classification of many with the Münster sect who had no real connexion with it. The latter mistake, it is to be noted, has been much more common than the former. The Mennonites, for example, have been identified with the earlier Anabaptists, on the ground that they included among their number many of the fanatics of Münster. But the continuity of a sect is to be traced in its principles, and not in its adherents, and it must be remembered that Menno and his followers expressly repudiated the distinctive doctrines of the Münster Anabaptists. They have never aimed at any social or political revolution, and have been as remarkable for sobriety of conduct as the Münster sect was for its fanaticism (see MENNONITES). In English history frequent reference is made to the Anabaptists during the 16th and 17th centuries, but there is no evidence that any considerable number of native Englishmen ever adopted the principles of the Münster sect. Many of the followers of Münzer and Bockholdt seem to have fled from persecution in Germany and the Netherlands to be subjected to a persecution scarcely less severe in England. The mildest measure adopted towards these refugees was banishment from the kingdom, and a large number suffered at the stake. It was easier to burn Anabaptists than to refute their arguments, and contemporary writers were struck with the intrepidity and number of their martyrs. Thus Stanislaus Hosius (1504–1579), a Polish cardinal and bishop of Warmie, wrote (*Opera*, Venice, 1573, p. 202):—

> "They are far readier than followers of Luther and Zwingli to meet death, and bear the harshest tortures for their faith. For they run to suffer punishments, no matter how horrible, as if to a banquet: so that if you take that as a test either of the truth of doctrine or of their certitude of grace, you would easily conclude that in no other sect is to be found a faith so true or grace so certain. But as Paul wrote: 'Even if I give my body up to be burned and have not charity, it avails me naught.' But he has not charity who divides the unity. . . . He cannot be a martyr who is not in the Church."

The excesses of John of Leiden, the Brigham Young of that age, cast an unjust stigma on the Baptists, of whom the vast majority were good, quiet people who merely carried out in practice the early Christian ideals of which their persecutors prated. They have been reckoned an extreme left wing of the Reformation, because for a time they followed Luther and Zwingli. Yet their Christology and negative attitude towards the state rather indicate, as in the case of Wicklif, Hus and the Fraticelli, an affinity to the Cathari and other medieval sects. But this affiliation is hard to establish. The earliest Anabaptists of Zürich allowed that the Picardi or Waldensians had, in contrast with Rome and the Reformers, truth on their side, yet did not claim to be in their succession; nor can it be shown that their adult baptism derived from any of the older Baptist sects, which undoubtedly lingered in parts of Europe. Later on Hermann Schyn claimed descent for the peaceful Baptists from the Waldensians, who certainly, as the records of the Flemish inquisition, collected by P. Fredericq, prove, were wide-spread during the 15th century over north France and Flanders. It would appear from the way in which Anabaptism sprang up everywhere independently, as if more than one ancient sect took in and through it a new lease of life. Ritschl discerned in it the leaven of the Fraticelli or Franciscan Tertiaries. In Moravia, if what Alex. Rost related be true, namely that they called themselves

Apostolici, and went barefooted healing the sick, they must have at least absorbed into themselves a sect of whom we hear in the 12th century in the north of Europe as deferring baptism to the age of 30, and rejecting oaths, prayers for the dead, relics and invocation of saints. The Moravian Anabaptists, says Rost, went bare-footed, washed each other's feet (like the Fraticelli), had all goods in common, worked everyone at a handicraft, had a spiritual father who prayed with them every morning and taught them, dressed in black and had long graces before and after meals. Zeiler also in his German *Itinerary* (1618) describes their way of life. The Lord's Supper, or bread-breaking, was a commemoration of the Passion, held once a year. They sat at long tables, the elders read the words of institution and prayed, and passed a loaf round from which each broke off a bit and ate, the wine being handed round in flagons. Children in their colonies were separated from the parents, and lived in the school, each having his bed and blanket. They were taught reading, writing and summing, cleanliness, truthfulness and industry, and the girls married the men chosen for them. In the following points Anabaptists resembled the medieval dissenters:—(1) They taught that Jesus did not take the flesh from his mother, but either brought his body from heaven or had one made for him by the Word. Some even said that he passed through his mother, as water through a pipe, into the world. In pictures and sculptures of the 15th century and earlier, we often find represented this idea, originated by Marcion in the 2nd century. The Anabaptists were accused of denying the Incarnation of Christ: they did, but not in the sense that he was not divine; they rather denied him to be human. (2) They condemned oaths, and also the reference of disputes between believers to law-courts. (3) The believer must not bear arms or offer forcible resistance to wrongdoers, nor wield the sword. No Christian has the *jus gladii*. (4) Civil government belongs to the world, is Caesar. The believer who belongs to God's kingdom must not fill any office, nor hold any rank under government, which is to be passively obeyed. (5) Sinners or unfaithful ones are to be excommunicated, and excluded from the sacraments and from intercourse with believers unless they repent, according to Matt. xviii. 15 *seq.* But no force is to be used towards them.

Some sects calling themselves *Spirituales* or *Perfecti* also held that the baptized cannot sin, a very ancient tenet.

They seem to have preserved among them the primitive manual called the *Teaching of the Apostles*, for Bishop Longland in England condemned an Anabaptist for repeating one of its maxims "that alms should not be given before they did sweat in a man's hand." This was between 1518 and 1521.

On the 12th of April 1549, certain London Anabaptists brought before a commission of bishops asserted:—

> "That a man regenerate could not sin; that though the outward man sinned, the inward man sinned not; that there was no Trinity of Persons; that Christ was only a holy prophet and not at all God; that all we had by Christ was that he taught us the way to heaven; that he took no flesh of the Virgin, and that the baptism of infants was not profitable."

The Anabaptists were great readers of Revelation and of the Epistle of James, the latter perhaps by way of counteracting Luther's one-sided teaching of justification by faith alone. Luther feebly rejected this scripture as "a right strawy epistle." English Anabaptists often knew it by heart. Excessive reading of Revelation seems to have been the chief cause of the aberrations of the Münster fanatics.

In Poland and Holland certain of the Baptists denied the Trinity, hence the saying that a Socinian was a learned Baptist (see SOCINUS). With these Menno and his followers refused to hold communion.

One of the most notable features of the early Anabaptists is that they regarded any true religious reform as involving social amelioration. The socialism of the 16th century was necessarily Christian and Anabaptist. Lutheranism was more attractive to grand-ducal patriots and well-to-do burghers than to the poor and oppressed and disinherited. The Lutherans and Zwinglians never converted the Anabaptists. Those who yielded to stress of persecution fell back into Papalism and went to swell the tide of the Catholic reaction.

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ANABASIS (*ἀνάβασις*, a march up country), the title given by Xenophon (*q.v.*) to his narrative of the expedition of Cyrus the younger against his brother, Artaxerxes of Persia, 401 B.C., and adopted by Arrian for his history of the expedition of Alexander the Great.

ANABOLISM (Gr. ἀνά, up, βολή, a throw), the biological term for the building up in an organism of more complex from simpler substances, constructive metabolism. (See PHYSIOLOGY.)

ANACHARSIS, a Scythian philosopher, who lived about 600 B.C. He was the son of Gnurus, chief of a nomadic tribe of the Euxine shores, and a Greek woman. Instructed in the Greek language by his mother, he prevailed upon the king to entrust him with an embassy to Athens about 589 B.C. He became acquainted with Solon, from whom he rapidly acquired a knowledge of the wisdom and learning of Greece, and by whose influence he was introduced to the principal persons in Athens. He was the first stranger who received the privileges of citizenship. He was reckoned one of the Seven Sages, and it is said that he was initiated into the Eleusinian mysteries. After he had resided several years at Athens, he travelled through different countries in quest of knowledge, and returned home filled with the desire of instructing his countrymen in the laws and the religion of the Greeks. According to Herodotus he was killed by his brother Saulius while he was performing sacrifice to the goddess Cybele. It was he who compared laws to spiders' webs, which catch small flies and allow bigger ones to escape. His simple and forcible mode of expressing himself gave birth to the proverbial expression "Scythian eloquence," but his epigrams are as unauthentic as the letters which are often attributed to him. According to Strabo he was the first to invent an anchor with two flukes. Barthélémy borrows his name as the title for his *Anacharsis en Grèce*.

Herodotus iv. 76; Lucian, *Scytha*; Cicero, *Tusc. Disp.* v. 32; Diog. Laert. i. 101.

ANACHRONISM (from ἀνά, back, and χρόνος, time), a neglect or falsification, whether wilful or undesigned, of chronological relation. Its commonest use restricts it to the ante-dating of events, circumstances or customs; in other words, to the introduction, especially in works of imagination that rest on a historical basis, of details borrowed from a later age. Anachronisms may be committed in many ways, originating, for instance, in disregard of the different modes of life and thought that characterize different periods, or in ignorance of the progress of the arts and sciences and the other ascertained facts of history, and may vary from glaring inconsistency to scarcely perceptible misrepresentation. Much of the thought entertained about the past is so deficient in historical perspective as to be little better than a continuous anachronism. It is only since the close of the 18th century that this kind of untruthfulness has jarred on the general intelligence. Anachronisms abound in the works of Raphael and Shakespeare, as well as in those of the meanest daubers and playwrights of earlier times. In particular, the artists, on the stage and on the canvas, in story and in song, assimilated their *dramatis personae* to their own nationality and their own time. The Virgin was represented here as an Italian contadina, and there as a Flemish frow; Alexander the Great appeared on the French stage in the full costume of Louis XIV. down to the time of Voltaire; and in England the contemporaries of Addison could behold, without any suspicion of burlesque,

> "Cato's long wig, flower'd gown, and lacquer'd chair."

Modern realism, the progress of archaeological research, and the more scientific spirit of history, have made an anachronism an offence, where our ancestors saw none.

ANACOLUTHON (Gr. for "not following on"), a grammatical term, given to a defectively constructed sentence which does not run on as a continuous whole; this may occur either, in a text, by some corruption, or, in the case of a writer or speaker, simply through his forgetting the way in which he started. In the case of a man who is full of his subject, or who is carried along by the passion of the moment, such inconsequents are very apt to occur. Of Niebuhr it is told that his oral lectures consisted almost entirely of anacoluthic constructions. To this kind of licence some languages, as Greek and English, readily lend themselves; while the grammatical rigidity of others, as Latin and French, admits of it but sparingly. In Herodotus, Thucydides, Aeschylus, Pindar and Plato, abundant specimens are to be found; and the same is true of the writers of the Elizabethan age in English. The following is an example:—"And he charged him to tell no man; *but go show thyself*," &c. (Luke v. 14).

ANACONDA, a city and the county-seat of Deer Lodge county, Montana, U.S.A., situated in the mountains on the W. side of Deer Lodge Valley, in the S.W. part of the state, about 26 m. N.W. of Butte, and at an altitude of about 5300 ft. Pop. (1890) 3975; (1900) 9453, of whom 3478 were foreign-born; (1906, estimate) 12,267. It is connected with Butte by the Butte, Anaconda & Pacific railroad. Among its public buildings are the county court-house and the Hearst free public library (1898). Industrially, Anaconda is essentially a smelting camp for the copper ores from the Butte mines, probably the largest copper-smelter in the world being located here; the principal copper-mine at Butte—one of the most famous copper-mines in the world—is called the Anaconda. In 1905 the capital invested in manufacturing was $13,728,456, and the factory product was valued at $28,581,530. Electric power generated at the Helena Power Transmission Company's plant on the Missouri river, 18 m. from Helena, comes to Anaconda over 110 m. of wire at 70,000 voltage. Anaconda is to a large degree the market and trading-place of the Big Hole Basin cattle country in the north-western part of Beaverhead county; with Wisdom, in the Big Hole Basin, it was connected in 1905 by a 65 m. telephone line. Anaconda was first settled in 1884 and was chartered as a city in 1888.

ANACONDA, an aquatic boa, inhabiting the swamps and rivers of the dense forests of tropical South America. It is the largest of all modern snakes, said to attain over 30 ft. in length. The *Eunectes murinus* (formerly called *Boa murina*) differs from *Boa* by the snout being covered with shields instead of small scales, the inner of the three nasal shields being in contact with that of the other side. The general colour is dark olive-brown, with large oval black spots arranged in two alternating rows along the back, and with smaller white-eyed spots along the sides. The belly is whitish, spotted with black. The anaconda combines an arboreal with an aquatic life, and feeds chiefly upon birds and mammals, mostly during the night. It lies submerged in the water, with only a small part of its head above the surface, waiting for any suitable prey, or it establishes itself upon the branches of a tree which overhangs the water or the track of game. Being eminently aquatic this snake is viviparous. It is the only large boa which is decidedly ill-tempered.

ANACREON, Greek lyric poet, was born about 560 B.C., at Teos, an Ionian city on the coast of Asia Minor. Little is known of his life, except a few scattered notices, not in all cases certainly authentic. He probably shared the voluntary exile of the mass of his fellow-townsmen, who, when Cyrus the Great was besieging the Greek cities of Asia (545), rather than surrender their city to his general Harpagus, sailed to Abdera in Thrace, where they founded a colony. Anacreon seems to have taken part in the fighting, in which, on his own admission, he did not distinguish himself, but, like Alcaeus and Horace, threw away his shield and fled. From Thrace he removed to the court of Polycrates of Samos, one of the best of those old "tyrants," who by no means deserved the name in its worst sense. He is said to have acted as tutor to Polycrates; that he enjoyed the tyrant's confidence we learn on the authority of Herodotus (iii. 121), who represents the poet as sitting in the royal chamber when audience was given to the Persian herald. In return for his favour and protection, Anacreon wrote many complimentary odes upon his patron. Like his fellow-lyrist, Horace, who was one of his great admirers, and in many respects of a kindred spirit, Anacreon seems to have been made for the society of courts. On the death of Polycrates, Hipparchus, who was then in power at Athens and inherited the literary tastes of his father Peisistratus, sent a special embassy to fetch the popular poet to Athens in a galley of fifty oars. Here he became acquainted with the poet Simonides, and other members of the brilliant circle which had gathered round Hipparchus. When this circle was broken up by the assassination of Hipparchus, Anacreon seems to have returned to his native town of Teos, where, according to a metrical epitaph ascribed to his friend Simonides, he died and was buried. According to others, before returning to Teos he accompanied Simonides to the court of Echecrates, a Thessalian dynast of the house of the Aleuadae. Lucian mentions Anacreon amongst his instances of the longevity of eminent men, as having completed eighty-five years. If an anecdote given by Pliny (*Nat. Hist.* vii. 7) is to be trusted, he was choked at last by a grape-stone, but the story has an air of mythical adaptation to the poet's habits, which makes it somewhat apocryphal. Anacreon was for a long time popular at Athens, where his statue was to be seen on the Acropolis, together with that of his friend Xanthippus, the father of Pericles. On several coins of Teos he is represented, holding a lyre in his hand, sometimes sitting, sometimes standing. A marble statue found in 1835 in the Sabine district, and now in the Villa Borghese, is said to represent Anacreon. Anacreon had a reputation as a composer of hymns, as well as of those bacchanalian and amatory lyrics which are commonly associated with his name. Two short hymns to Artemis and Dionysus, consisting of eight and eleven lines respectively, stand first amongst his few undisputed remains, as printed by recent editors. But pagan hymns, especially when addressed to such deities as Aphrodite, Eros and Dionysus, are not so very unlike what we call "Anacreontic" poetry as to make the contrast of style as great as the word might seem to imply. The tone of Anacreon's lyric effusions has probably led to an unjust estimate, by both ancients and moderns, of the poet's personal character. The "triple worship" of the Muses, Wine and Love, ascribed to him as his religion in an old Greek epigram (*Anthol.* iii. 25,51), may have been as purely professional in the two last cases as in the first, and his private character on such points was probably neither much better nor worse than that of his contemporaries. Athenaeus remarks acutely that he seems at least to have been sober when he wrote; and he himself strongly repudiates, as Horace does, the brutal characteristics of intoxication as fit only for barbarians and Scythians (*Fr.* 64). Of the five books of lyrical pieces by Anacreon which Suidas and Athenaeus mention as extant in their time, we have now but the merest fragments, collected from the citations of later writers. Those graceful little poems (most of them first printed from the MSS. by Henry Stephens in 1554), which long passed among the learned for the songs of Anacreon, and which are well-known to many English readers in the translations of Cowley and Moore, are really of much later date, though possibly here and there genuine fragments of the poet are included. Modern critics, however, regard the entire collection as imitations belonging to different periods—the oldest probably to Alexandrian times, the most recent to the last days of paganism. They will always retain a certain popularity from their lightness and elegance, and some of them are fair copies of Anacreon's style, which would lend itself readily enough to a clever imitator. A strong argument against their genuineness lies in the fact that the peculiar forms of the Ionic Greek, in which Anacreon wrote, are not to be found in these reputed odes, while the fragments of his poems quoted by ancient writers are full of Ionicisms. Again, only one of the quotations from Anacreon in ancient writers is to be found in these poems, which further contain no references to contemporaries, whereas Strabo (xiv. p. 638) expressly states that Anacreon's poems included numerous allusions to Polycrates. The character of Love as a mischievous little boy is quite different from that given by Anacreon, who describes him as "striking with a mighty axe, like a smith," and is more akin to the conceptions of later literature.

The best edition of the genuine fragments of Anacreon, as well as of the Anacreontea, is by Bergk (*Poetae lyrici graeci*, 1882). He includes in an appendix a similar collection of imitations from the *Anecdota graeca* of P. Matranga (1850), which had their origin in the beginning of the middle ages, and resemble the Christian anacreontics of Sophronius.

ANACREONTICS (from the name of the Greek poet Anacreon), the title given to short lyrical pieces, of an easy kind, dealing with love and wine. The English word appears to have been first used in 1656 by Abraham Cowley, who called a section of his poems "anacreontiques," because they were paraphrased out of the so-called writings of Anacreon into a familiar measure which was supposed to represent the metre of the Greek. Half a century later, when the form had been much cultivated, John Phillips (1631–1706) laid down the arbitrary rule that an anacreontic line "consists of seven syllables, without being tied to any certain law of quantity." In the 18th century, the antiquary William Oldys (1696–1761) was the author of a little piece which is the perfect type of an anacreontic: this begins:—

> "Busy, curious, thirsty fly,
> Drink with me, and drink as I;
> Freely welcome to my cup,
> Could'st thou sip and sip it up.
> Make the most of life you may;
> Life is short and wears away."

In 1800 Tom Moore published a collection of erotic anacreontics which are also typical in form; Moore speaks of the necessity of catching "the careless facility with which Anacreon appears to have trifled," as a reason why anacreontics are often tame and worthless. He dwells, moreover, on the absurdity of writing "pious anacreontics," a feat, however, which was performed by several of the Greek Christian poets, and in particular by Gregory of Nazianzus and John of Damascus. (E. G.)

ANADYOMENE (Ἀναδυομένη), an epithet of Aphrodite (Venus), expressive of her having sprung from the foam of the sea. In a famous picture by Apelles she was represented under this title as if just emerged from the sea and in the act of wringing her tresses. This painting was executed for the temple of Asclepius at Cos, from which it was taken to Rome by Augustus in part payment of tribute, and set up in the temple of Caesar. In the time of Nero, owing to its dilapidated condition, it was replaced by a copy made by the painter Dorotheus (Pliny, *Nat. Hist.* xxxv. 36). There are several epigrams on it in the Greek anthology.

ANADYR, (1) a gulf, and (2) a river, in the extreme N.E. of Siberia, in the Maritime Province. The gulf extends from Cape Chukchi on the north to Cape Navarin on the south, forming part of the Bering Sea. The river, taking its rise in the Stanovoi mountains as the Ivashki or Ivachno, about 67° N. lat. and 173° E. long., flows through the Chukchi country, at first south-west and then east, and enters the Gulf of Anadyr after a course of about 500 m. The country through which it passes is thinly populated, barren and desolate. For nine months of the year the ground is covered with snow. Reindeer, upon which the inhabitants subsist, are found in considerable numbers.

ANAEMIA (from Gr. ἀν-, privative, and αἷμα, blood), literally "want of blood," a word used as a generic term for various forms of disease characterized by a defective constitution of the blood. For different types of anaemia see the article BLOOD, section *Pathology*.

ANAESTHESIA and **ANAESTHETICS** (Gr. ἀναισθησία, from ἀν-, privative, and αἴσθησις, sensation), terms used in medicine to describe a state of local or general insensibility to external impressions, and the substances used for inducing this state. In diseases of the brain or spinal cord anaesthesia is an occasional symptom, but in such cases it is usually limited in extent, involving a limb or a definite area of the body's surface. Complete anaesthesia occurs in a state of catalepsy or trance—conditions associated with no definite lesion of the nervous system.

The artificial induction of anaesthesia has come to occupy a foremost place in modern medicine, but there is abundant evidence to show that it is a practice of great antiquity. Besides the mention by Homer of the anaesthetic effects of nepenthe, and the reference by Herodotus to the practice of the Scythians of inhaling the vapours of a certain kind of hemp to produce intoxication, the employment of anaesthetics in surgery by the use of mandragora is particularly alluded to by Dioscorides and Pliny. It also appears, from an old Chinese manuscript laid before the French Academy by Stanislas Julien, that a physician named Hoa-tho, who lived in the 3rd century, gave his patients a preparation of hemp, whereby they were rendered insensible during the performance of surgical operations. Mandragora was extensively used as an anaesthetic by Hugo de Lucca, who practised in the 13th century. The soporific effects of mandrake are alluded to by Shakespeare, who also makes frequent mention of anaesthetizing draughts, the composition of which is not specified.

In the *Medical Gazette*, vol. xii. p. 515, Dr Sylvester, quoting from a German work by Meissner, published in 1782, mentions the case of Augustus, king of Poland, who underwent amputation while rendered insensible by a narcotic. But the practice of anaesthesia never became general, and surgeons appear to have usually regarded it with disfavour. When, towards the close of the 18th century, the discoveries of Priestley gave an impetus to chemical research, the properties of gases and vapours began to be more closely investigated, and the belief was then entertained that many of them would become of great medicinal value. In 1800, Sir Humphry Davy, experimenting on nitrous oxide (the so-called "laughing gas"), discovered its anaesthetic properties, and described the effects it had on himself when inhaled with the view of relieving local pain. He suggested its employment in surgery in the following words:—"As nitrous oxide, in its extensive operation, seems capable of destroying physical pain, it may probably be used with advantage in surgical operations in which no great effusion of blood takes place." His suggestion, however, remained unheeded for nearly half a century. The inhalation of sulphuric ether for the relief of asthma and other lung affections had been employed by Dr Pearson of Birmingham as early as 1785; and in 1805 Dr J. C. Warren of Boston, U.S.A., used this treatment in the later stages of pulmonary consumption.

In 1818 Faraday showed that the inhalation of the vapour of ether produced anaesthetic effects similar to those of nitrous oxide; and this property of ether was also shown by the American physicians, John D. Godman (1822), James Jackson (1833), Wood and Bache (1834).

These observations, however, appear to have been regarded in the light of mere scientific curiosities and subjects for lecture-room experiment, rather than as facts capable of being applied practically in the treatment of disease, till December 1844, when Dr Horace Wells, a dentist of Hartford, Connecticut, underwent in his own person the operation of tooth-extraction while rendered insensible by nitrous oxide. Satisfied, from further experience, that teeth could be extracted in this way without pain, Dr Wells proposed to establish the practice of painless dentistry under the influence of the gas; but in consequence of an unfortunate failure in an experiment at Boston he abandoned the project. On the 30th of September 1846 Dr W. T. G. Morton, a dentist of Boston, employed the vapour of ether to procure general anaesthesia in a case of tooth-extraction, and thereafter administered it in cases requiring surgical operation with complete success. This great achievement marked a new era in surgery. Operations were performed in America in numerous instances under ether inhalation, the result being only to establish more firmly its value as a successful anaesthetic. The news of the discovery reached England on the 17th of December 1846. On the 19th of December Mr Robinson, a dentist in London, and on the 21st Robert Liston, the eminent surgeon, operated on patients anaesthetized by ether; and the practice soon became general both in Great Britain and on the continent.

Sir James Simpson was the first to apply anaesthesia by ether to midwifery practice; this he did in 1847, and found that the pains of labour could be abolished without interference with uterine contractions or injury to the child. On the 8th of March 1847 M. J. P. Flourens read a paper before the Académie des Sciences on the effect of chloroform on the lower animals, but no notice was taken of what has since proved to be a discovery of epoch-making importance. In November of the same year Simpson announced his discovery of the anaesthetic properties of chloroform, the trial of which had been suggested to him by Wildie, a chemist of Liverpool. As the result, chloroform came to be widely used instead of ether, though it was found by several casualties that it was not the absolutely safe anaesthetic that had at first been hoped. It, however, remained the drug that was chiefly used till Dr J. T. Clover (1825–1882) of London introduced his regulating ether-inhaler in 1876, embodying a new principle—that of limiting the quantity of air during etherization and regulating the strength of the vapour.

During the intervening period, as the results of the labours of John Snow, Sir Benjamin Ward Richardson, Thomas Nunnely, and Colton amongst others, several drugs were found to possess anaesthetic properties. Of these one, ethyl chloride, which was speedily given up, has come into deserved prominence at the present time; and another, nitrous oxide, which had been lost sight of since Wells's failure at Boston, was reintroduced, and it became and has remained the most popular anaesthetic in dental practice.

Since 1876 no new drugs have been introduced; the progress has been in the direction of improvements in the technique of anaesthetization. The most important of these is the administration of oxygen with nitrous oxide, resulting from the recognition of the fact that this drug does not owe its anaesthetic properties to partial asphyxia, as was thought till the contrary was shown by Edmund Andrews of Chicago in 1868. It was not till twenty years later that this knowledge was put to practical use, when F. W. Hewett introduced his regulating stopcock, which enabled the anaesthetist to exhibit the nitrous oxide and oxygen in such proportions as were demanded by the patient's condition. At the present time the anaesthetics in common use are the following:—

(1) Nitrous oxide gas, or laughing gas, N_2O. This is a colourless, odourless gas, which for convenience is carried about in liquid form in iron cylinders. When about to be used, it is allowed to escape into a large rubber bag, connected with a closely-fitting face-piece, which covers up the nose and mouth, and allows of inspiration only from the bag of gas, expiration being into the air. When thus given the patient is exposed to a certain degree of asphyxia. This asphyxia is not only not necessary but is harmful, and may be obviated by giving oxygen in small amounts simultaneously by means of Hewett's regulating stopcock. This drug is used chiefly for dental operations, and for minor surgery where absolute muscular relaxation is not required. When mixed with oxygen, it can be given if necessary for an hour or longer. It has an induction period of a few breaths only, and the recovery is as a rule unaccompanied by excitement or nausea. It is also used as a preliminary to ether; the gas is given till unconsciousness is reached, the unpleasant taste of the ether being thus avoided and the induction period shortened. The mortality from nitrous oxide is small, and from the gas and oxygen in expert hands nil.

(2) Ethyl chloride, C_2H_5Cl, a colourless liquid of a pleasant odour, boiling at 12.5° C. It is used in the same class of operations as the last anaesthetic. It is best given in an apparatus that consists of a mask closely adapted to the face, and a rubber bag of small capacity, with which is connected the bottle containing the ethyl chloride. The vapour supplied from the bottle is breathed backwards and forwards from the bag, fresh air being admitted in small quantities only. The period of induction is shorter than in the case of nitrous oxide, the patient losing consciousness in two or three breaths; the stage of recovery is not so uniformly pleasant, headache, nausea and vomiting occurring not infrequently. It is difficult at present to estimate the mortality, as it has only recently come into general use, but it seems to occupy an intermediate position between ether and chloroform.

(3) Ether, or ethyl oxide, $(C_2H_5)_2O$, a colourless, volatile liquid, boiling at 36.5° C. It has a pungent odour. It is best administered, as in the case of ethyl chloride, by limiting the amount of air during inhalation. The induction is much slower than in the case of the last two drugs, and it is accompanied by a feeling of suffocation, owing to the pungent odour of the ether. On that account the anaesthetic is best started with nitrous oxide or ethyl chloride. The recovery is always marked by some nausea and very frequently by vomiting. The mortality is small during the actual operation, but fatalities from respiratory complications later on are not uncommon.

(4) Chloroform, $CHCl_3$, a colourless liquid of a penetrating odour, boiling at 63° C. It is administered in such a way as to ensure the free admixture of air. To secure this the face-piece must be loosely-fitting, and the strength of the vapour so gradually increased that the patient is never inconvenienced or impelled to hold the breath. The induction is slow, occupying two or more minutes, but it is not at all unpleasant; nausea and vomiting during recovery are rarer than in the case of ether, but if they do occur they last longer. The mortality on the table is about 1 in 2500.

The question as to which is the better anaesthetic, ether or chloroform, for long operations, is a moot point. In the hands of an experienced anaesthetist there is probably nothing to choose as regards safety, and the anaesthetic advantages of the latter are incontestable. In the hands of the less-experienced anaesthetist, ether is the more suitable drug. At the extremes of life, chloroform is well taken, as it is also by women in labour, and it is indicated where there has been recent inflammation of the air passages. In operations, too, about the mouth, chloroform must be the drug used, as a closely-fitting mask is obviously impossible.

The introduction by inhalation of any of the above drugs into the organism produces an anaesthesia, the degree of which at any moment varies directly as the amount or tension of the vapour in the blood, and therefore also as the tension of the vapour in the inspired air. The organism in this case may be compared to an electric lamp, of which the voltage is, say 100, a current of any less voltage will only produce a red heat, however many amperes are forced through; with the voltage at 100 the filament will be white hot, at over 100 the filament will fuse. So with these drugs: with the vapour at a low tension a certain low depth of anaesthesia is obtained; if the administrator increases the tension, true surgical anaesthesia is produced; if he increases it again, the filament fuses and the patient dies. This is the principle which guides the anaesthetist; it is the quality of the vapour that decides the depth of the anaesthesia, not the quantity. An infinite quantity of chloroform may be absorbed with impunity if the tension be low, but a few drops will kill if the tension be high. For practical purposes four degrees of anaesthesia are described, through which a patient passes from unconsciousness to (in the last resort) death:—

(1) A state of disordered consciousness, with analgesia; the patient's ideas are confused, the special senses are disturbed, and though the application of stimuli to the skin causes no mental impression, yet in response to them there may be what look like purposeful movements.

(2) In the second stage there is complete loss of consciousness, and though the reflexes persist, the movements in response to the stimuli are purposeless. The muscles generally act strongly.

(3) The stage of surgical anaesthesia; there is a general muscular relaxation, with the loss of many of the reflexes, *i.e.* an operation may be performed without evoking any movement on the part of the patient, while the vital reflexes and the vital centres in the medulla are still active, and the heart muscle is not paralysed.

(4) Finally, the stage of paralysis of the medulla, when the respiratory and circulatory centres are paralysed, and the heart muscle itself is poisoned and death ensues.

The aim of the anaesthetist is to keep the patient in the third degree of anaesthesia, thus avoiding the movements of the second and the dangers of the fourth; he therefore keeps the patient under close observation, and by watching the respiration, pulse and facial aspect, is able to judge the condition of the respiration and circulation. He has a further guide in the lid-reflex, *i.e.* the movement of the eyelid when the globe is touched; this and the size of the pupil tell him to what extent the central nervous system is depressed and complete the information he requires.

It will have been observed that the administration of the above drugs is by inhalation, and has to be continued throughout the operation, the reason being that all the drugs are as rapidly excreted as they are absorbed, especially by the lungs, and therefore no other method would be of any avail. That there are drugs which are sufficiently slowly eliminated to allow of an operation being performed between the moment of induction and that of recovery, cannot be doubted, and their discovery and use can only be a matter of time. Even at the present time there is one, urethane, which, if injected with a hypodermic needle, soon produces a profound general anaesthesia. It has only been used on the lower animals, as its depressing effect on the respiratory centre contra-indicates its use in human beings.

Local Anaesthesia.—Much attention has recently been devoted to the discovery of methods by which the insensibility may be confined to the area of operation and the loss of consciousness avoided. Such a procedure has been common for many years for small operations, but it is only lately that it has been successfully applied to the severer ones. It is very doubtful whether local anaesthesia will ever replace general in the latter class. Though the preliminary starvation is avoided, and the patient has the shock of operation alone to recover from, without the cardiac depression resulting from the anaesthetic during the operation, the patient, unless of a very apathetic temperament, is in that state of severe nervous strain, when any unexpected movement or remark, or sight of a soiled instrument, may produce an alarming or fatal syncope. The earliest local anaesthetic was cold, produced by a mixture of ice and salt. In place of this cumbersome method, the skin is now frozen by means of a fine spray of ether or ethyl chloride directed upon it. The spraying is discontinued when the skin becomes white, and it is then allowed to regain its colour. The moment this occurs the incision is made and will be quite painless. The recovery, like that from any other frost-bite, is very painful, and the time during which an operation can be done is very short; consequently this method has been very largely superseded by the use of drugs. The drugs chiefly used are cocaine and its derivatives. Cocaine has by far the highest anaesthetic properties; it is, however, in certain individuals a most powerful cardiac depressant and has caused numerous fatalities, and further, it cannot be sterilized by heat, as it undergoes decomposition. Eucaine has now largely taken its place, though its anaesthetic properties are less; it is, however, less toxic, and can be sterilized by heat. In combination with these drugs there is usually given some of the extract of the suprarenal body of the sheep; this substance increases and prolongs the anaesthetic effect by constricting the blood-vessels, the result of which is to reduce the haemorrhage, and also to prevent the too rapid absorption of the drug into the general system, confining it to the area of operation.

The chief methods of bringing about local anaesthesia are as follows:—

(1) Painting or spraying a solution of the drugs on to the area on which it is proposed to operate.

(2) Injection by means of a needle of the solution into the skin and the deeper structures.

(3) Spinal analgesia. The method of inducing analgesia by injecting solutions into the sheath surrounding the spinal cord was devised by Bier in 1898, and for the purpose he employed a solution of cocaine. It was found, however, that there was considerable danger with this drug, so the method was not adopted to any great extent, until Fourneau discovered *stovaine* in 1904.

The principle involved in spinal anaesthesia is this: that a substance in solution is injected into the sac containing the spinal cord in the lumbar region. The spinal cord as such ends at the level of the first lumbar vertebra in a leash of nerves termed the *cauda equina*. When giving an injection there is little danger of injuring these nerves because in this situation there is a space filled with fluid between the wall of the sac and the nerves. The substances injected, by virtue of their specific action on nervous tissues, cause loss of painful sensations in the lower limbs and for a variable distance up the trunk. It has been found that the specific gravity of the solution injected has some influence on the height to which the analgesia will extend up the trunk, and this distance can also be controlled by altering the position of the patient. The canal in which the cord is situated is not a straight tube, but is curved backwards in the sacral and upper dorsal regions, and forwards in the lower dorsal and lumbar regions. Therefore with the patient lying on his back, any solution injected that has a greater specific gravity than that of the cerebrospinal fluid which bathes the cord, tends to gravitate towards the sacral and upper dorsal regions; and, conversely, any solution of lower specific gravity than that of the cerebrospinal fluid tends to rise and produce analgesia at a still higher level. In this way the situation of the fluid producing analgesia can be controlled to some extent. It has been found that a very serious danger exists if the solution passes up to the brain, or even if it passes higher than the sixth cervical nerve. It is important that the osmotic pressure of the solutions employed should be as nearly as possible that of the cerebrospinal fluid, that is to say, the nearer the solution is isotonic with the cerebrospinal fluid, the better will be the analgesia, and the less will be the harmful effects. At present it has not been found possible to separate in any of the substances employed the radicle which produces motor effects from that which blocks the advent of sensory stimuli. Although both effects last only a short time there seems to be a certain risk due to the temporary muscular paralysis, and in a patient with a tendency to bronchitis this is a matter of considerable moment.

The fluid is injected in the following manner. A puncture is made with a special trocar and canula in the lumbar region between the second and third or third and fourth lumbar spines. The sheath of the sac having been entered, as is evidenced by the loss of resistance to the point of the trocar, and by the fact that cerebrospinal fluid escapes when the trocar is withdrawn, the dose of the fluid selected is injected through the canula, which is then withdrawn. An important point is that the operation must be absolutely aseptic; great care is taken to sterilize thoroughly the instruments, site of operation and fluid used. The patient is placed in that position which will yield the best and safest analgesia for the operation; it is essential, however, that the patient's head be raised well above the level of the spine. The injection is followed very quickly, generally within three to five minutes, by the production of analgesia, which lasts for a period varying from half an hour to two hours. Various substances have been used for the injection, of which the following are the chief—tropacocaine, stovaine, novocaine, cocaine, eucaine and alypin. All of these have been combined with adrenalin hydrochloride with a view to limiting their action in one degree or another; and also with other inert substances in such quantity as will produce isotonic solutions of relatively high specific gravity.

The points in favour of this method of producing analgesia are as follows: (*a*) The patient is not rendered unconscious, and is often able to assist at his own operation, such as by coughing or moving his limbs in any way as may be desired. (*b*) There are no troublesome after-effects, such as nausea, vomiting and thirst. (*c*) The formation of haematoma is less frequent. (*d*) Surgical shock is considerably lessened, especially in such operations as amputations and severe abdominal emergencies. (*e*) The risk attending a general anaesthetic is avoided.

The disadvantages at present attending the method are: (*a*) A severe form of headache may sometimes follow, but this has seemed to depend on the kind of fluid injected, and in the recent cases has not been so frequent as in the early ones. (*b*) The paralysis of muscles. In a very few cases this has been permanent. The temporary paralysis of the muscles of respiration is apt to be a serious matter. (*c*) Occasionally incontinence of urine and faeces occurs; this, however, has not been permanent except in a few of the earlier cases. (*d*) The uncertainty of the method, so that the analgesia is not always as complete as is desirable. (*e*) The analgesia for safety must be limited to a line below the level of the second rib in front. (*f*) The use of the Trendelenburgh position is impossible, or indeed the use of any position which involves lowering the patient's head.

It would appear that the method undoubtedly has its uses, and that it will take its place in surgery and find its proper level. A large amount of work is being done on the subject, with a view of determining the limitations and possibilities of the method, the best kind of substance to use and the proper dose to employ.

Finally, a large number of operations have been performed under a local anaesthesia produced by hypnotism (*q.v.*), but this is a method that can only be used on selected cases. (H. C. C.)

ANAGNIA [mod. *Anagni*; pop. (1901) 10,059], an ancient town of the Hernici, situated on a hill (1558 ft.) above the valley of the Trerus and the Via Labicana (the post-station 3 m. below the town, from which a branch road ascended to it, was *Compitum Anagninum*, which was 40 m. E.S.E. of Rome: see T. Ashby, in *Papers of the British School at Rome*, i. 215). In 1880 a pre-Aryan grave was found between the town and the river, with a skeleton painted red, stone implements and a bronze dagger. After the Italian immigration, its position in a fertile district soon gave it importance, and it became the seat of the assembly of the Hernican towns. In the war of 306 B.C. it was conquered by Q. Marcius Tremulus and lost its independence. Its inhabitants had certainly acquired Roman citizenship before the Social War and it continued to be a *municipium* throughout the Roman period. It was besieged by the Saracens in 877, but in the 11th century was a place of considerable importance, the Conti and Gaetani being the chief families; Pope Boniface VIII., a member of the latter, was there made prisoner in 1303. The ancient city walls are in some points still existing, in others they have been much restored; they are built of rectangular blocks of porous limestone about 1½ft. high. On the north of the town they are especially well-preserved, and at one point the area within them is slightly extended by a terrace supported by three lofty pillars. Within the city there are no ancient remains, except some massive substruction walls which supported buildings on the hillside. The present town still preserves in parts its medieval aspect. The cathedral, constructed in 1074 at the summit of the hill, is externally plain; it has a fine Gothic interior, somewhat spoilt by restoration, with a good Cosmati pavement, and a canopy and paschal candlestick in the same style. The crypt contains frescoes of the 13th century, and in the treasury are valuable vestments. Lower down is the Palazzo Civico, belonging to the 11th or early 12th century, which is supported on arches of a single span, under which the road passes. Its posterior façade is fine. Pope Adrian IV. (Nicholas Breakspeare) died here, and there is a chapel of St Thomas Becket in the crypt of the cathedral.

See L. Pigorini, in *Bullettino di Paletnologia Italiana* (1880, 8 seq.); J. Kulakowski, in *Atti del Congresso Internazionale di Scienze Storiche* (Rome, 1904), v. 673 seq. (T. As.)

ANAGRAM (Gr. ἀνά, back, and γράφειν, to write), the result of transposing the letters of a word or words in such a manner as to produce other words that possess meaning. The construction of anagrams is an amusement of great antiquity, its invention being ascribed without authority to the Jews, probably because the later Hebrew writers, particularly the Kabbalists, were fond of it, asserting that "secret mysteries are woven in the numbers of letters." Anagrams were known to the Greeks and also to the Romans, although the known Latin examples of words of more than one syllable are nearly all imperfect. They were popular throughout Europe during the middle ages and later, particularly in France, where a certain Thomas Billon was appointed "anagrammatist to the king" by Louis XIII. W. Camden (*Remains*, 7th ed., 1674) defines "Anagrammatisme" as "a dissolution of a name truly written into his letters, as his elements, and a new connection of it by artificial transposition, without addition, subtraction or change of any letter, into different words, making some perfect sence applyable to the person named." Dryden disdainfully called the pastime the "torturing of one poor word ten thousand ways," but many men and women of note have found amusement in it. A well-known anagram is the change of *Ave Maria, gratia plena, Dominus tecum* into *Virgo serena, pia, munda et immaculata.* Among others are the anagrammatic answer to Pilate's question, "*Quid est veritas?*"—namely, "*Est vir qui adest*"; and the transposition of "Horatio Nelson" into "*Honor est a Nilo*"; and of "Florence Nightingale" into "Flit on, cheering angel." James I.'s courtiers discovered in "James Stuart" "A just master," and converted "Charles James Stuart" into "Claimes Arthur's seat." "Eleanor Audeley," wife of Sir John Davies, is said to have been brought before the High Commission in 1634 for extravagances, stimulated by the discovery that her name could be transposed to "Reveale, O Daniel," and to have been laughed out of court by another anagram submitted by the dean of the Arches, "Dame Eleanor Davies," "Never soe mad a ladie." There must be few names that could furnish so many anagrams as that of "Augustus de Morgan," who tells that a friend had constructed about 800 on his name, specimens of which are given in his *Budget of Paradoxes*, p. 82. The pseudonyms adopted by authors are often transposed forms, more or less exact, of their names; thus "Calvinus" becomes "Alcuinus"; "François Rabelais," "Alcofribas Nasier"; "Bryan Waller Proctor," "Barry Cornwall, poet"; "Henry Rogers," "R. E. H. Greyson," &c. It is to be noted that the last two are impure anagrams, an "r" being left out in both cases. "Telliamed," a simple reversal, is the *title* of a well-known work by "De Maillet." The most remarkable pseudonym of this class is the name "Voltaire," which the celebrated philosopher assumed instead of his family name, "François Marie Arouet," and which is now generally allowed to be an anagram of "Arouet, l.j.," that is, Arouet the younger. Perhaps the only practical use to which anagrams have been turned is to be found in the transpositions in which some of the astronomers of the 17th century embodied their discoveries with the design apparently of avoiding the risk that, while they were engaged in further verification, the credit of what they had found out might be claimed by others. Thus Galileo announced his discovery that Venus had phases like the moon in the form, "*Haec immatura a me jam frustra leguntur—oy,*" that is, "*Cynthiae figuras aemulatur Mater Amorum.*"

Another species of anagram, called "palindrome" (Gr. πάλιν, back, and δρόμος, running), is a word or sentence which may be read backwards as well as forwards, letter by letter, while preserving the same meaning; for example, the words "Anna," "noon," "tenet," or the sentence with which Adam is humorously supposed to have greeted Eve: "Madam, I'm Adam!"

A still more complicated variety is the "logogram" (Gr. λόγος, word), a versified puzzle containing several words derived from recombining the letters of the original word, the difficulty lying in the fact that synonyms of the derived words may be used. Thus, if the original word be " curtain," the word " dog " may be used instead of " cur."

ANAH, or 'Āna, a town on the Euphrates, about mid-way between the Gulf of Alexandretta and the Persian Gulf. It is called Ḫanat in a Babylonian letter (about 2200 B.C.), and An-at by the scribe of Assur-naṣir-pal (879 B.C.), 'Αναθω (Isidore Charax), Anatha (Ammianus Marcellinus) by Greek and Latin writers in the early Christian centuries, 'Āna (sometimes, as if plural, 'Ānāt) by Arabic writers. The name has been connected with that of the deity Anat. Whilst 'Āna has thus retained its name for forty-one centuries the site is variously described. Most early writers concur in placing it on an island; so Assur-naṣir-pal, Isidore, Ammianus Marcellinus, Ibn Serapion, al-Istakri, Abulfeda and al-Ḳaramāni. Ammianus (*lib.* 24, *c.* 2) calls it a ***munimentum***, Theophylactus Simocatta (iv. 10, v. 1, 2) *τὸ 'Αναθων φρούριον*, Zosimus (iii. 14) a *φρούριον*, opp. Φαθυσαι, which may be the *Βεθ(θ)ινα* of Ptolemy (v. 19).[1] Leonhart Rauwolff, in A.D. 1574, found it " divided . . . into two towns," the one " Turkish," " so surrounded by the river, that you cannot go into it but by boats," the other, much larger, on the Arabian side of the river.[2] G. A. Olivier in the beginning of the 19th century describes it as a long street (5 or 6 m. long), parallel to the right bank of the Euphrates—some 100 yards from the water's edge and 300 to 400 paces from the rocky barrier of the Arabian desert—with, over against its lower part, an island bearing at its north end the ruins of a fortress (p. 451).

This southernmost town of Mesopotamia proper (*Gezira*) must have shared the chequered history of that land (see Mesopotamia). Of 'Āna's fortunes under the early Babylonian empire the records have not yet been unearthed; but in a letter dating from the third millennium B.C., six men of Hanat (Ha-na-at^{KI}) are mentioned in a statement as to certain disturbances which had occurred in the sphere of the Babylonian Resident of Suḫi, which would include the district of 'Āna. How 'Āna fared at the hands of the Mitanni and others is unknown. The suggestion that Amenophis (Amenḫotep) I. (16th century B.C.) refers to it is improbable; but we seem to be justified in holding 'Āna to be the town " in the middle of the Euphrates " opposite (*ina pul*) to which Assur-naṣir-pal halted in his campaign of 879 B.C. The supposed reference to 'Āna in the speech put into the mouth of Sennacherib's messengers to Hezekiah (2 Kings xix. 13, Is. xxxvii. 13) is exceedingly improbable. The town may be mentioned, however, in four 7th century documents edited by C. H. W. Johns.[3] It was at 'Āna that the emperor Julian met the first opposition on his disastrous expedition against Persia (363), when he got possession of the place and transported the people; and there that Ziyād and Shureiḫ with the advanced guard of 'Ali's army were refused passage across the Euphrates (36/657) to join 'Ali in Mesopotamia (Ṭabari i. 3261). Later 'Āna was the place of exile of the caliph Qaim (al-Qāim bi-amr-illāh) when Basīsīri was in power (450/1058). In the 14th century 'Āna was the seat of a Catholicos, primate of the Persians (Marin Sanuto). In 1610 Della Valle found a Scot, George Strachan, resident at 'Āna (to study Arabic) as physician to the amīr (i. 671–681). In 1835 the steamer " Tigris " of the English Euphrates expedition went down in a hurricane just above 'Āna, near where Julian's force had suffered from a similar storm. Della Valle described 'Āna as the chief Arab town on the Euphrates, an importance which it owes to its position on one of the routes from the west to Bagdād; Texeira said that the power of its amīr extended to Palmyra (early 17th century); but Olivier found the ruling prince with only twenty-five men in his service, the town becoming more depopulated every day from lack of protection from the Arabs of the desert. Von Oppenheim (1893) reported that Turkish troops having been recently stationed at the place, it had no longer to pay blackmail (*ḫuwwa*) to the Arabs. F. R. Chesney reported some 1800 houses, 2 mosques and 16 water-wheels; W. F. Ainsworth (1835) reported the Arabs as inhabiting the N.W. part of the town, the Christians the centre, and the Jews the S.E.; Della Valle (1610) found some sun-worshippers still there.

Modern 'Āna lies from W. to E. on the right bank along a bend of the river just before it turns S. towards Hīt, and presents an attractive appearance. It extends, chiefly as a single street, for several miles along a narrow strip of land between the river and a ridge of rocky hills. The houses are separated from one another by fruit gardens. 'Āna marks the boundary between the olive (N.) and the date (S.). Arab poets celebrated its wine (Yāqūt, iii. 593 f.), and Mustaufi (8/14th century) tells of the fame of its palm-groves. In the river, facing the town, is a succession of equally productive islands. The most easterly contains the ruins of the old castle, whilst the remains of the ancient Anatho extend from this island for about 2 m. down the left bank. Coarse cloth is almost the only manufacture.

Bibliography.—In addition to the authorities cited above may be mentioned: G. A. Olivier, *Voyage dans l'empire othoman, &c.*, iii. 450-459 (1807); Carl Ritter, *Erdkunde von Asien*, vii. b., pp. 716-726 (1844); W. F. Ainsworth, *Euphrates Expedition*, i. 401-418 (1888). For a map see sheet 5 of the atlas accompanying Chesney's work. (H. W. H.)

ANAHEIM, a city of Orange county, California, U.S.A., about 24 m. S.E. of Los Angeles, about 12 m. from the Pacific Ocean, and about 3 m. from the Santa Ana river. Pop. (1890) 1273; (1900) 1456. It is served by the Atchison, Topeka & Santa Fé, and the Southern Pacific railways. It lies in a fine fruit region, in which oranges, lemons, apricots, grapes and walnuts are raised. The plain on which it is laid out, now fertile and well-watered, was originally an arid waste. Water for irrigation is obtained from the Santa Ana river, about 15 m. above the nearest point along the river to the city. The city itself has an area of only 1⅓ sq. m., and in 1908 the population of the district, including that of the city, was estimated at 5000. The principal manufactures are dried and canned fruits, wine, beer, and agricultural implements. Anaheim is of particular interest as the earliest of various settlements in southern California in which co-operation has made possible the establishment of intensive fruit culture in semi-desert regions. In 1857 fifty Germans (mostly mechanics) organized in San Francisco the Los Angeles Vineyard Association and bought 1165 acres of land here which could be irrigated from the Santa Ana river; each member took possession of a 20 acre share only when gradual improvement had made everything ready for occupancy and the tracts had been distributed by lot, with bonuses or rebates to equalize them in value to the drawers. This ended the co-operative feature of the enterprise, which was never communistic except that its irrigating canal remained common property. The settlement was uninterruptedly successful, and was influential as a pioneer experiment. Anaheim was incorporated as a town in 1870; this incorporation was revoked in 1872; in 1878 the town was incorporated again; and in 1888 Anaheim received a city charter.

ANÁHUAC, a geographical district of Mexico, limited by the traditional and vaguely defined boundaries of an ancient Indian empire or confederation of that name previous to the Spanish conquest. The word is said to signify " country by the waters " in the old Aztec language; hence the theory that Anáhuac was located on the sea coast. One of the theories relating to the location of Anáhuac describes it as all the plateau region of Mexico, with an area equal to three-fourths of the republic, and extending between the eastern and western coast ranges from Rio Grande to the isthmus of Tehuantepec. A more exact description, however, limits it to the great plateau valley in which the city of Mexico is located, between 18° 40′ and 20° 30′ N. lat., about 200 m. long by 75 m. wide, with an average elevation of 7500 ft., and a mean temperature of 62°. The accepted meaning of the name fits this region as well as any on the sea coast, as the lakes of this valley formerly covered one-tenth of its area. The existence of the name in southern Utah, United States, and on the gulf coast of Mexico, has given rise to theories of other locations and wider bounds for the old Indian empire.

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[1] Steph. Byz. (*sub* Τῦρος) says that Arrian calls Anatha Τῦρος.

[2] Texeira (1610) says that "Anna" lay on both banks of the river, and so Della Valle (i. 671).

[3] *Ass. Deeds and Doc.* nos. 23, 168, 228, 385. The characters used are DIŠ TU, which may mean Ana-tu.

ANALCITE, a commonly occurring mineral of the zeolite group. It crystallizes in the cubic system, the common form being the icositetrahedron (211), either alone (fig. 1) or in combination with the cube (100); sometimes the faces of the cube predominate in size, and its corners are each replaced by three small triangular faces representing the icositetrahedron (fig. 2). Although cubic in form, analcite usually shows feeble double refraction, and is thus optically anomalous. This feature of analcite has been much studied, Sir David Brewster in 1826 being the earliest investigator. Crystals of analcite are often perfectly colourless and transparent with a brilliant glassy lustre, but some are opaque and white or pinkish-white. The hardness of the mineral is 5 to 5½, and its specific gravity is 2·25. Chemically, analcite is a hydrated sodium and aluminium silicate, $NaAlSi_2O_6+H_2O$; small amounts of the sodium being sometimes replaced by calcium or by potassium. The water of crystallization is readily expelled by heat, with modification of the optical characters of the crystals. Before the blowpipe the mineral readily fuses with intumescence to a colourless glass. It is decomposed by acids with separation of gelatinous silica.

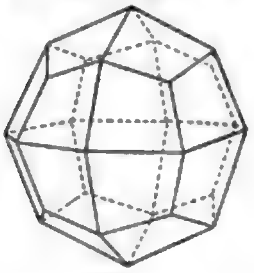

FIG. 1.

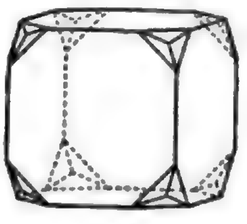

FIG. 2.

Analcite usually occurs, associated with other zeolitic minerals, lining amygdaloidal cavities in basic volcanic rocks such as basalt and melaphyre, and especially in such as have undergone alteration by weathering; the Tertiary basalts of the north of Ireland frequently contain cavities lined with small brilliant crystals of analcite. Larger crystals of the same kind are found in the basalt of the Cyclopean Islands (Scogli de' Ciclopi or Faraglioni) N.E. of Catania, Sicily. Large opaque crystals of the pinkish-white colour are found in cavities in melaphyre at the Seisser Alpe near Schlern in southern Tirol. In all such cases the mineral is clearly of secondary origin, but of late years another mode of occurrence has been recognized, analcite having been found as a primary constituent of certain igneous rocks such as monchiquite and some basalts. The irregular grains, of which it has the form, had previously been mistaken for glass.

Owing to the fact that analcite often crystallizes in cubes, it was long known as cubic zeolite or as cuboite. The name now in use was proposed in 1797 in the form analcime, by R. J. Haüy, in allusion to the weak (ἄναλκις) electrification of the mineral produced by friction. Euthallite is a compact, greenish analcite, produced by the alteration of elaeolite at various localities in the Langesund-fjord in southern Norway. Eudnophite, from the same region, was originally described as an orthorhombic mineral dimorphous with analcite, but has since been found to be identical with it. Cluthalite, from the Clyde (Clutha) valley, is an altered form of the mineral. (L. J. S.)

ANALOGY (Gr. ἀναλογία, proportion), a term signifying, (1) in general, resemblance which falls short of absolute similarity or identity. Thus by analogy, the word "loud," originally applied to sounds, is used of garments which obtrude themselves on the attention; all metaphor is thus a kind of analogy. (2) Euclid used the term for proportionate equality; but in mathematics it is now obsolete except in the phrase, "Napier's Analogies" in spherical trigonometry (see NAPIER, JOHN). (3) In grammar, it signifies similarity in the dominant characteristics of a language, derivation, orthography and so on. (4) In logic, it is used of arguments by inference from resemblances between known particulars to other particulars which are not observed. Under the name of "example" (παράδειγμα) the process is explained by Aristotle (*Prior Anal.* ii. 4) as an inference which differs from induction (*q.v.*) in having a particular, not a general, conclusion; *i.e.* if A is demonstrably like B in certain respects, it may be assumed to be like it in another, though the latter is not demonstrated. Kant and his followers state the distinction otherwise, *i.e.* induction argues from the possession of an attribute by many members of a class that all members of the class possess it, while analogy argues that, because A has some of B's qualities, it must have them all (cf. Sir Wm. Hamilton, *Lectures on Logic*, ii. 165-174, for a slight modification of this view). J. S. Mill very properly rejects this artificial distinction, which is in practice no distinction at all; he regards induction and analogy as generically the same, though differing in the demonstrative validity of their evidence, *i.e.* induction proceeds on the basis of scientific, causal connexion, while analogy, in absence of proof, temporarily accepts a probable hypothesis. In this sense, analogy may obviously have a universal conclusion. This type of inference is of the greatest value in physical science, which has frequently and quite legitimately used such conclusions until a negative instance has disproved or further evidence confirmed them (for a list of typical cases see T. Fowler's edition of Bacon's *Nov. Org.* Aph. ii. 27 note). The value of such inferences depends on the nature of the resemblances on which they are based and on that of the differences which they disregard. If the resemblances are small and unimportant and the differences great and fundamental, the argument is known as "False Analogy." The subject is dealt with in Francis Bacon's *Novum Organum*, especially ii. 27 (see T. H. Fowler's notes) under the head of *Instantiae conformes sive proportionatae.* Strictly the argument by analogy is based on similarity of relations between things, not on the similarity of things, though it is, in general, extended to cover the latter. See works on Logic, *e.g.* J. S. Mill, T. H. Fowler, W. S. Jevons. For Butler's *Analogy* and its method see BUTLER, JOSEPH.

The term was used in a special sense by Kant in his phrase, "Analogies of Experience," the third and most important group in his classification of the *a priori* elements of knowledge. By it he understood the fundamental laws of pure natural science under the three heads, substantiality, causality, reciprocity (see F. Paulsen, *I. Kant*, Eng. trans. 1902, pp. 188 ff.).

ANALYSIS (Gr. ἀνά and λύειν, to break up into parts), in general, the resolution of a whole into its component elements; opposed to synthesis, the combining of separate elements or minor wholes into an inclusive unity. It differs from mere "disintegration" in proceeding on a definite scientific plan. In grammar, analysis is the breaking up of a sentence into subject, predicate, object, &c. (an exercise introduced into English schools by J. D. Morell about 1852); so the analysis of a book or a lecture is a synopsis of the main points. The chief technical uses of the word, which retains practically the same meaning in all the sciences, are in (1) philosophy, (2) mathematics, (3) chemistry.

(1) Logical analysis is the process of examining into the connotation of a concept or idea, and separating the attributes from the whole and each other. It, therefore, does not increase knowledge, but merely clarifies and tests it. In this sense Kant distinguished an analytic from a synthetic judgment, as one in which the predicate is involved in the essence of the subject. Such judgments are also known as verbal, as opposed to real or ampliative judgments. The processes of synthesis and analysis though formally contradictory are practically supplementary; thus to analyse the connotation is to synthesize the denotation of a term, and vice versa; the process of knowledge involves the two methods, analysis being the corrective of synthetic empiricism. In a wider sense the whole of formal logic is precisely the analysis of the laws of thought. Analytical psychology is distinguished from genetic and empirical psychology inasmuch as it proceeds by the method of introspective investigation of mental phenomena instead of by physiological or psycho-physical experiment. For the relation between analysis and synthesis on the one hand, and deduction and induction on the other, see INDUCTION.

(2) In mathematics, analysis has two distinct meanings, conveniently termed ancient and modern. Ancient analysis,

as described by Pappus, related chiefly to geometrical problems, and is the method of reasoning from the solution, as taken for granted, to consequences which are known to be true, whereas synthesis reasons from known data to the solution. (See Geometry.)

Modern analysis is practically coeval with Descartes, the founder of "analytical geometry," although the calculus of general quantities had previously been termed analysis. Many mathematical subjects are now included under this name, and are treated in the following articles:—Geometry, Analytical; Infinitesimal Calculus; Differential Equation; Variations, Calculus of; Curve; Surface; Function; Spherical Harmonics; Series; Fourier's Series; Groups, Theory of; Probability.

(3) In Chemistry, the word analysis was introduced by Robert Boyle to denote the determination of the composition of substances. (See Chemistry, *Analytical*).

ANALYST, in modern times, a person professionally skilled in chemical analysis. He may be called upon, in the discharge of his profession, to analyse a wide range of substances. Apart from private practitioners and those engaged in large manufacturing concerns, analysts employed by public bodies are termed public analysts. In most large manufacturing establishments there is usually a staff of analysts, whose duty it is primarily to exercise constant watchfulness over the processes of manufacture, to test the purity of the substances used, as well as that of the final products. The services of analysts are constantly required in judicial enquiries, sometimes in purely criminal cases, sometimes in civil proceedings, such as offences against the customs or excise or under the various British Food and Drugs Acts. In the case of criminal proceedings, the services of the official analyst attached to the British Home Office are employed. The inland revenue department has a laboratory at Somerset House, with a staff of analysts, who are engaged in analysing for excise and other purposes. Under the Fertilizers and Feeding Stuffs Act 1893, the Board of Agriculture employs an agricultural chemist, whose duty is the analysis of fertilizers and feeding stuffs.

A "public analyst" is an analyst appointed by a local authority for the purposes of the Sale of Food and Drugs Acts. He must be possessed of competent medical, chemical and microscopical knowledge to analyse all articles of food and drink (see Adulteration).

ANALYTIC (the adjective of "analysis," *q.v.*), according with, or consisting in, the method of separating a whole into its parts, the opposite of synthetic. For analytic *chemistry*, analytic *language*, &c., see the articles under the noun-headings. The title of ἀναλυτικά or *Analytics* was given by Aristotle to his treatises on logic.

ANAMALAI HILLS, a range of mountains in southern India, in the Coimbatore district of Madras, lying between 10° 13′ and 10° 31′ N. lat., and between 76° 52′ and 77° 23′ E. long., forming a portion of the Western Ghats, after this range has been broken by the Palghat Pass, south of the Nilgiris. They really consist of a forest-clad and grassy tableland, with summits rising about 8000 ft.; the Anaimudi mountain, which is the highest in southern India, having an altitude of 8850 ft. Their geological formation is metamorphic gneiss, veined with felspar and quartz, and interspersed with reddish porphyrite. The lower slopes yield valuable teak and other timber; and some land has been taken up for coffee planting. The only inhabitants are a few wild tribes who live by hunting and collecting jungle produce.

ANAMORPHOSIS (a Gr. word, derived from ἀνά, back, and μορφή, form: the second *o* in the Greek is long, but in English the pronunciation varies), a deformation or distortion of appearance; in drawing, the representation of an object as seen, for instance, altered by reflexion in a mirror; in botany, *e.g.* in the case of fungi or lichens, an abnormal change giving the appearance of a different species.

'ANAN BEN DAVID, a Persian Jew of the 8th century, and founder within Judaism of the sect of Qaraites (Karaites) which set itself in opposition to the rabbinic tradition. 'Anan was an unsuccessful candidate for the dignity of Exilarch, and thus his opposition to the rabbanite Jews was political as well as theological. His secession occurred at a moment when the time was ripe for a reaction against rabbinism, and 'Anan became the rallying point for many opponents of tradition. (See Qaraites.)

ĀNANDA, one of the principal disciples of the Buddha (*q.v.*). He has been called the beloved disciple of the Buddhist story. He was the first cousin of the Buddha, and was devotedly attached to him. Ānanda entered the Order in the second year of the Buddha's ministry, and became one of his personal attendants, accompanying him on most of his wanderings and being the interlocutor in many of the recorded dialogues. He is the subject of a special panegyric delivered by the Buddha just before his death (*Book of the Great Decease*, v. 38); but it is the panegyric of an unselfish man, kindly, thoughtful for others and popular; not of the intellectual man, versed in the theory and practice of the Buddhist system of self-culture. So in the long list of the disciples given in the *Anguttara* (i. xiv.) where each of them is declared to be the chief in some gift, Ānanda is mentioned five times (which is more often than any other), but it is as chief in conduct and in service to others and in power of memory, not in any of the intellectual powers so highly prized in the community. This explains why he had not attained to arahatship; and in the earliest account of the convocation said to have been held by five hundred of the principal disciples immediately after the Buddha's death, he was the only one who was not an arahat (*Cullavagga*, book xi.). In later accounts this incident is explained away. Thirty-three verses ascribed to Ānanda are preserved in a collection of lyrics by the principal male and female members of the order (*Thera Gāthā*, 1017–1050). They show a gentle and reverent but simple spirit. (T. W. R. D.)

ANANIAS, the Gr. form of Hananiah, or Ananiah, a name occurring several times in the Old Testament and Apocrypha (Neh. iii. 23, 1 Ch. xxv. 23, Tob. v. 12. &c.), and three times in the New Testament. Special mention need be made only of the bearers of the name in the New Testament. (1) A member of the first Christian community, who, with his wife Sapphira, was miraculously punished by Peter with sudden death for hypocrisy and falsehood (Acts v. 1–10; cf. Josh. vii. 1 ff.). (2) A disciple at Damascus who figures in the story of the conversion and baptism of Paul (Acts ix. 10–17, xxii. 12–16). (3) Son of Nedebaios (Jos. *Ant.* xx. 5. 2), a high priest who presided during the trial of Paul at Jerusalem and Caesarea (Acts xxiii. 2, xxiv. 1–5). He officiated as high priest from about A.D. 47 to 59. Quadratus, governor of Syria, accused him of being responsible for acts of violence. He was sent to Rome for trial (A.D. 52), but was acquitted by the emperor Claudius. Being a friend of the Romans, he was murdered by the people at the beginning of the Jewish war.

ANANTAPUR, a town and district of India, in the Madras presidency. The town has a station on the Madras railway, 62 m. S.E. from Bellary. Pop. (1901) 7938.

The district of Anantapur was constituted in 1882 out of the unwieldy district of Bellary. It has an area of 5557 sq. m., and in its northern and central portions is a high plateau, generally undulating, with large granite rocks or low hill ranges rising here and there above its surface. In the southern portion of the district the surface is more hilly, the plateau there rising to 2600 ft. above the sea. There is a remarkable fortress rock at Gooty, 2171 ft. above the sea, and a similar but larger rock at Penukonda, with an elevation equal to that of Bangalore, about 3100 ft. Gooty fortress was a stronghold of the Mahrattas, but was taken from them by Hyder Ali. In 1789 it was ceded by Tippoo to the nizam, and in 1800 the nizam ceded the district of Anantapur with others to the British in payment for a subsidiary British force. The population in 1901 was 788,254, showing an increase of 8 % in the decade. The principal crops are millet, rice, other food grains, pulse, oil seeds and cotton. There are several steam factories for pressing cotton. Two railways traverse the district.

ANAPA, a seaport town of Russia, in the government of Kuban, on the N. coast of the Black Sea, 45 m. S.E. from the Strait of Yenikale or Kerch, giving access to the Sea of Azov. It was originally built in 1781 as a frontier fortress of the Turks against Russia. Three times captured by the Russians, in 1791, 1807 and 1828, and twice restored by them, in 1792 and 1812, it was finally left in their hands by the treaty of Adrianople in 1829. During the Crimean War its fortifications were destroyed (1855) by the Russians themselves. Pop. (1897) 6676.

ANAPAEST (from Gr. ἀνάπαιστος, reversed), a metrical foot consisting of three syllables, the first two short and the third long and accented; so called as the reverse of a dactyl, which has the first a long syllable, followed by two short ones. An anapaestic verse is one which only contains, or is mostly made up of, anapaestic feet.

ANARCHISM (from the Gr. ἀν-, and ἀρχή, contrary to authority), the name given to a principle or theory of life and conduct under which society is conceived without government—harmony in such a society being obtained, not by submission to law, or by obedience to any authority, but by free agreements concluded between the various groups, territorial and professional, freely constituted for the sake of production and consumption, as also for the satisfaction of the infinite variety of needs and aspirations of a civilized being. In a society developed on these lines, the voluntary associations which already now begin to cover all the fields of human activity would take a still greater extension so as to substitute themselves for the state in all its functions. They would represent an interwoven network, composed of an infinite variety of groups and federations of all sizes and degrees, local, regional, national and international—temporary or more or less permanent—for all possible purposes: production, consumption and exchange, communications, sanitary arrangements, education, mutual protection, defence of the territory, and so on; and, on the other side, for the satisfaction of an ever-increasing number of scientific, artistic, literary and sociable needs. Moreover, such a society would represent nothing immutable. On the contrary—as is seen in organic life at large—harmony would (it is contended) result from an ever-changing adjustment and readjustment of equilibrium between the multitudes of forces and influences, and this adjustment would be the easier to obtain as none of the forces would enjoy a special protection from the state.

If, it is contended, society were organized on these principles, man would not be limited in the free exercise of his powers in productive work by a capitalist monopoly, maintained by the state; nor would he be limited in the exercise of his will by a fear of punishment, or by obedience towards individuals or metaphysical entities, which both lead to depression of initiative and servility of mind. He would be guided in his actions by his own understanding, which necessarily would bear the impression of a free action and reaction between his own self and the ethical conceptions of his surroundings. Man would thus be enabled to obtain the full development of all his faculties, intellectual, artistic and moral, without being hampered by overwork for the monopolists, or by the servility and inertia of mind of the great number. He would thus be able to reach full *individualisation*, which is not possible either under the present system of *individualism*, or under any system of state-socialism in the so-called *Volkstaat* (popular state).

The Anarchist writers consider, moreover, that their conception is not a Utopia, constructed on the *a priori* method, after a few desiderata have been taken as postulates. It is derived, they maintain, from an *analysis of tendencies* that are at work already, even though state socialism may find a temporary favour with the reformers. The progress of modern technics, which wonderfully simplifies the production of all the necessaries of life; the growing spirit of independence, and the rapid spread of free initiative and free understanding in all branches of activity—including those which formerly were considered as the proper attribution of church and state—are steadily reinforcing the no-government tendency.

As to their economical conceptions, the Anarchists, in common with all Socialists, of whom they constitute the left wing, maintain that the now prevailing system of private ownership in land, and our capitalist production for the sake of profits, represent a monopoly which runs against both the principles of justice and the dictates of utility. They are the main obstacle which prevents the successes of modern technics from being brought into the service of all, so as to produce general well-being. The Anarchists consider the wage-system and capitalist production altogether as an obstacle to progress. But they point out also that the state was, and continues to be, the chief instrument for permitting the few to monopolize the land, and the capitalists to appropriate for themselves a quite disproportionate share of the yearly accumulated surplus of production. Consequently, while combating the present monopolization of land, and capitalism altogether, the Anarchists combat with the same energy the state, as the main support of that system. Not this or that special form, but the state altogether, whether it be a monarchy or even a republic governed by means of the *referendum*.

The state organization, having always been, both in ancient and modern history (Macedonian empire, Roman empire, modern European states grown up on the ruins of the autonomous cities), the instrument for establishing monopolies in favour of the ruling minorities, cannot be made to work for the destruction of these monopolies. The Anarchists consider, therefore, that to hand over to the state all the main sources of economical life—the land, the mines, the railways, banking, insurance, and so on—as also the management of all the main branches of industry, in addition to all the functions already accumulated in its hands (education, state-supported religions, defence of the territory, &c.), would mean to create a new instrument of tyranny. State capitalism would only increase the powers of bureaucracy and capitalism. True progress lies in the direction of decentralization, both *territorial* and *functional*, in the development of the spirit of local and personal initiative, and of free federation from the simple to the compound, *in lieu* of the present hierarchy from the centre to the periphery.

In common with most Socialists, the Anarchists recognize that, like all evolution in nature, the slow evolution of society is followed from time to time by periods of accelerated evolution which are called revolutions; and they think that the era of revolutions is not yet closed. Periods of rapid changes will follow the periods of slow evolution, and these periods must be taken advantage of—not for increasing and widening the powers of the state, but for reducing them, through the organization in every township or commune of the local groups of producers and consumers, as also the regional, and eventually the international, federations of these groups.

In virtue of the above principles the Anarchists refuse to be party to the present state organization and to support it by infusing fresh blood into it. They do not seek to constitute, and invite the working men not to constitute, political parties in the parliaments. Accordingly, since the foundation of the International Working Men's Association in 1864–1866, they have endeavoured to promote their ideas directly amongst the labour organizations and to induce those unions to a direct struggle against capital, without placing their faith in parliamentary legislation.

The Historical Development of Anarchism.—The conception of society just sketched, and the tendency which is its dynamic expression, have always existed in mankind, in opposition to the governing hierarchic conception and tendency—now the one and now the other taking the upper hand at different periods of history. To the former tendency we owe the evolution, by the masses themselves, of those institutions—the clan, the village community, the gild, the free medieval city—by means of which the masses resisted the encroachments of the conquerors and the power-seeking minorities. The same tendency asserted itself with great energy in the great religious movements of medieval times, especially in the early movements of the reform and its forerunners. At the same time it evidently found its expression in the writings of some thinkers, since the times of Lao-tsze, although, owing to its non-scholastic and popular origin, it obviously found less sympathy among the scholars than the opposed tendency.

As has been pointed out by Prof. Adler in his *Geschichte des*

Sozialismus und Kommunismus, Aristippus (b. *c.* 430 B.C.), one of the founders of the Cyrenaic school, already taught that the wise must not give up their liberty to the state, and in reply to a question by Socrates he said that he did not desire to belong either to the governing or the governed class. Such an attitude, however, seems to have been dictated merely by an Epicurean attitude towards the life of the masses.

The best exponent of Anarchist philosophy in ancient Greece was Zeno (342–267 or 270 B.C.), from Crete, the founder of the Stoic philosophy, who distinctly opposed his conception of a free community without government to the state-Utopia of Plato. He repudiated the omnipotence of the state, its intervention and regimentation, and proclaimed the sovereignty of the moral law of the individual—remarking already that, while the necessary instinct of self-preservation leads man to egotism, nature has supplied a corrective to it by providing man with another instinct—that of sociability. When men are reasonable enough to follow their natural instincts, they will unite across the frontiers and constitute the Cosmos. They will have no need of law-courts or police, will have no temples and no public worship, and use no money—free gifts taking the place of the exchanges. Unfortunately, the writings of Zeno have not reached us and are only known through fragmentary quotations. However, the fact that his very wording is similar to the wording now in use, shows how deeply is laid the tendency of human nature of which he was the mouth-piece.

In medieval times we find the same views on the state expressed by the illustrious bishop of Alba, Marco Girolamo Vida, in his first dialogue *De dignitate reipublicae* (Ferd. Cavalli, in *Mem. dell' Istituto Veneto*, xiii.; Dr E. Nys, *Researches in the History of Economics*). But it is especially in several early Christian movements, beginning with the 9th century in Armenia, and in the preachings of the early Hussites, particularly Chojecki, and the early Anabaptists, especially Hans Denk (cf. Keller, *Ein Apostel der Wiedertäufer*), that one finds the same ideas forcibly expressed—special stress being laid of course on their moral aspects.

Rabelais and Fénelon, in their Utopias, have also expressed similar ideas, and they were also current in the 18th century amongst the French Encyclopaedists, as may be concluded from separate expressions occasionally met with in the writings of Rousseau, from Diderot's *Preface* to the *Voyage* of Bougainville, and so on. However, in all probability such ideas could not be developed then, owing to the rigorous censorship of the Roman Catholic Church.

These ideas found their expression later during the great French Revolution. While the Jacobins did all in their power to centralize everything in the hands of the government, it appears now, from recently published documents, that the masses of the people, in their municipalities and "sections," accomplished a considerable constructive work. They appropriated for themselves the election of the judges, the organization of supplies and equipment for the army, as also for the large cities, work for the unemployed, the management of charities, and so on. They even tried to establish a direct correspondence between the 36,000 communes of France through the intermediary of a special board, outside the National Assembly (cf. Sigismund Lacroix, *Actes de la commune de Paris*).

It was Godwin, in his *Enquiry concerning Political Justice* (2 vols., 1793), who was the first to formulate the political and economical conceptions of Anarchism, even though he did not give that name to the ideas developed in his remarkable work. Laws, he wrote, are not a product of the wisdom of our ancestors: they are the product of their passions, their timidity, their jealousies and their ambition. The remedy they offer is worse than the evils they pretend to cure. If and only if all laws and courts were abolished, and the decisions in the arising contests were left to reasonable men chosen for that purpose, real justice would gradually be evolved. As to the state, Godwin frankly claimed its abolition. A society, he wrote, can perfectly well exist without any government: only the communities should be small and perfectly autonomous. Speaking of property, he stated that the rights of every one "to every substance capable of contributing to the benefit of a human being" must be regulated by justice alone: the substance must go "to him who most wants it." His conclusion was Communism. Godwin, however, had not the courage to maintain his opinions. He entirely rewrote later on his chapter on property and mitigated his Communist views in the second edition of *Political Justice* (8vo, 1796).

Proudhon was the first to use, in 1840 (*Qu'est-ce que la propriété?* first memoir), the name of Anarchy with application to the no-government state of society. The name of "Anarchists" had been freely applied during the French Revolution by the Girondists to those revolutionaries who did not consider that the task of the Revolution was accomplished with the overthrow of Louis XVI., and insisted upon a series of economical measures being taken (the abolition of feudal rights without redemption, the return to the village communities of the communal lands enclosed since 1669, the limitation of landed property to 120 acres, progressive income-tax, the national organization of exchanges on a just value basis, which already received a beginning of practical realization, and so on).

Now Proudhon advocated a society without government, and used the word Anarchy to describe it. Proudhon repudiated, as is known, all schemes of Communism, according to which mankind would be driven into communistic monasteries or barracks, as also all the schemes of state or state-aided Socialism which were advocated by Louis Blanc and the Collectivists. When he proclaimed in his first memoir on property that "Property is theft," he meant only property in its present, Roman-law, sense of "right of use and abuse"; in property-rights, on the other hand, understood in the limited sense of *possession*, he saw the best protection against the encroachments of the state. At the same time he did not want violently to dispossess the present owners of land, dwelling-houses, mines, factories and so on. He preferred to attain the same end by rendering capital incapable of earning interest; and this he proposed to obtain by means of a national bank, based on the mutual confidence of all those who are engaged in production, who would agree to exchange among themselves their produces at cost-value, by means of labour cheques representing the hours of labour required to produce every given commodity. Under such a system, which Proudhon described as "Mutuellisme," all the exchanges of services would be strictly equivalent. Besides, such a bank would be enabled to lend money without interest, levying only something like 1%, or even less, for covering the cost of administration. Every one being thus enabled to borrow the money that would be required to buy a house, nobody would agree to pay any more a yearly rent for the use of it. A general "social liquidation" would thus be rendered easy, without violent expropriation. The same applied to mines, railways, factories and so on.

In a society of this type the state would be useless. The chief relations between citizens would be based on free agreement and regulated by mere account keeping. The contests might be settled by arbitration. A penetrating criticism of the state and all possible forms of government, and a deep insight into all economic problems, were well-known characteristics of Proudhon's work.

It is worth noticing that French mutualism had its precursor in England, in William Thompson, who began by mutualism before he became a Communist, and in his followers John Gray (*A Lecture on Human Happiness*, 1825; *The Social System*, 1831) and J. F. Bray (*Labour's Wrongs and Labour's Remedy*, 1839). It had also its precursor in America. Josiah Warren, who was born in 1798 (cf. W. Bailie, *Josiah Warren, the First American Anarchist*, Boston, 1900), and belonged to Owen's "New Harmony," considered that the failure of this enterprise was chiefly due to the suppression of individuality and the lack of initiative and responsibility. These defects, he taught, were inherent to every scheme based upon authority and the community of goods. He advocated, therefore, complete individual liberty. In 1827 he opened in Cincinnati a little country store which was the first "Equity Store," and which the people called

"Time Store," because it was based on labour being exchanged hour for hour in all sorts of produce. "Cost—the limit of price," and consequently "no interest," was the motto of his store, and later on of his "Equity Village," near New York, which was still in existence in 1865. Mr Keith's "House of Equity" at Boston, founded in 1855, is also worthy of notice.

While the economical, and especially the mutual-banking, ideas of Proudhon found supporters and even a practical application in the United States, his political conception of Anarchy found but little echo in France, where the Christian Socialism of Lamennais and the Fourierists, and the State Socialism of Louis Blanc and the followers of Saint-Simon, were dominating. These ideas found, however, some temporary support among the left-wing Hegelians in Germany, Moses Hess in 1843, and Karl Grün in 1845, who advocated Anarchism. Besides, the authoritarian Communism of Wilhelm Weitling having given origin to opposition amongst the Swiss working men, Wilhelm Marr gave expression to it in the 'forties.

On the other side, Individualist Anarchism found, also in Germany, its fullest expression in Max Stirner (Kaspar Schmidt), whose remarkable works (*Der Einzige und sein Eigenthum* and articles contributed to the *Rheinische Zeitung*) remained quite overlooked until they were brought into prominence by John Henry Mackay.

Prof. V. Basch, in a very able introduction to his interesting book, *L'Individualisme anarchiste: Max Stirner* (1904), has shown how the development of the German philosophy from Kant to Hegel, and "the absolute" of Schelling and the *Geist* of Hegel, necessarily provoked, when the anti-Hegelian revolt began, the preaching of the same "absolute" in the camp of the rebels. This was done by Stirner, who advocated, not only a complete revolt against the state and against the servitude which authoritarian Communism would impose upon men, but also the full liberation of the individual from all social and moral bonds—the rehabilitation of the "I," the supremacy of the individual, complete "a-moralism," and the "association of the egotists." The final conclusion of that sort of Individual Anarchism has been indicated by Prof. Basch. It maintains that the aim of all superior civilization is, not to permit *all* members of the community to develop in a normal way, but to permit certain better endowed individuals "fully to develop," even at the cost of the happiness and the very existence of the mass of mankind. It is thus a return towards the most common individualism, advocated by all the would-be superior minorities, to which indeed man owes in his history precisely the state and the rest, which these individualists combat. Their individualism goes so far as to end in a negation of their own starting-point,—to say nothing of the impossibility for the individual to attain a really full development in the conditions of oppression of the masses by the "beautiful aristocracies." His development would remain uni-lateral. This is why this direction of thought, notwithstanding its undoubtedly correct and useful advocacy of the full development of each individuality, finds a hearing only in limited artistic and literary circles.

Anarchism in the International Working Men's Association.—A general depression in the propaganda of all fractions of Socialism followed, as is known, after the defeat of the uprising of the Paris working men in June 1848 and the fall of the Republic. All the Socialist press was gagged during the reaction period, which lasted fully twenty years. Nevertheless, even Anarchist thought began to make some progress, namely in the writings of Bellegarrique (*Cœurderoy*), and especially Joseph Déjacque (*Les Lasaréennes*, *L'Humanisphère*, an Anarchist-Communist Utopia, lately discovered and reprinted). The Socialist movement revived only after 1864, when some French working men, all "mutualists," meeting in London during the Universal Exhibition with English followers of Robert Owen, founded the International Working Men's Association. This association developed very rapidly and adopted a policy of direct economical struggle against capitalism, without interfering in the political parliamentary agitation, and this policy was followed until 1871. However, after the Franco-German War, when the International Association was prohibited in France after the uprising of the Commune, the German working men, who had received manhood suffrage for elections to the newly constituted imperial parliament, insisted upon modifying the tactics of the International, and began to build up a Social-Democratic political party. This soon led to a division in the Working Men's Association, and the Latin federations, Spanish, Italian, Belgian and Jurassic (France could not be represented), constituted among themselves a Federal union which broke entirely with the Marxist general council of the International. Within these federations developed now what may be described as *modern Anarchism*. After the names of "Federalists" and "Anti-authoritarians" had been used for some time by these federations the name of "Anarchists," which their adversaries insisted upon applying to them, prevailed, and finally it was revindicated.

Bakunin (*q.v.*) soon became the leading spirit among these Latin federations for the development of the principles of Anarchism, which he did in a number of writings, pamphlets and letters. He demanded the complete abolition of the state, which—he wrote—is a product of religion, belongs to a lower state of civilization, represents the negation of liberty, and spoils even that which it undertakes to do for the sake of general well-being. The state was an historically necessary evil, but its complete extinction will be, sooner or later, equally necessary. Repudiating all legislation, even when issuing from universal suffrage, Bakunin claimed for each nation, each region and each commune, full autonomy, so long as it is not a menace to its neighbours, and full independence for the individual, adding that one becomes really free only when, and in proportion as, all others are free. Free federations of the communes would constitute free nations.

As to his economical conceptions, Bakunin described himself, in common with his Federalist comrades of the International (César De Paepe, James Guillaume Schwitzguébel), a "Collectivist Anarchist"—not in the sense of Vidal and Pecqueur in the 'forties, or of their modern Social-Democratic followers, but to express a state of things in which all necessaries for production are owned in common by the Labour groups and the free communes, while the ways of retribution of labour, Communist or otherwise, would be settled by each group for itself. Social revolution, the near approach of which was foretold at that time by all Socialists, would be the means of bringing into life the new conditions.

The Jurassic, the Spanish, and the Italian federations and sections of the International Working Men's Association, as also the French, the German and the American Anarchist groups, were for the next years the chief centres of Anarchist thought and propaganda. They refrained from any participation in parliamentary politics, and always kept in close contact with the Labour organizations. However, in the second half of the 'eighties and the early 'nineties of the 19th century, when the influence of the Anarchists began to be felt in strikes, in the 1st of May demonstrations, where they promoted the idea of a general strike for an eight hours' day, and in the anti-militarist propaganda in the army, violent prosecutions were directed against them, especially in the Latin countries (including physical torture in the Barcelona Castle) and the United States (the execution of five Chicago Anarchists in 1887). Against these prosecutions the Anarchists retaliated by acts of violence which in their turn were followed by more executions from above, and new acts of revenge from below. This created in the general public the impression that violence is the substance of Anarchism, a view repudiated by its supporters, who hold that in reality violence is resorted to by all parties in proportion as their open action is obstructed by repression, and exceptional laws render them outlaws. (Cf. *Anarchism and Outrage*, by C. M. Wilson, and *Report of the Spanish Atrocities Committee*, in "Freedom Pamphlets"; *A Concise History of the Great Trial of the Chicago Anarchists*, by Dyer Lum (New York, 1886); *The Chicago Martyrs: Speeches*, &c.).[1]

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[1] It is important to remember that the term "Anarchist" is inevitably rather loosely used in public, in connexion with the authors

Anarchism continued to develop, partly in the direction of Proudhonian "Mutuellisme," but chiefly as Communist-Anarchism, to which a third direction, Christian-Anarchism, was added by Leo Tolstoy, and a fourth, which might be ascribed as literary-Anarchism, began amongst some prominent modern writers.

The ideas of Proudhon, especially as regards mutual banking, corresponding with those of Josiah Warren, found a considerable following in the United States, creating quite a school, of which the main writers are Stephen Pearl Andrews, William Grene, Lysander Spooner (who began to write in 1850, and whose unfinished work, *Natural Law*, was full of promise), and several others, whose names will be found in Dr Nettlan's *Bibliographie de l'anarchie*.

A prominent position among the Individualist Anarchists in America has been occupied by Benjamin R. Tucker, whose journal *Liberty* was started in 1881 and whose conceptions are a combination of those of Proudhon with those of Herbert Spencer. Starting from the statement that Anarchists are egotists, strictly speaking, and that every group of individuals, be it a secret league of a few persons, or the Congress of the United States, has the right to oppress all mankind, provided it has the power to do so, that equal liberty for all and absolute equality ought to be the law, and "mind every one your own business" is the unique moral law of Anarchism, Tucker goes on to prove that a general and thorough application of these principles would be beneficial and would offer no danger, because the powers of every individual would be limited by the exercise of the equal rights of all others. He further indicated (following H. Spencer) the difference which exists between the encroachment on somebody's rights and resistance to such an encroachment; between domination and defence: the former being equally condemnable, whether it be encroachment of a criminal upon an individual, or the encroachment of one upon all others, or of all others upon one; while resistance to encroachment is defensible and necessary. For their self-defence, both the citizen and the group have the right to any violence, including capital punishment. Violence is also justified for enforcing the duty of keeping an agreement. Tucker thus follows Spencer, and, like him, opens (in the present writer's opinion) the way for reconstituting under the heading of "defence" all the functions of the state. His criticism of the present state is very searching, and his defence of the rights of the individual very powerful. As regards his economical views B. R. Tucker follows Proudhon.

The Individualist Anarchism of the American Proudhonians finds, however, but little sympathy amongst the working masses. Those who profess it—they are chiefly "intellectuals"—soon realize that the *individualization* they so highly praise is not attainable by individual efforts, and either abandon the ranks of the Anarchists, and are driven into the Liberal individualism of the classical economists, or they retire into a sort of Epicurean a-moralism, or super-man-theory, similar to that of Stirner and Nietzsche. The great bulk of the Anarchist working men prefer the Anarchist-Communist ideas which have gradually evolved out of the Anarchist Collectivism of the International Working Men's Association. To this direction belong—to name only the better

of a certain class of murderous outrages, and that the same looseness of definition often applies to the professions of "Anarchism" made by such persons. As stated above, a philosophic Anarchist would repudiate the connexion. And the general public view which regards Anarchist doctrines indiscriminately is to that extent a confusion of terms. But the following *résumé* of the chief modern so-called "Anarchist" incidents is appended for convenience in stating the facts under the heading where a reader would expect to find them.

Between 1882 and 1886, in France, Prince Kropotkin, Louise Michel and others were imprisoned. In England, Most, one of the German Anarchist leaders, founded *Die Freiheit*, and, for defending in it the assassination of Alexander II. at St Petersburg, was sentenced to eighteen months' imprisonment with hard labour. After this he moved to the United States, and re-established his paper there in New York, in May 1886. During this period there were several Anarchist congresses in the United States. In one at Albany, in 1878, the revolutionary element, led by Justus Schwab, broke away from the others; at Allegheny City, in 1879, again there was a rupture between the peaceful and the revolutionary sections. *The Voice of the People* at St Louis, the *Arbeiter Zeitung* at Chicago, and the *Anarchist* at Boston, were the organs of the revolutionary element. In 1883, at Pittsburg, a congress of twenty-eight delegates, representing twenty-two towns, drew up an address to the working men of America. The programme it proposed was as follows:—

First, Destruction of the existing class rule by all means, *i.e.* energetic, relentless, revolutionary and international action.

Second, Establishment of a free society, based upon co-operative organization of production.

Third, Free exchange of equivalent products by and between the productive organizations, without commerce and profit-mongery.

Fourth, Organization of education on a secular, scientific and equal basis for both sexes.

Fifth, Equal rights for all, without distinction of sex or race.

Sixth, Regulation of all public affairs by free contracts between the autonomous (independent) communes and associations, resting on a federalistic basis.

This, together with an appeal to the working men to organize, was published in Chicago, November 1883, by a local committee of four, representing French, Bohemian, German and English sections, the head of the last being August Spies, who was hanged in 1887 for participation in the Haymarket affair in Chicago, 4th May 1886. This affair was the culmination of a series of encounters between the Chicago working men and the police, which had covered several years. The meeting of 4th May was called by Spies and others to protest against the action of the police, by whom several working men had been killed in collisions growing out of the efforts to introduce the eight hours' day. The mayor of the city attended the meeting, but, finding it peaceful, went home. The meeting was subsequently entered by the police and commanded to disperse. A bomb was thrown, several policemen being killed and a number wounded. For this crime eight men were tried in one panel and condemned, seven—Spies, Parsons, Engel, Fischer, Fielden, Schwab, and Ling—to death, and one—Neebe—to imprisonment for fifteen years. The sentences on Fielden and Schwab were commuted by Governor Oglesby to imprisonment for life, on the recommendation of the presiding judge and the prosecuting attorney. Ling committed suicide in jail, and Spies, Parsons, Engel and Fischer were hanged, 11th November 1887. On 26th June 1893 an unconditional pardon was granted the survivors, Fielden, Schwab and Neebe, by Governor Altgeld. The reasons for the pardon were stated by the governor to be that, upon an examination of the records he found that the jury had not been drawn in the usual manner, but by a special bailiff, who made his own selection and had summoned a "prejudiced jury"; that the "state had never discovered who it was that threw the bomb which killed the policemen, and the evidence does not show any connexion whatever between the defendants and the man who did throw it," . . . or that this man "ever heard or read a word coming from the defendants, and consequently fails to show that he acted on any advice given by them." Judge Gary, the judge at the trial, published a defence of its procedure in the *Century Magazine*, vol. xxiii p. 803.

A number of outbreaks in later years were attributed to the propaganda of reform by revolution, like those in Spain and France in 1892, in which Ravachol was a prominent figure. In 1893 a bomb was exploded in the French Chamber of Deputies by Vaillant. The spirit of these men is well illustrated by the reply which Vaillant made to the judge who reproached him for endangering the lives of innocent men and women: "There can be no innocent bourgeois." In 1894 there was an explosion in a Parisian café, and another in a theatre at Barcelona. For the latter outrage six men were executed. President Carnot of the French Republic was assassinated by an Italian at Lyons in the same year. The empress Elizabeth of Austria was assassinated in September 1898. These events, all associated by the public with "Anarchism," led to the passage by the United States Congress of a law, in 1894, to keep out foreign Anarchists, and to deport any who might be found in the country, and also to the assemblage of an international conference in Rome, in 1898, to agree upon some plan for dealing with these revolutionists. It was proposed that their offences should no longer be classed as political, but as common-law crimes, and be made subject to extradition. The suppression of the revolutionary press and the international co-operation of the police were also suggested. The results of the conference were not, however, published; and the question of how to deal with the campaign against society fell for a while into abeyance. The attempt made by the youth Sipido on the (then) prince of Wales at Brussels in 1900 recalled attention to the subject. The acquittal of Sipido, and the failure of the Belgian government to see that justice was done in an affair of such international importance, excited considerable feeling in England, and was the occasion of a strongly-worded note from the British to the Belgian government. The murder of King Humbert of Italy in July 1900 renewed the outcry against Italian Anarchists. Even greater horror and indignation were excited by the assassination of President McKinley by Czolgoscz on the 6th of September 1901, at Buffalo, U.S.A. And a particularly dastardly attempt was made to blow up the young king and queen of Spain on their wedding-day in 1906. (Ed. *E.B.*)

known exponents of Anarchism—Elisée Reclus, Jean Grave, Sebastien Faure, Emile Pouget in France; Enrico Malatesta and Covelli in Italy; R. Mella, A. Lorenzo, and the mostly unknown authors of many excellent manifestos in Spain; John Most amongst the Germans; Spies, Parsons and their followers in the United States, and so on; while Domela Nieuwenhuis occupies an intermediate position in Holland. The chief Anarchist papers which have been published since 1880 also belong to that direction; while a number of Anarchists of this direction have joined the so-called Syndicalist movement—the French name for the non-political Labour movement, devoted to direct struggle with capitalism, which has lately become so prominent in Europe.

As one of the Anarchist-Communist direction, the present writer for many years endeavoured to develop the following ideas: to show the intimate, logical connexion which exists between the modern philosophy of natural sciences and Anarchism; to put Anarchism on a scientific basis by the study of the tendencies that are apparent now in society and may indicate its further evolution; and to work out the basis of Anarchist ethics. As regards the substance of Anarchism itself, it was Kropotkin's aim to prove that Communism—at least partial—has more chances of being established than Collectivism, especially in communes taking the lead, and that Free, or Anarchist-Communism is the only form of Communism that has any chance of being accepted in civilized societies; Communism and Anarchy are therefore two terms of evolution which complete each other, the one rendering the other possible and acceptable. He has tried, moreover, to indicate how, during a revolutionary period, a large city—if its inhabitants have accepted the idea—could organize itself on the lines of Free Communism; the city guaranteeing to every inhabitant dwelling, food and clothing to an extent corresponding to the comfort now available to the middle classes only, in exchange for a half-day's, or a five-hours' work; and how all those things which would be considered as luxuries might be obtained by every one if he joins for the other half of the day all sorts of free associations pursuing all possible aims—educational, literary, scientific, artistic, sports and so on. In order to prove the first of these assertions he has analysed the possibilities of agriculture and industrial work, both being combined with brain work. And in order to elucidate the main factors of human evolution, he has analysed the part played in history by the popular constructive agencies of mutual aid and the historical rôle of the state.

Without naming himself an Anarchist, Leo Tolstoy, like his predecessors in the popular religious movements of the 15th and 16th centuries, Chojecki, Denk and many others, took the Anarchist position as regards the state and property rights, deducing his conclusions from the general spirit of the teachings of the Christ and from the necessary dictates of reason. With all the might of his talent he made (especially in *The Kingdom of God in Yourselves*) a powerful criticism of the church, the state and law altogether, and especially of the present property laws. He describes the state as the domination of the wicked ones, supported by brutal force. Robbers, he says, are far less dangerous than a well-organized government. He makes a searching criticism of the prejudices which are current now concerning the benefits conferred upon men by the church, the state and the existing distribution of property, and from the teachings of the Christ he deduces the rule of non-resistance and the absolute condemnation of all wars. His religious arguments are, however, so well combined with arguments borrowed from a dispassionate observation of the present evils, that the anarchist portions of his works appeal to the religious and the non-religious reader alike.

It would be impossible to represent here, in a short sketch, the penetration, on the one hand, of Anarchist ideas into modern literature, and the influence, on the other hand, which the libertarian ideas of the best comtemporary writers have exercised upon the development of Anarchism. One ought to consult the ten big volumes of the *Supplement littéraire* to the paper *La révolte* and later the *Temps nouveaux*, which contain reproductions from the works of hundreds of modern authors expressing Anarchist ideas, in order to realize how closely Anarchism is connected with all the intellectual movement of our own times. J. S. Mill's *Liberty*, Spencer's *Individual versus The State*, Marc Guyau's *Morality without Obligation or Sanction*, and Fouillée's *La morale, l'art et la religion*, the works of Multatuli (E. Douwes Dekker), Richard Wagner's *Art and Revolution*, the works of Nietzsche, Emerson, W. Lloyd Garrison, Thoreau, Alexander Herzen, Edward Carpenter and so on; and in the domain of fiction, the dramas of Ibsen, the poetry of Walt Whitman, Tolstoy's *War and Peace*, Zola's *Paris* and *Le travail*, the latest works of Merezhkovsky, and an infinity of works of less known authors,—are full of ideas which show how closely Anarchism is interwoven with the work that is going on in modern thought in the same direction of enfranchisement of man from the bonds of the state as well as from those of capitalism.

Bibliography.—William Godwin, *An Enquiry concerning Political Justice and its Influence on General Virtue and Happiness*, 1st edition. 2 vols. (1793). Mutualism:—John Gray, *A Lecture on Human Happiness* (1825); *The Social System, a Treatise on the Principles of Exchange* (1831); Proudhon, *Qu'est-ce que la propriété?* 1er mémoire (1840) (Eng. trans. by B. Tucker); *Idée générale sur la révolution* (1851); *Confession d'un révolutionnaire* (1849); *Contradictions économiques* (1846); Josiah Warren, *Practicable Details of Equitable Commerce* (New York, 1852); *True Civilization* (Boston, 1863); Stephen Pearl Andrews, *The Science of Society* (1851); *Cost, the Limit of Price*; Moses Hess, "Sozialismus und Communismus. Philosophie der That" (on Herwegh's *Ein-und-Zwanzig Bogen aus der Schweiz*, 1843); Karl Grün, *Die soziale Bewegung in Frankreich und Belgien* (1845); W. Marr, *Das junge Deutschland* (1845). Anarchist Individualism:—Max Stirner (J. K. Schmidt), *Der Einzige und sein Eigenthum* (1845) (Fr. trans., 1900); J. H. Mackay, *Max Stirner, sein Leben und sein Werk* (1898); V. Basch, *L'Individualisme anarchists* (1904). Transition period:—J. Déjacque, *Les Lazaréennes* (1851); *Le Libertaire*, weekly, New York, 1858–1861, containing *L'Humanisphère* (re-edited at Brussels, *Bibl. des temps nouveaux*). Anarchist Collectivism of the International:—The papers *Egalité*, *Progrès* (Locle), *Solidarité*; James Guillaume, *Idées sur l'organisation sociale* (1876); *Bulletin de la fédération jurassienne* (1872–1879); A. Schwitzguébel, *Œuvres*; Paul Brousse, *Le Suffrage universel* (1874); *L'Etat à Versailles et dans l'association internationale* (1874); newspaper *L'Avant-garde* (suppressed 1878); Arthur Arnould, *L'État et la révolution* (1877); *Histoire populaire de la commune* (3 vols., 1878); César de Paepe, in *Rive gauche* and *La liberté* (1867–1883). Many others are in the *Comptes rendus* of the congresses of the International Working Men's Association. All these ideas, conceived as a whole, may be found in Bakunin's *Fédéralisme, socialisme et anti-théologisme*, published first in portions under the names of *L'Empire knouto-germanique*, *Dieu et l'état*, *The State-Idea and Anarchy* (Russian), and only now reproduced in full in his *Œuvres* (Paris, 1905 and seq.); *Sozialpolitischer Briefwechsel* (1894); *Statuts de l'alliance internationale* (1868); *Proposition motivée au comité central de la ligue de la paix et de la liberté* (1868). The famous *Revolutionary Catechism* attributed to Bakunin, was not his work. *Biographie von Michael Bakunin*, by Dr M. Nettlan, 3 large vols., contains masses of letters, &c. (hectographed in 50 copies; in all chief libraries).

Modern Anarchism.—The best sources are the collections of newspapers which, although compelled sometimes to change their names, were run for considerable lengths of time and are appearing still: J. Most, *Freiheit*, since 1878; *Le Révolté—La Révolte—Temps nouveaux*, since 1878; Domela Nieuwenhuis, *Recht voor Allen*, since 1878; *Freedom*, since 1886; *Le Libertaire*; Pouget's *Père Pèsuard*; *Réveil-Risveglio*; see Nettlan's *Bibliographie*. These papers and a great number of pamphlets are indispensable for those who intend to know anarchism, as the works published in book form are not numerous. Of the latter only a few will be mentioned:—Elisée Reclus, *Evolution and Revolution*, many editions in all languages; "Anarchy by an Anarchist," in *Contemp. Review* (May, 1884); *The Ideal and Youth* (1895); Jean Grave, *La Société au lendemain de la révolution*, many editions since 1882; *La Société mourante et l'anarchie* (1893); *L'Autonomie selon la science* (1882); *La Société future* (1895); *L'Anarchie, son but, ses moyens*; Sébastien Faure, *La Douleur universelle* (1892); A. Hamon, *Les Hommes et les théories de l'anarchie* (1893); *Psychologie de l'anarchiste-socialiste* (1895); Enrico Malatesta, *Fra Contadini*, transl. in all languages—Eng. trans. *A Talk about Anarchist Communism*, in "Freedom Pamphlets" (1891); *Anarchy* (do. 1892); *Au café*; and many other Italian pamphlets, as also several papers started at various times in Italy under different names: F. S. Merlino, *Socialismo o Monopolismo?* (1887). Pamphlets, reviews and papers by P. Gori, L. Molinari, E. Covelli, &c. The manifestos of the Spanish Federations contain excellent expositions of Anarchism; cf. also many books, pamphlets and papers by J. Lluñas y Pujals, J. Serrano y Oteiza, Ricardo Mella, A. Lorenzo, &c. John Most, the paper

Freiheit, of which a few articles only have been reprinted as pamphlets in the *Internationale Bibliothek* ("The Deistic Pestilence," "The Beast of Property" in English); *Memoiren, 3 fascicules*. F. Domela Nieuwenhuis, *Le Socialisme en danger* (1895); C. Malato, *Philosophie de l'anarchie* (1890); Charlotte Wilson, *Anarchism* ("Fabian Tracts," 4); *Anarchism and Violence* ("Freedom Pamphlets"); Albert Parsons, *Anarchism, its Philosophy and Scientific Basis* (Chicago, 1888); *The Chicago Martyrs: Speeches in Court*; P. Kropotkin, *Paroles d'un révolté* (1884); *Conquest of Bread* (1906) (1st French ed. in 1890); *Anarchist Morality*; *Anarchy, its Philosophy and Ideals*; *Anarchist Communism*; *The State, its Historic Rôle*; and other "Freedom Pamphlets"; *Fields, Factories and Workshops* (5th popular edition, 1807); *Mutual Aid: a Factor of Evolution* (1904). Modern Individualist Anarchists:—B. Tucker, the paper *Liberty* (1892 sqq.); *Instead of a Book, by one too busy to write one* (Boston, 1893); Dyer Lum, *Social Problems* (1883); Lysander Spooner, *Natural Law, or the Science of Justice* (Boston, 1891). Religious Anarchists:—Leo Tolstoy, *The Kingdom of God in Yourselves*; *My Faith*; *Confession*; *&c.*

The best work on Anarchism, and in fact the only one written with full knowledge of the Anarchist literature, and quite fairly, is by a German judge Dr Paul Eltzbacher, *Anarchismus* (transl. in all chief European languages, except English). Prof. Adler's article "Anarchismus" in Conrad's *Handwörterbuch der Staatswissenschaften*, vol. i., is less accurate for modern times than for the earlier periods. G. v. Zenker, *Der Anarchismus* (1895); and Prof. Edmund Bernatzik, "Der Anarchismus," in Schmoller's *Jahrbuch*, may also be mentioned—the remainder being written with absolute want of knowledge of the subject.

A most important work is the reasoned *Bibliographie de l'anarchie*, by Dr M. Nettlan (Brussels, 1897, 8vo, 294 ff.), written with a full knowledge of the subject and its immense literature. (P. A. K.)

ANASTASIUS, the name of four popes.

ANASTASIUS I., pope from 399–401. He it was who condemned the writings of Origen shortly after their translation into Latin.

ANASTASIUS II., pope from 496–498. He lived in the time of the schism of Acacius of Constantinople. He showed some tendency towards conciliation, and thus brought upon himself the lively reproaches of the author of the *Liber pontificalis*. On the strength of this tradition, Dante has placed this pope in hell.

ANASTASIUS III., pope from 911–913, was a Roman by birth. Practically nothing is recorded of him, his pontificate falling in the period when Rome was in the power of the Roman nobles.

ANASTASIUS IV. was pope from 1153 to 1154. He was a Roman named Conrad, son of Benedictus, and at the time of his election, on the 9th of July 1153, was cardinal bishop of Sabina. He had taken part in the double election of 1130, had been one of the most determined opponents of Anacletus II. and, when Innocent II. fled to France, had been left behind as his vicar in Italy. During his short pontificate, however, he played the part of a peacemaker; he came to terms with the emperor Frederick I. in the vexed question of the appointment to the see of Magdeburg and closed the long quarrel, which had raged through four pontificates, about the appointment of William Fitzherbert (d. 1154)—commonly known as St William of York—to the see of York, by sending him the pallium, in spite of the continued opposition of the powerful Cistercian order. Anastasius died on the 3rd of December 1154, and was succeeded by Cardinal Nicholas of Albano as Adrian IV.

ANASTASIUS I. (*c.* 430–518), Roman emperor, was born at Dyrrhachium not later than A.D. 430. At the time of the death of Zeno (491), Anastasius, a palace official (*silentiarius*), held a very high character, and was raised to the throne of the Roman empire of the East, through the choice of Ariadne, Zeno's widow, who married him shortly after his accession. His reign, though afterwards disturbed by foreign and intestine wars and religious distractions, commenced auspiciously. He gained the popular favour by a judicious remission of taxation, and displayed great vigour and energy in administering the affairs of the empire. The principal wars in which Anastasius was engaged were those known as the Isaurian and the Persian. The former (492–496) was stirred up by the supporters of Longinus, the brother of Zeno. The victory of Cotyaeum in 493 "broke the back" of the revolt, but a guerilla warfare continued in the Isaurian mountains for some years longer. In the war with Persia (502–505), Theodosiopolis and Amida were captured by the enemy, but the Persian provinces also suffered severely and the Romans recovered Amida. Both adversaries were exhausted when peace was made (506) on the basis of *status quo*. Anastasius afterwards built the strong fortress of Daras to hold Nisibis in check. The Balkan provinces were devastated by invasions of Slavs and Bulgarians; to protect Constantinople and its vicinity against them he built the "Anastasian wall," extending from the Propontis to the Euxine. The emperor was a convinced Monophysite, but his ecclesiastical policy was moderate; he endeavoured to maintain the principle of the *Henotikon* of Zeno and the peace of the church. It was the uncompromising attitude of the orthodox extremists, and the rebellious demonstrations of the Byzantine populace, that drove him in 512 to abandon this policy and adopt a monophysitic programme. His consequent unpopularity in the European provinces was utilized by an ambitious man, named Vitalian, to organize a dangerous rebellion, in which he was assisted by a horde of "Huns" (514–515); it was finally suppressed by a naval victory won by the general Marinus. The financial policy of Anastasius was so prudent and economical that it gained him a reputation for avarice and contributed to his unpopularity. He died in 518.

AUTHORITIES.—Sources: Joshua the Stylite, *Chronicle*, ed. Wright, with English translation, Cambridge, 1882; Marcellinus, *Chronicle*; Zachariah of Mytilene, *Chronicle* (Eng. trans. by Hamilton and Brooks, London, 1899); Evagrius, *Ecclesiastical History*; John Lydus, *De Magistratibus*; John Malalas, *Chronicle*. Modern works: Gibbon, *Decline and Fall*, vol. iv. (ed. Bury); Bury, *Later Roman Empire*, vol. i.

ANASTASIUS II. (d. 721), Roman emperor in the East, whose original name was Artemius, was raised to the throne of Constantinople by the voice of the senate and people in A.D. 713, on the deposition of Philippicus, whom he had served in the capacity of secretary. The empire was threatened by the Saracens both by land and sea, and Anastasius sent an army under Leo the Isaurian, afterwards emperor, to defend Syria; adopted wise and resolute measures for the defence of his capital; attempted to reorganize the discipline of the army; and equipped and despatched to Rhodes a formidable naval force, with orders not only to resist the approach of the enemy, but to destroy their naval stores. The troops of the Opsikian province, resenting the emperor's strict measures, mutinied, slew the admiral, and proclaimed Theodosius, a person of low extraction, emperor. After a six months' siege, Constantinople was taken by Theodosius; and Anastasius, who had fled to Nicaea, was compelled to submit to the new emperor, and, retiring to Thessalonica, became a monk (716). In 721 he headed a revolt against Leo, who had succeeded Theodosius, and receiving a considerable amount of support, laid siege to Constantinople; but the enterprise failed, and Anastasius, falling into Leo's hands, was put to death by his orders.

AUTHORITIES.—Sources: Theophanes, *Chronicle*; Nicephorus Patriarches, *Breviarium*. Modern works: Gibbon, *Decline and Fall*, vol. v. (ed. Bury); Bury, *Later Roman Empire*, vol. ii.

ANASTOMOSIS (a Greek word in which the second *o* is long, from ἀναστομοῦν, to furnish with a mouth or outlet), the intercommunication between two vessels; a word used in vegetable and animal anatomy for the communication between channels (arteries and veins) containing fluid, and also for the crossing between the veins or branches of leaves, trees, insect-wings or river-connexions, and by analogy in art-design.

ANATASE, one of the three mineral forms of titanium dioxide. It is always found as small, isolated and sharply developed crystals, and like rutile, a more commonly occurring modification of titanium dioxide, it crystallizes in the tetragonal system; but, although the degree of symmetry is the same for both, there is no relation between the interfacial angles of the two minerals, except, of course, in the prism-zone of 45° and 90°. The common pyramid {111} (fig. 1) of anatase,[1] parallel to the faces of which there are perfect cleavages, has an angle over the polar edge of 82° 9′, the corresponding angle (111):($\bar{1}$11) of rutile being 56° 52½′. It was on account of this steeper pyramid of anatase that the mineral was named, by R. J. Haüy in 1801, from the Gr. ἀνάτασις, "extension," the vertical axis of the crystals being longer than in rutile. There are also important differences between the physical characters of anatase and rutile; the former is not quite so hard (H=5½-6) or dense (sp. gr.=3·9); it is optically negative, rutile being positive; and its lustre is even more strongly adamantine or metallic-adamantine than that of rutile.

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[1] For the notation see CRYSTALLOGRAPHY.

Two types or habits of anatase crystals may be distinguished. The commoner occurs as simple acute double pyramids {111} (fig. 1) with an indigo-blue to black colour and steely lustre. Crystals of this kind are abundant at Le Bourg d'Oisans in Dauphiné, where they are associated with rock-crystal, felspar and axinite in crevices in granite and mica-schist. Similar crystals, but of microscopic size, are widely distributed in sedimentary rocks, such as sandstones, clays and slates, from which they may be separated by washing away the lighter constituents of the powdered rock. Crystals of the second type have numerous pyramidal faces developed, and they are usually flatter or sometimes prismatic in habit (fig. 2); the colour is honey-yellow to brown. Such crystals closely resemble xenotime in appearance and, indeed, were for a long time supposed to belong to this species, the special name wiserine being applied to them. They occur attached to the walls of crevices in the gneisses of the Alps, the Binnenthal near Brieg in canton Valais, Switzerland, being a well-known locality.

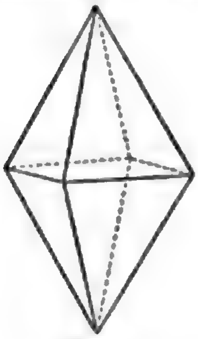
FIG. 1.

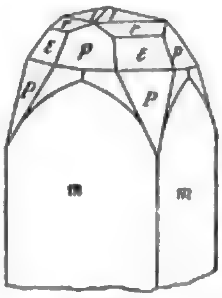

FIG. 2.

When strongly heated, anatase is converted into rutile, changing in specific gravity to 4·1; naturally occurring pseudomorphs of rutile after anatase are also known. Crystals of anatase have been artificially prepared by several methods; for instance, by the interaction of steam and titanium chloride or fluoride.

Another name commonly in use for this mineral is octahedrite, a name which, indeed, is earlier than anatase, and given because of the common (acute) octahedral habit of the crystals. Other names, now obsolete, are oisanite and dauphinite, from the well-known French locality. (L. J. S.)

ANATHEMA (from Gr. *ἀνατιθέναι*, to lift up), literally an offering, a thing set aside. The classical Greek form *ἀνάθημα* (Lat. *anathēma*) was the technical term for a gift (cf. *donarium*, *oblatio*) made to a god either in gratitude or with a view to propitiation. Thus at Athens the Thesmothetae (perhaps all the archons) made a vow that, should they break any law, they would dedicate a life-size gilt statue in the temple at Delphi. Similarly, of spoils taken in war, a part, generally a tenth, was dedicated to the god of the city (*e.g.* to Athena); to this class probably belong the trophies erected by the victors on the field of battle; sometimes a captured ship was placed upon a hill as an offering to Poseidon (Neptune). Persons who had recovered from an illness offered *anathemata* in the temples of Asclepius (Aesculapius); those who had escaped from shipwreck offered their clothes, or, if these had been lost, a lock of hair, to Neptune (Hor. *Odes*, i. 5. 13; Virg. *Aeneid*, xii. 768). The latter offering was very commonly made by young men and girls, especially young brides. Works of art of all kinds and the implements of a craftsman giving up his work were likewise dedicated. Such presents were far more common, as also more valuable, among the Greeks than among the Romans. Similar practices were prevalent, to an extent hardly realized, among the Christians up to the middle ages and even later. Just as the ancients hung their offerings on trees, temple columns and the images of the gods, so offerings were made to the Cross, to the Virgin Mary and on altars generally.

In the form *anathĕma*, the word is used in the Septuagint, the New Testament and ecclesiastical writers as the equivalent of the Hebrew *ḥerem*, which is commonly translated "accursed thing" (A.V.) or "devoted thing" (R.V.; cf. the Roman *devotio*). In Hebrew the root *ḥ-r-m* means to "set apart," "devote to Yahweh," for destruction; but in Arabic it means simply to separate or seclude (cf. "harem"). The idea of destruction or perdition is thus a secondary meaning of the word, which gradually lost its primary sense of consecration. In the New Testament, though it is used in the sense of "offering" (Luke xxi. 5), it generally signifies "separated" from the church, *i.e.* "accursed" (cf. Gal. i. 8 ff.; 1 Cor. xvi. 22), and it became the regular formula of excommunication from the time of the council of Chalcedon in 451, especially against heretics, *e.g.* in the canons of the council of Trent and those of the Vatican council of 1870. See EXCOMMUNICATION; PENANCE. The expression *maranatha* ("the Lord cometh"), which follows *anathema* in 1 Cor. xvi. 22, is often erroneously quoted as though it were an amplification of the curse.

ANATOLI, JACOB (*c.* 1194–1256), Hebrew translator from the Arabic. He was invited to Naples by the enlightened ruler Frederick II., and under this royal patronage and in association with Michael Scot, made Arabic learning accessible to Western readers. Among his most important services were translations of works by Averroes.

ANATOLIA (Gr. *ἀνατολή*, sunrise, *i.e.* eastern land), in ancient geography, the country east of the Aegean, *i.e.* Asia Minor. It was the name of one of the three themes (provinces) into which Phrygia was divided in the military reorganization of the East Roman empire. It is now used (by the Turks in the form (*Anadōli*) to denote a division of the Turkish empire, practically coincident with Asia Minor (*q.v.*).

ANATOMY (Gr. *ἀνατομή*, from *ἀνα-τέμνειν*, to cut up), literally dissection or cutting asunder, a term always used to denote the study of the structure of living things; thus there is *animal anatomy* (zootomy) and *vegetable anatomy* (phytotomy). Animal anatomy may include the study of the structure of different animals, when it is called *comparative anatomy* or *animal morphology*, or it may be limited to one animal only, in which case it is spoken of as *special anatomy*. From a utilitarian point of view the study of Man is the most important division of special anatomy, and this *human anatomy* may be approached from different points of view. From that of the medical man it consists of a knowledge of the exact form, position, size and relationship of the various structures of the human body in health, and to this study the term *descriptive* or *topographical human anatomy* is given, though it is often, less happily, spoken of as *Anthropotomy*. An accurate knowledge of all the details of the human body takes years of patient observation to gain and is possessed by only a few. So intricate is man's body that only a small number of professional human anatomists are complete masters of all its details, and most of them specialize on certain parts, such as the brain, viscera, &c.; contenting themselves with a good working knowledge of the rest. Topographical anatomy must be learned by each person for himself by the repeated dissection and inspection of the dead human body. It is no more a science than a pilot's knowledge is, and, like that knowledge, must be exact and available in moments of emergency.

From the morphological point of view, however, human anatomy is a scientific and fascinating study, having for its object the discovery of the causes which have brought about the existing structure of Man, and needing a knowledge of the allied sciences of embryology or ontogeny, phylogeny and histology.

Pathological or morbid anatomy is the study of diseased organs, while sections of normal anatomy, applied to various purposes, receive special names such as medical, surgical, gynaecological, artistic and superficial anatomy. The comparison of the anatomy of different races of mankind is part of the science of physical anthropology or anthropological anatomy. In the present edition of this work the subject of anatomy is treated systematically rather than topographically. Each anatomical article contains first a description of the structures of an organ or system (such as nerves, arteries, heart, &c.), as it is found in Man; and this is followed by an account of the development or embryology and comparative anatomy or morphology, as far as vertebrate animals are concerned; but only those parts of the lower animals which are of interest in explaining Man's structure are here dealt with. The articles have a twofold purpose; first, to give enough details of man's structure to make the articles on physiology, surgery, medicine and pathology intelligible; and, secondly, to give the non-expert inquirer, or the worker in some other branch of science, the chief theories on which the modern scientific groundwork of anatomy is built.

The following separate anatomical articles will be found under their own headings:—

- Alimentary canal.
- Arteries.
- Brain.
- Coelom and serous membranes.
- Connective tissues.
- Diaphragm.
- Ductless glands.
- Ear.
- Epithelial, endothelial and glandular tissues.
- Eye.
- Heart.
- Joints.
- Liver.
- Lymphatic system.
- Mammary gland.
- Mouth and salivary glands.
- Muscular system.
- Nervous system.
- Nerve.
- Olfactory system.
- Pharynx.
- Pancreas.
- Placenta.
- Reproductive system.
- Respiratory system.
- Scalp.
- Skeleton.
- Skin and Exoskeleton.
- Skull.
- Spinal cord.
- Teeth.
- Tongue.
- Urinary system.
- Vascular system.
- Veins.

History of Anatomy[1]

In tracing the history of the origin of anatomy, it may be justly said that more learning than judgment has been displayed. Some writers claim for it the highest antiquity, and pretend to find its first rudiments alternately in the animal sacrifices of the shepherd kings, the Jews and other ancient nations, and in the art of embalming as practised by the Egyptian priests.[2] Even the descriptions of wounds in the *Iliad* have been supposed adequate to prove that in the time of Homer mankind had distinct notions of the structure of the human body. Of the first it may be said that the rude information obtained by the slaughter of animals for sacrifice does not imply profound anatomical knowledge; and those who adduce the second as evidence are deceived by the language of the poet of the Trojan War, which, distinguishing certain parts by their ordinary Greek epithets, as afterwards used by Hippocrates, Galen and all anatomists, has been rather too easily supposed to prove that the poet had studied systematically the structure of the human frame.

With not much greater justice has the cultivation of anatomical knowledge been ascribed to Hippocrates, who, because he is universally allowed to be the father of medicine, has also been thought to be the creator of the science of anatomy. Of the seven individuals of the family of the Heracleidae who bore this celebrated name, the second, who was the son of Heraclides and Phenarita, and grandson of the first Hippocrates, was indeed distinguished as a physician of great observation and experience, and the first who appreciated the value of studying accurately the phenomena, effects and terminations of disease. It does not appear, however, notwithstanding the vague and general panegyrics of J. Riolan, Bartholin, D. le Clerc, and A. Portal, that the anatomical knowledge of this illustrious person was either accurate or profound. Of the works ascribed to Hippocrates, five only are genuine. Most of them were written either by subsequent authors of the same name, or by one or other of the numerous impostors who took advantage of the zealous munificence of the Ptolemies, by fabricating works under that illustrious name. Of the few which are genuine, there is none expressly devoted to anatomy; and of his knowledge on this subject the only proofs are to be found in the exposition of his physiological opinions, and his medical or surgical instructions. From these it appears that Hippocrates had some accurate notions on osteology, but that of the structure of the human body in general his ideas were at once superficial and erroneous. In his book on injuries of the head, and in that on fractures, he shows that he knew the sutures of the cranium and the relative situation of the bones, and that he had some notion of the shape of the bones in general and of their mutual connexions. Of the muscles, of the soft parts in general, and of the internal organs, his ideas are confused, indistinct and erroneous. The term φλέψ he seems, in imitation of the colloquial Greek, to have used generally to signify a blood-vessel, without being aware of the distinction of vein and artery; and the term ἀρτηρία, or air-holder, is restricted to the windpipe. He appears to have been unaware of the existence of the nervous chords; and the term *nerve* is used by him, as by Grecian authors in general, to signify a *sinew* or *tendon*. On other points his views are so much combined with peculiar physiological doctrines, that it is impossible to assign them the character of anatomical facts; and even the works in which these doctrines are contained are with little probability to be ascribed to the second Hippocrates. If, however, we overlook this difficulty, and admit what is contained in the genuine Hippocratic writings to represent at least the sum of knowledge possessed by Hippocrates and his immediate descendants, we find that he represents the brain as a gland, from which exudes a viscid fluid; that the heart is muscular and of pyramidal shape, and has two ventricles separated by a partition, the fountains of life—and two auricles, receptacles of air; that the lungs consist of five ash-coloured lobes, the substance of which is cellular and spongy, naturally dry, but refreshed by the air; and that the kidneys are glands, but possess an attractive faculty, by virtue of which the moisture of the drink is separated and descends into the bladder. He distinguishes the bowels into colon and rectum (ὁ ἀρχός).

Hippocrates.

The knowledge possessed by the second Hippocrates was transmitted in various degrees of purity to the descendants and pupils, chiefly of the family of the Heracleidae, who succeeded him. Several of these, with feelings of grateful affection, appear to have studied to preserve the written memory of his instructions, and in this manner to have contributed to form part of that collection of treatises which have long been known to the learned world under the general name of the ***Hippocratic writings.*** Though composed, like the genuine remains of the physicians of Cos, in the Ionian dialect, all of them differ from these in being more diffuse in style, more elaborate in form, and in studying to invest their anatomical and medical matter with the fanciful ornaments of the Platonic philosophy. Hippocrates had the merit of early recognizing the value of facts apart from opinions, and of those facts especially which lead to general results; and in the few genuine writings which are now extant it is easy to perceive that he has recourse to the simplest language, expresses himself in terms which, though short and pithy, are always precise and perspicuous, and is averse to the introduction of philosophical dogmas. Of the greater part of the writings collected under his name, on the contrary the general character is verboseness, prolixity and a great tendency to speculative opinions. For these reasons, as well as for others derived from internal evidence, while the Aphorisms, the Epidemics and the works above mentioned, bear distinct marks of being the genuine remains of Hippocrates, it is impossible to regard the book *Περὶ φύσιος ἀνθρώπου* as entirely the composition of that physician; and it appears more reasonable to view it as the work of some one of the numerous disciples to whom the author had communicated the results of his observation, which they unwisely attempted to combine with the philosophy of the Platonic school and their own mysterious opinions.

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[1] The article in the 9th edition of this Encyclopaedia, dealing with the history of anatomy, and written by the late Dr Craigie of Edinburgh, has gained such a just reputation as the classical work on the subject in the English language that it is substantially reproduced. Here and there points of special or biographical interest are drawn attention to in the shape of footnotes, but any reader interested in the subject would do well to consult, with this article, the work of R. R. von Toply, *Studien zur Geschichte der Anatomie im Mittelalter* (Leipzig, 1898). In addition to this Professor A. Macalister has published a series of articles, under the head of "Archaeologia Anatomica," in the *Journal of Anatomy and Physiology.* These are written from a structural rather than a bibliographical point of view, and will be found under the following headings: "Atlas and Epistropheus," *J. Anat.* vol. xxxiii. p. 204; "Veins of Forearm," vol. xxxiii. p. 343; "Poupart's Ligament," vol. xxxiii. p. 493; "Tendo-Achillis," vol. xxxiii. p. 676; "Parotid," vol. xxxv. p. 117; "Trochanter," vol. xxxv. p. 269.

[2] The oldest anatomical treatise extant is an Egyptian papyrus probably written sixteen centuries before our era. It shows that the heart, vessels, liver, spleen, kidneys, ureters and bladder were recognized, and that the blood-vessels were known to come from the heart. Other vessels are described, some carrying air, some mucus, while two to the right ear are said to carry the breath of life, and two to the left ear the breath of death. See A. Macalister, "Archaeologia Anatomica," *J. Anat. and Phys.* vol. xxxii. p. 775. But see also the article Omen.

Polybus.

Among those who aimed at this distinction, the most fortunate in the preservation of his name is Polybus, the son-in-law of the physician of Cos. This person, who must not be confounded with the monarch of Corinth, immortalized by Sophocles in the tragic story of Oedipus, is represented as a recluse, severed from the world and its enjoyments, and devoting himself to the study of anatomy and physiology, and to the composition of works on these subjects. To him has been ascribed the whole of the book on the *Nature of the Child* and most of that *On Man*; both physiological treatises interspersed with anatomical sketches. His anatomical information, with which we are specially concerned, appears to have been rude and inaccurate, like that of his preceptor. He represents the large vessels of the body as consisting of four pairs; the first proceeding from the head by the back of the neck and spinal cord to the hips, lower extremities and outer ankle; the second, consisting of the jugular vessels (*αἱ σφαγίτιδες*), proceeding to the loins, thighs, hams and inner ankle; the third proceeding from the temples by the neck to the *scapula* and lungs, and thence by mutual intercrossings to the spleen and left kidney, and the liver and right kidney, and finally to the rectum; and the fourth from the fore-part of the neck to the upper extremities, the fore-part of the trunk, and the organs of generation.

This specimen of the anatomical knowledge of one of the most illustrious of the Hippocratic disciples differs not essentially from that of Syennesis, the physician of Cyprus, and Diogenes, the philosopher of Apollonia, two authors for the preservation of whose opinions we are indebted to Aristotle. They may be admitted as representing the state of anatomical knowledge among the most enlightened men at that time, and they only show how rude and erroneous were their ideas on the structure of the animal body. It may indeed, without injustice, be said that the anatomy of the Hippocratic school is not only erroneous, but fanciful and imaginary in often substituting mere supposition and assertion for what ought to be matter of fact. From this censure it is impossible to exempt even the name of Plato himself, for whom some notices in the *Timaeus* on the structure of the animal body, as taught by Hippocrates and Polybus, have procured a place in the history of the science.

Aristotle.

Amidst the general obscurity in which the early history of anatomy is involved, only two leading facts may be admitted with certainty. The first is, that previous to the time of Aristotle there was no accurate knowledge of anatomy; and the second, that all that was known was derived from the dissection of the lower animals only. By the appearance of Aristotle this species of knowledge, which was hitherto acquired in a desultory and irregular manner, began to be cultivated systematically and with a definite object; and among the services which the philosopher of Stagira rendered to mankind, one of the greatest and most substantial is, that he was the founder of Comparative Anatomy, and was the first to apply its facts to the elucidation of zoology. The works of this ardent and original naturalist show that his zootomical knowledge was extensive and often accurate; and from several of his descriptions it is impossible to doubt that they were derived from frequent personal dissection. Aristotle, who was born 384 years before the Christian era, or in the first year of the 99th Olympiad, was at the age of thirty-nine requested by Philip to undertake the education of his son Alexander. During this period it is said he composed several works on anatomy, which, however, are now lost. The military expedition of his royal pupil into Asia, by laying open the animal stores of that vast and little-known continent, furnished Aristotle with the means of extending his knowledge, not only of the animal tribes, but of their structure, and of communicating more accurate and distinct notions than were yet accessible to the world. A sum of 800 talents, and the concurrent aid of numerous intelligent assistants in Greece and Asia, were intended to facilitate his researches in composing a system of zoological knowledge; but it has been observed that the number of instances in which he was thus compelled to trust to the testimony of other observers led him to commit errors in description which personal observation might have enabled him to avoid.

The first three books of the *History of Animals*, a treatise consisting of ten books, and the four books on the *Parts of Animals*, constitute the great monument of the *Aristotelian Anatomy*. From these we find that Aristotle was the first who corrected the erroneous statements of Polybus, Syennesis and Diogenes regarding the blood-vessels, which they made, as we have seen, to arise from the head and brain. These he represents to be two in number, placed before the spinal column, the larger on the right, the smaller on the left, which, he also remarks, is by some called *aorta* (ἀορτή), the first time we observe that this epithet occurs in the history. Both he represents to arise from the heart, the larger from the largest upper cavity, the smaller or aorta from the middle cavity, but in a different manner and forming a narrower canal. He also distinguishes the thick, firm and more tendinous structure of the aorta from the thin and membranous structure of vein. In describing the distribution of the later, however, he confounds the *vena cava* and pulmonary artery, and, as might be expected, he confounds the ramifications of the former with those of the arterial tubes in general. While he represents the lung to be liberally supplied with blood, he describes the brain as an organ almost destitute of this fluid. His account of the distribution of the aorta is wonderfully correct. Though he does not notice the coeliac, and remarks that the aorta sends no direct branches to the liver and spleen, he had observed the mesenteric, the renal and the common iliac arteries. It is nevertheless singular that though he remarks particularly that the renal branches of the aorta go to the substance and not the *pelvis* (*κοιλία*) of the kidney, he appears to mistake the ureters for branches of the aorta. Of the nerves (*νευρά*) he appears to have the most confused notions. Making them arise from the heart, which he says has nerves (tendons) in its largest cavity, he represents the aorta to be a nervous or tendinous vein (*νευρώδης φλέψ*). By and by, afterwards saying that all the articulated bones are connected by nerves, he makes them the same as ligaments.

He distinguishes the windpipe or air-holder (*ἀρτηρία*) from the oesophagus, because it is placed before the latter, because food or drink passing into it causes distressing cough and suffocation, and because there is no passage from the lung to the stomach. He knew the situation and use of the epiglottis, seems to have had some indistinct notions of the larynx, represents the windpipe to be necessary to convey air to and from the lungs, and appears to have a tolerable understanding of the structure of the lungs. He repeatedly represents the heart, the shape and site of which he describes accurately, to be the origin of the blood-vessels, in opposition to those who made them descend from the head; yet, though he represents it as full of blood and the source and fountain of that fluid, and even speaks of the blood flowing from the heart to the veins, and thence to every part of the body, he says nothing of the circular motion of the blood. The diaphragm he distinguishes by the name *διάζωμα*, and *ὑπόζωμα*. With the liver and spleen, and the whole alimentary canal, he seems well acquainted. The several parts of the quadruple stomach of the ruminating animals are distinguished and named; and he even traces the relations between the teeth and the several forms of stomach, and the length or brevity, the simplicity or complication of the intestinal tube. Upon the same principle he distinguishes the *jejunum* (*ἡ νῆστις*), or the empty portion of the small intestines in animals (*τὸ ἔντερον λεπτόν*), the *caecum* (*τυφλόν τι καὶ ὀγκῶδες*), the colon (*τὸ κῶλον*), and the sigmoid flexure (στενώτερον καὶ εἰλιγμένον). The modern epithet of *rectum* is the literal translation of his description of the straight progress (εὐθὺ) of the bowel to the anus (πρωκτός). He knew the nasal cavities and the passage from the tympanal cavity of the ear to the palate, afterwards described by B. Eustachius. He distinguishes as "partes similares" those structures, such as bone, cartilage, vessels, sinews, blood, lymph, fat, flesh, which, not confined to one locality, but distributed throughout the body generally, we now term the tissues or textures, whilst he applies the term "partes dissimilares" to the regions of the head, neck, trunk and extremities.

Next to Aristotle occur the names of Diocles of Carystus and Praxagoras of Cos, the last of the family of the Asclepiadae. The latter is remarkable for being the first who distinguished the arteries from the veins, and the author of the opinion that the former were air-vessels.

Alexandrian school.

Erasistratus.

Hitherto anatomical inquiry was confined to the examination of the bodies of brute animals. We have, indeed, no testimony of the human body being submitted to examination previous to the time of Erasistratus and Herophilus; and it is vain to look for authentic facts on this point before the foundation of the Ptolemaic dynasty of sovereigns in Egypt. This event, which, as is generally known, succeeded the death of Alexander, 320 years before the Christian era, collected into one spot the scattered embers of literature and science, which were beginning to languish in Greece under a weak and distracted government and an unsettled state of society. The children of her divided states, whom domestic discord and the uncertainties of war rendered unhappy at home, wandered into Egypt, and found, under the fostering hand of the Alexandrian monarchs, the means of cultivating the sciences, and repaying with interest to the country of Thoth and Osiris the benefits which had been conferred on the infancy of Greece by Thales and Pythagoras. Alexandria became in this manner the repository of all the learning and knowledge of the civilized world; and while other nations were sinking under the effects of internal animosities and mutual dissensions, or ravaging the earth with the evils of war, the Egyptian Greeks kept alive the sacred flame of science, and preserved mankind from relapsing into their original barbarism. These happy effects are to be ascribed in an eminent degree to the enlightened government and liberal opinions of Ptolemy Soter, and his immediate successors Philadelphus and Euergetes. The two latter princes, whose authority was equalled only by the zeal with which they patronized science and its professors, were the first who enabled physicians to dissect the human body, and prevented the prejudices of ignorance and superstition from compromising the welfare of the human race. To this happy circumstance Herophilus and Erasistratus are indebted for the distinction of being known to posterity as the first anatomists who dissected and described the parts of the human body. Both these physicians flourished under Ptolemy Soter, and probably Ptolemy Philadelphus, and were indeed the principal supports of what has been named in medical history the Alexandrian School, to which their reputation seems to have attracted numerous pupils. But though the concurrent testimony of antiquity assigns to these physicians the merit of dissecting the humon body, time, which wages endless war with the vanity and ambition of man, has dealt hardly with the monuments of their labours. As the works of neither have been preserved, great uncertainty prevails as to the respective merits of these ancient anatomists; and all that is now known of their anatomical researches is obtained from the occasional notices of Galen, Oribasius and some other writers. From these it appears that Erasistratus recognized the valves of the heart, and distinguished them by the names of *tricuspid* and *sigmoid*; that he studied particularly the shape and structure of the brain, and its divisions, and cavities, and membranes, and likened the convolutions to the folds of the jejunum; that he first formed a distinct idea of the nature of the nerves, which he made issue from the brain; and that he discovered lymphatic vessels in the mesentery, first in brute animals, and afterwards, it is said, in man. He appears also to have distinguished the nerves into those of sensation and those of motion.

Herophilus.

Of Herophilus it is said that he had extensive anatomical knowledge, acquired by dissecting not only brutes but human bodies. Of these he probably dissected more than any of his predecessors or contemporaries. Devoted to the assiduous cultivation of anatomy, he appears to have studied with particular attention those parts which were least understood. He recognized the nature of the pulmonary artery, which he denominates *arterious vein*; he knew the vessels of the mesentery, and showed that they did not go to the *vena portae*, but to certain glandular bodies; and he first applied the name of *twelve-inch* or *duodenum* (δωδεκαδάκτυλος) to that part of the alimentary canal which is next to the stomach. Like Erasistratus, he appears to have studied carefully the configuration of the brain; and though, like him, he distinguishes the nerves into those of sensation and those of voluntary motion, he adds to them the ligaments and tendons. A tolerable description of the liver by this anatomist is preserved in the writings of Galen. He first applied the name of choroid or vascular membrane to that which is found in the cerebral ventricles; he knew the straight venous sinus which still bears his name; and to him the linear furrow at the bottom of the fourth ventricle is indebted for its name of *calamus scriptorius*.

The celebrity of these two great anatomists appears to have thrown into the shade for a long period the names of all other inquirers; for, among their numerous and rather celebrated successors in the Alexandrian school, it is impossible to recognize a name which is entitled to distinction in the history of anatomy. In a chasm so wide it is not uninteresting to find, in one who combined the characters of the greatest orator and philosopher of Rome, the most distinct traces of attention to anatomical knowledge. Cicero, in his treatise *De Natura Deorum*, in a short sketch of physiology, such as it was taught by Aristotle and his disciples, introduces various anatomical notices, from which the classical reader may form some idea of the state of anatomy at that time. The Roman orator appears to have formed a pretty distinct idea of the shape and connexions of the windpipe and lungs; and though he informs his readers that he knows the alimentary canal, he omits the details through motives of delicacy. In imitation of Aristotle, he talks of the blood being conveyed by the veins (*venae*), that is, blood-vessels, through the body at large; and, like Praxagoras, of the air inhaled by the lungs being conveyed through the arteries.

Aretaeus, though chiefly known as a medical author, makes some observations on the lung and the pleura, maintains the glandular structure of the kidney, and describes the anastomosis or communications of the capillary extremities of the *vena cava* with those of the portal vein.

Celsus.

The most valuable depository of the anatomical knowledge of these times is the work of Celsus, one of the most judicious medical authors of antiquity. He left, indeed, no express anatomical treatise; but from the introductions to the 4th and 8th books of his work, *De Medicina*, with incidental remarks in the 7th, the modern reader may form very just ideas of his anatomical attainments. From these it appears that Celsus was well acquainted with the windpipe and lungs and the heart; with the difference between the windpipe and oesophagus (*stomachus*), which leads to the stomach (*ventriculus*); and with the shape, situation and relations of the diaphragm. He enumerates also the principal facts relating to the situation of the liver, the spleen, the kidneys and the stomach. He appears, however, to have been unaware of the distinction of *duodenum* or twelve-inch bowel, already admitted by Herophilus, and represents the stomach as directly connected by means of the *pylorus* with the *jejunum* or upper part of the small intestine.

The 7th and 8th books, which are devoted to the consideration of those diseases which are treated by manual operation, contain sundry anatomical notices necessary to explain the nature of the diseases or mode of treatment. Of these, indeed, the merit is unequal; and it is not wonderful that the ignorance of the day prevented Celsus from understanding rightly the mechanism of the pathology of hernia. He appears, however, to have formed a tolerably just idea of the mode of cutting into the urinary bladder; and even his obstetrical instructions show that his knowledge of the uterus, vagina and appendages was not contemptible. It is in osteology, however, that the information of Celsus is chiefly conspicuous. He enumerates the sutures and several of the holes of the cranium, and describes at great length the superior and inferior maxillary bones and the teeth. With a good deal of care he describes the vertebrae and the ribs, and gives very briefly the situation and shape of the *scapula*, *humerus*, *radius* and *ulna*, and even of the carpal and metacarpal bones, and then of the different bones of the pelvis and lower extremities. He had formed a just idea of the articular connexions, and is desirous to impress the fact that none is formed without cartilage. From his mention of many minute holes (*multa et tenuia foramina*) in the recess of the nasal cavities, it is evident that he was acquainted with the perforated plate of the ethmoid bone; and from saying that the straight part of the auditory canal becomes flexuous and terminates in numerous minute cavities (*multa et tenuia foramina diducitur*), it is inferred by Portal that he knew the semicircular canals.

Though the writings of Celsus show that he cultivated anatomical knowledge, it does not appear that the science was much studied by the Romans; and there is reason to believe that, after the decay of the school of Alexandria, it languished in neglect and obscurity. It is at least certain that the appearance of Marinus during the reign of Nero is mentioned by authors as an era remarkable for anatomical inquiry, and that this person is distinguished by Galen as the restorer of a branch of knowledge which had been before him suffered to fall into undeserved neglect. From Galen also we learn that Marinus gave an accurate account of the muscles, that he studied particularly the glands, and that he discovered those of the mesentery. He fixed the number of nerves at seven; he observed the palatine nerves, which he rated as the fourth pair; and described as the fifth the auditory and facial, which he regards as one pair, and the hypoglossal as the sixth.

Rufus.

Not long after Marinus appeared Rufus (or Ruffus) of Ephesus, a Greek physician, who in the reign of Trajan was much attached to physiology, and as a means of cultivating this science studied Comparative Anatomy and made sundry experiments on living animals. Of the anatomical writings of this author there remains only a list or catalogue of names of different regions and parts of the animal body. He appears, however, to have directed attention particularly to the tortuous course of the uterine vessels, and to have recognized even at this early period the Fallopian tube. He distinguishes the nerves into those of sensation and those of motion. He knew the recurrent nerve. His name is further associated with the ancient experiment of compressing in the situation of the carotid arteries the pneumogastric nerve, and thereby inducing insensibility and loss of voice.

Galen.

Of all the authors of antiquity, however, none possesses so just a claim to the title of anatomist as Claudius Galenus, the celebrated physician of Pergamum, who was born about the 130th year of the Christian era, and lived under the reigns of Hadrian, the Antonines, Commodus and Severus. He was trained by his father Nicon (whose memory he embalms as an eminent mathematician, architect and astronomer) in all the learning of the day, and initiated particularly into the mysteries of the Aristotelian philosophy. In an order somewhat whimsical he afterwards studied philosophy successively in the schools of the Stoics, the Academics, the Peripatetics and the Epicureans. When he was seventeen years of age, his father, he informs us, was admonished by a dream to devote his son to the study of medicine; but it was fully two years after that Galen entered on this pursuit, under the auspices of an instructor whose name he has thought proper to conceal. Shortly after he betook himself to the study of anatomy under Satyrus, a pupil of Quintus, and of medicine under Stratonicus, a Hippocratic physician, and Aeschrion, an empiric. He had scarcely attained the age of twenty when he had occasion to deplore the loss of the first and most affectionate guide of his studies; and soon after he proceeded to Smyrna to obtain the anatomical instructions of Pelops, who, though mystified by some of the errors of Hippocrates, is commemorated by his pupil as a skilful anatomist. After this he appears to have visited various cities distinguished for philosophical or medical teachers; and, finally, to have gone to Alexandria with the view of cultivating more accurately and intimately the study of anatomy under Heraclianus. Here he remained till his twenty-eighth year, when he regarded himself as possessed of all the knowledge then attainable through the medium of teachers. He now returned to Pergamum to exercise the art which he had so anxiously studied, and received, in his twenty-ninth year, an unequivocal testimony of the confidence which his fellow-citizens reposed in his skill, by being intrusted with the treatment of the wounded gladiators; and in this capacity he is said to have treated wounds with success which were fatal under former treatment. A seditious tumult appears to have caused him to form the resolution of quitting Pergamum and proceeding to Rome at the age of thirty-two. Here, however, he remained only five years; and returning once more to Pergamum, after travelling for some time, finally settled in Rome as physician to the emperor Commodus. The anatomical writings ascribed to Galen, which are numerous, are to be viewed not merely as the result of personal research and information, but as the common depository of the anatomical knowledge of the day, and as combining all that he had learnt from the several teachers under whom he successively studied with whatever personal investigation enabled him to acquire. It is on this account not always easy to distinguish what Galen had himself ascertained by personal research from that which was known by other anatomists. This, however, though of moment to the history of Galen as an anatomist, is of little consequence to the science itself; and from the anatomical remains of this author a pretty just idea may be formed both of the progress and of the actual state of the science at that time.

The osteology of Galen is undoubtedly the most perfect of the departments of the anatomy of the ancients. He names and distinguishes the bones and sutures of the cranium nearly in the same manner as at present. Thus, he notices the quadrilateral shape of the parietal bones; he distinguishes the squamous, the styloid, the mastoid and the petrous portions of the temporal bones; and he remarks the peculiar situation and shape of the sphenoid bone. Of the ethmoid, which he omits at first, he afterwards speaks more at large in another treatise. The malar he notices under the name of zygomatic bone; and he describes at length the upper maxillary and nasal bones, and the connexion of the former with the sphenoid. He gives the first clear account of the number and situation of the vertebrae, which he divides into *cervical*, *dorsal* and *lumbar*, and distinguishes from the sacrum and coccyx. Under the head *Bones of the Thorax*, he enumerates the sternum, the ribs (*αἱ πλευραί*), and the dorsal vertebrae, the connexion of which with the former he designates as a variety of *diarthrosis*. The description of the bones of the extremities and their articulations concludes the treatise.

Though in myology Galen appears to less advantage than in osteology, he nevertheless had carried this part of anatomical knowledge to greater perfection than any of his predecessors. He describes a frontal muscle, the six muscles of the eye and a seventh proper to animals; a muscle to each *ala nasi*, four muscles of the lips, the thin cutaneous muscle of the neck, which he first termed *platysma myoides* or muscular expansion, two muscles of the eyelids, and four pairs of muscles of the lower jaw—the temporal to raise, the masseter to draw to one side, and two depressors, corresponding to the digastric and internal pterygoid muscles. After speaking of the muscles which move the head and the scapula, he adverts to those by which the windpipe is opened and shut, and the intrinsic or proper muscles of the larynx and hyoid bone. Then follow those of the tongue, pharynx and neck, those of the upper extremities, the trunk and the lower extremities successively; and in the course of this description he swerves so little from the actual facts that most of the names by which he distinguishes the principal muscles have been retained by the best modern anatomists. It is chiefly in the minute account of these organs, and especially in reference to the minuter muscles, that he appears inferior to the moderns.

The angiological knowledge of Galen, though vitiated by the erroneous physiology of the times and ignorance of the separate uses of arteries and veins, exhibits, nevertheless, some accurate facts which show the diligence of the author in dissection. Though, in opposition to the opinions of Praxagoras and Erasistratus, he proved that the arteries in the living animal contain not air but blood, it does not appear to have occurred to him to determine in what direction the blood flows, or whether it was movable or stationary. Representing the left ventricle of the heart as the common origin of all the arteries, though he is misled by the pulmonary artery, he nevertheless traces the distribution of the branches of the aorta with some accuracy. The *vena azygos* also, and the jugular veins, have contributed to add to the confusion of his description, and to render his angiology the most imperfect of his works.

In neurology we find him to be the author of the dogma that the brain is the origin of the nerves of sensation, and the spinal cord of those of motion; and he distinguishes the former from the latter by their greater softness or less consistence. Though he admits only seven cerebral pairs, he has the merit of distinguishing and tracing the distribution of the greater part of both classes of nerves with great accuracy. His description of the brain is derived from dissection of the lower animals, and his distinctions of the several parts of the organ have been retained by modern anatomists. His mode of demonstrating this organ, which indeed is clearly described, consists of five different steps. In the first the bisecting membrane—*i.e.* the falx (*μῆνιγξ διχοτομοῦσα*)—and the connecting blood-vessels are removed; and the dissector, commencing at the anterior extremity of the great fissure, separates the hemispheres gently as far as the *torcular*, and exposes a smooth surface (*τὴν χώραν τυλώδη πως οὖσαν*), the mesolobe of the moderns, or the middle band. In the second he exposes by successive sections the ventricles, the choroid plexus and the middle partition. The third exhibits the pineal body (*σῶμα κωνοειδὲς*) or conarium, concealed by a membrane with numerous veins, meaning that part of the plexus which is now known by the name of *velum interpositum*, and a complete view of the ventricles. The fourth unfolds the third ventricle (*τὶς ἄλλη τρίτη κοιλία*), the communication between the two lateral ones, the arch-like body (*σῶμα ψαλιδοειδὲς*) *fornix*, and the passage from the third to the fourth ventricle. In the fifth he gives an accurate description of the relations of the third and fourth ventricle, of the situation of the two pairs of eminences, *nates* (*γλουτά*) and *testes* (*διδύμια* or *ὄρχεις*), the scolecoid or worm-like process, anterior and posterior, and lastly the linear furrow, called by Herophilus *calamus scriptorius*.

In the account of the thoracic organs equal accuracy may be recognized. He distinguishes the *pleura* by the name of inclosing membrane (*ὑμὴν ὑπεζωκώς, membrana succingens*), and remarks its similitude in structure to that of the peritoneum, and the covering which it affords to all the organs. The pericardium also he describes as a membranous sac with a circular basis corresponding to the base of the heart and a conical apex; and after an account of the tunics of the arteries and veins, he speaks shortly of the lung, and more at length of the heart, which, however, he takes some pains to prove not to be muscular, because it is harder, its fibres are differently arranged, and its action is incessant, whereas that of muscle alternates with the state of rest; he gives a good account of the valves and of the vessels; and notices especially the bony ring formed in the heart of the horse, elephant and other large animals.

The description of the abdominal organs, and of the kidneys and urinary apparatus, is still more minute, and in general accurate. Our limits, however, do not permit us to give any abstract of them; and it is sufficient in general to say that Galen gives correct views of the arrangement of the peritoneum and omentum, and distinguishes accurately the several divisions of the alimentary canal and its component tissues. In the liver, which he allows to receive an envelope from the peritoneum, he admits, in imitation of Erasistratus, a proper substance or *parenchyma*, interposed between the vessels, and capable of removal by suitable dissection. His description of the organs of generation is rather brief, and is, like most of his anatomical sketches, too much blended with physiological dogmas.

This short sketch may communicate some idea of the condition of anatomical knowledge in the days of Galen, who indeed is justly entitled to the character of rectifying and digesting, if not of creating, the science of anatomy among the ancients. Though evidently confined, perhaps entirely by the circumstances of the times, to the dissection of brute animals, so indefatigable and judicious was he in the mode of acquiring knowledge, that many of his names and distinctions are still retained with advantage in the writings of the moderns. Galen was a practical anatomist, and not only describes the organs of the animal body from actual dissection, but gives ample instructions for the proper mode of exposition. His language is in general clear, his style as correct as in most of the authors of the same period, and his manner is animated. Few passages in early science are indeed so interesting as the description of the process for demonstrating the brain and other internal organs which is given by this patient and enthusiastic observer of nature. To some it may appear absurd to speak of anything like good anatomical description in an author who writes in the Greek language, or anything like an interesting and correct manner in a writer who flourished at a period when taste was depraved or extinct and literature corrupted—when the philosophy of Antoninus and the mild virtues of Aurelius could do little to soften the iron sway of Lucius Verus and Commodus; but the habit of faithful observation in Galen seems to have been so powerful that in the description of material objects, his genius invariably rises above the circumstances of his age. Though not so directly connected with this subject, it is nevertheless proper to mention that he appears to have been the first anatomist who can be said, on authentic grounds, to have attempted to discover the uses of organs by vivisection and experiments on living animals. In this manner he ascertained the position and demonstrated the action of the heart; and he mentions two instances in which, in consequence of disease or injury, he had an opportunity of observing the motions of this organ in the human body. In short, without eulogizing an ancient author at the expense of critical justice, or commending his anatomical descriptions as superior to those of the moderns, it must be admitted that the anatomical writings of the physician of Pergamum form a remarkable era in the history of the science; and that by diligence in dissection and accuracy in description he gave the science a degree of importance and stability which it has retained through a lapse of many centuries.

The death of Galen, which took place at Pergamum in the seventieth year of his age and the 200th of the Christian era, may be regarded as the downfall of anatomy in ancient times. After this period we recognize only two names of any celebrity in the history of the science—those of Soranus and Oribasius, with the more obscure ones of Meletius and Theophilus, the latter the chief of the imperial guard of Heraclius.

Soranus, who was an Ephesian, and flourished under the emperors Trajan and Hadrian, distinguished himself by his researches on the female organs of generation. He appears to have dissected the human subject; and this perhaps is one reason why his descriptions of these parts are more copious and more accurate than those of Galen, who derived his knowledge from the bodies of the lower animals. He denies the existence of the hymen, but describes accurately the clitoris. Soranus the anatomist must be distinguished from the physician of that name, who was also a native of Ephesus.

Oribasius.

Oribasius, who was born at Pergamum, is said to have been at once the friend and physician of the emperor Julian, and to have contributed to the elevation of that apostate to the imperial throne. For this he appears to have suffered the punishment of a temporary exile under Valens and Valentinian; but was soon recalled, and lived in great honour till the period of his death (387). By le Clerc, Oribasius is regarded as a compiler; and indeed his anatomical writings bear so close a correspondence with those of Galen that the character is not altogether groundless. In various points, nevertheless, he has rendered the Galenian anatomy more accurate; and he has distinguished himself by a good account of the salivary glands, which were overlooked by Galen.

To the same period generally is referred the Anatomical Introduction of an anonymous author, first published in 1618 by Lauremberg, and afterwards by C. Bernard. It is to be regarded as a compilation formed on the model of Galen and Oribasius. The same character is applicable to the treatises of Meletius and Theophilus.

The decline indicated by these languid efforts soon sank into a state of total inactivity; and the unsettled state of society during the latter ages of the Roman empire was extremely unfavourable to the successful cultivation of science. The sanguinary conflicts in which the southern countries of Europe were repeatedly engaged with their northern neighbours between the 2nd and 8th centuries tended gradually to estrange their minds from scientific pursuits; and the hordes of barbarians by which the Roman empire was latterly overrun, while they urged them to the necessity of making hostile resistance, and adopting means of self-defence, introduced such habits of ignorance and barbarism, that science was almost universally forgotten. While the art of healing was professed only by some few ecclesiastics or by itinerant practitioners, anatomy was utterly neglected; and no name of anatomical celebrity occurs to diversify the long and uninteresting period commonly distinguished as the dark ages.

Arabian Physicians.

Anatomical learning, thus neglected by European nations, is believed to have received a temporary cultivation from the Asiatics. Of these, several nomadic tribes, known to Europeans under the general denomination of Arabs and Saracens, had gradually coalesced under various leaders; and by their habits of endurance, as well as of enthusiastic valour in successive expeditions against the eastern division of the Roman empire, had acquired such military reputation as to render them formidable wherever they appeared. After a century and a half of foreign warfare or internal animosity, under the successive dynasties of the Omayyads and Abbasids, in which the propagation of Islam was the pretext for the extinction of learning and civilization, and the most remorseless system of rapine and destruction, the Saracens began, under the latter dynasty of princes, to recognize the value of science, and especially of that which prolongs life, heals disease and alleviates the pain of wounds and injuries. The caliph Mansur combined with his official knowledge of Moslem law the successful cultivation of astronomy; but to his grandson Mamun, the seventh prince of the line of the Abbasids, belongs the merit of undertaking to render his subjects philosophers and physicians. By the directions of this prince the works of the Greek and Roman authors were translated into Arabic; and the favour and munificence with which literature and its professors were patronized speedily raised a succession of learned Arabians. The residue of the rival family of the Omayyads, already settled in Spain, was prompted by motives of rivalry or honourable ambition to adopt the same course; and while the academy, hospitals and library of Bagdad bore testimony to the zeal and liberality of the Abbasids, the munificence of the Omayyads was not less conspicuous in the literary institutions of Cordova, Seville and Toledo.

Notwithstanding the efforts of the Arabian princes, however, and the diligence of the Arabian physicians, little was done for anatomy, and the science made no substantial acquisition. The Koran denounces as unclean the person who touches a corpse; the rules of Islam forbid dissection; and whatever their instructors taught was borrowed from the Greeks. Abu-Bekr Al-Rasi, Abu-Ali Ibn-Sina, Abul-Qasim and Abul Walid ibn Rushd, the Rhazes, Avicenna, Abulcasis and Averroes of European authors, are their most celebrated names in medicine; yet to none of these can the historian with justice ascribe any anatomical merit. Rhazes has indeed left descriptions of the eye, of the ear and its *meatus*, and of the heart; and Avicenna, Abul-Qasim and Averroes give anatomical descriptions of the parts of the human body. But of these the general character is, that they are copies from Galen, sometimes not very just, and in all instances mystified with a large proportion of the fanciful and absurd imagery and inflated style of the Arabian writers. The chief reason of their obtaining a place in anatomical history is, that by the influence which their medical authority enabled them to exercise in the European schools, the nomenclature which they employed was adopted by European anatomists, and continued till the revival of ancient learning restored the original nomenclature of the Greek physicians. Thus, the *cervix*, or nape of the neck, is *nucha*; the oesophagus is *meri*; the umbilical region is *sumen* or *sumac*; the abdomen is *myrach*; the peritoneum is *siphac*; and the omentum, *sirbus*.

From the general character now given justice requires that we except Abdallatif, the annalist of Egyptian affairs. This author, who maintains that it is impossible to learn anatomy from books, and that the authority of Galen must yield to personal inspection, informs us that the Moslem doctors did not neglect opportunities of studying the bones of the human body in cemeteries; and that he himself, by once examining a collection of bones in this manner, ascertained that the lower jaw is formed of one piece; that the sacrum, though sometimes composed of several, is most generally of one; and that Galen is mistaken when he asserts that these bones are not single.

School of Bologna.

The era of Saracen learning extends to the 13th century; and after this we begin to approach happier times. The university of Bologna, which, as a school of literature and law, was already celebrated in the 12th century, became, in the course of the following one, not less distinguished for its medical teachers. Though the misgovernment of the municipal rulers of Bologna had disgusted both teachers and students, and given rise to the foundation of similar institutions in Padua and Naples,—and though the school of Salerno, in the territory of the latter, was still in high repute,—it appears, from the testimony of M. Sarti, that medicine was in the highest esteem in Bologna, and that it was in such perfection as to require a division of its professors into physicians, surgeons, physicians for wounds, barber-surgeons, oculists and even some others. Notwithstanding these indications of refinement, however, anatomy was manifestly cultivated rather as an appendage of surgery than a branch of medical science; and according to the testimony of Guy de Chauliac, the cultivation of anatomical knowledge was confined to Roger of Parma, Roland, Jamerio, Bruno, and Lanfranc or Lanfranchi of Milan; and this they borrowed chiefly from Galen.

Mondino.

In this state matters appear to have proceeded with the medical school of Bologna till the commencement of the 14th century, when the circumstance of possessing a teacher of originality enabled this university to be the agent of as great an improvement in medical science as she had already effected in jurisprudence. This era, indeed, is distinguished for the appearance of Mondino (Mundinus), under whose zealous cultivation the science first began to rise from the ashes in which it had been buried. This father of modern anatomy, who taught in Bologna about the year 1315, quickly drew the curiosity of the medical profession by well-ordered demonstrations of the different parts of the human body. In 1315 he dissected and demonstrated the parts of the human body in two female subjects; and in the course of the following year he accomplished the same task on the person of a single female. But while he seems to have had sufficient original force of intellect to direct his own route, J. Riolan accuses him of copying Galen; and it is certain that his descriptions are corrupted by the barbarous leaven of the Arabian schools, and his Latin defaced by the exotic nomenclature of Avicenna and Rhazes. He died, according to G. Tiraboschi, in 1325.

Mondino divides the body into three cavities (*ventres*), the upper containing the animal members, as the head, the lower containing the natural members, and the middle containing the spiritual members. He first describes the anatomy of the lower cavity or the abdomen, then proceeds to the middle or thoracic organs, and concludes with the upper, comprising the head and its contents and appendages. His general manner is to notice shortly the situation and shape or distribution of textures or membranes, and then to mention the disorders to which they are subject. The peritoneum he describes under the name of *siphac*, in imitation of the Arabians, the omentum under that of *zirbus*, and the mesentery or *eucharus* as distinct from both. In speaking of the intestines he treats first of the rectum, then the colon, the left or sigmoid flexure of which, as well as the transverse arch and its connexion with the stomach, he particularly remarks; then the caecum or *monoculus*, after this the small intestines in general under the heads of ileum and jejunum, and latterly the duodenum, making in all six bowels. The liver and its vessels are minutely, if not accurately, examined; and the *cava*, under the name *chilis*, a corruption from the Greek κοίλη, is treated at length, with the emulgents and kidneys. His anatomy of the heart is wonderfully accurate; and it is a remarkable fact, which seems to be omitted by all subsequent authors, that his description contains the rudiments of the circulation of the blood. "Postea vero versus pulmonem est aliud orificium venae arterialis, quae *portat* sanguinem ad pulmonem a corde; quia cum pulmo deserviat cordi secundum modum dictum, ut ei recompenset, cor ei *transmittit* sanguinem per hanc venam, quae vocatur vena arterialis; est vena, quia portat sanguinem, et arterialis, quia habet duas tunicas; et habet duas tunicas, primo quia vadit ad membrum quod existit in continuo motu, et secundo quia portat sanguinem valde subtilem et cholericum." The merit of these distinctions, however, he afterwards destroys by repeating the old assertion that the left ventricle ought to contain spirit or air, which it generates from the blood. His osteology of the skull is erroneous. In his account of the cerebral membranes, though short, he notices the principal characters of the *dura mater*. He describes shortly the lateral ventricles, with their anterior and posterior *cornua*, and the choroid plexus as a blood-red substance like a long worm. He then speaks of the third or middle ventricle, and one posterior, which seems to correspond with the fourth; and describes the infundibulum under the names of *lacuna* and *emboton*. In the base of the organ he remarks, first, two mammillary caruncles, the optic nerves, which he reckons the first pair; the oculomuscular, which he accounts the second; the third, which appears to be sixth of the moderns; the fourth; the fifth, evidently the seventh; a sixth, the *nervus vagus*; and a seventh, which is the ninth of the moderns. Notwithstanding the misrepresentations into which this early anatomist was betrayed, his book is valuable, and has been illustrated by the successive commentaries of Alessandro Achillini, Jacopo Berengario and Johann Dryander (1500–1560).

Matthew de Gradibus, a native of Gradi, a town in Friuli, near Milan, distinguished himself by composing a series of treatises on the anatomy of various parts of the human body (1480). He is the first who represents the ovaries of the female in the correct light in which they were subsequently regarded by Nicolas Steno or Stensen (1638–1687).

Objections similar to those already urged in speaking of Mondino apply to another eminent anatomist of those times. Gabriel de Zerbis, who flourished at Verona towards the conclusion of the 15th century, is celebrated as the author of a system in which he is obviously more anxious to astonish his readers by the wonders of a verbose and complicated style than to instruct by precise and faithful description. In the vanity of his heart he assumed the title of *Medicus Theoricus*; but though, like Mondino, he derived his information from the dissection of the human subject, he is not entitled to the merit either of describing truly or of adding to the knowledge previously acquired. He is superior to Mondino, however, in knowing the olfactory nerves.

Achillini.

Eminent in the history of the science, and more distinguished than any of this age in the history of cerebral anatomy, Achillini of Bologna (1463–1512), the pupil and commentator of Mondino, appeared at the close of the 15th century. Though a follower of the Arabian school, the assiduity with which he cultivated anatomy has rescued his name from the inglorious obscurity in which the Arabian doctors have in general slumbered. He is known in the history of anatomical discovery as the first who described the two tympanal bones, termed *malleus* and *incus*. In 1503 he showed that the tarsus consists of seven bones; he rediscovered the fornix and the infundibulum; and he was fortunate enough to observe the course of the cerebral cavities into the inferior *cornua*, and to remark peculiarities to which the anatomists of a future age did not advert. He mentions the orifices of the ducts, afterwards described by Thomas Wharton (1610–1673). He knew the ileo-caecal valve; and his description of the duodenum, ileum and colon shows that he was better acquainted with the site and disposition of these bowels than any of his predecessors or contemporaries.

Berenger.

Not long after, the science boasts of one of its most distinguished founders. Berengario, commonly called Berenger of Carpi, in the Modenese territory, flourished at Bologna at the beginning of the 16th century. In the annals of medicine his name will be remembered not only as the most zealous and eminent in cultivating the anatomy of the human body, but as the first physician who was fortunate enough to calm the alarms of Europe, suffering under the ravages of syphilis, then raging with uncontrollable virulence. In the former character he surpassed both predecessors and contemporaries; and it was long before the anatomists of the following age could boast of equalling him. His assiduity was indefatigable; and he declares that he dissected above one hundred human bodies. He is the author of a compendium, of several treatises which he names Introductions (*Isagogae*), and of commentaries on the treatise of Mondino, in which he not only rectifies the mistakes of that anatomist, but gives minute and in general accurate anatomical descriptions.

He is the first who undertakes a systematic view of the several textures of which the human body is composed; and in a preliminary commentary he treats successively of the anatomical characters and properties of fat, of membrane in general (*panniculus*), of flesh, of nerve, of *villus* or fibre (*filum*), of ligament, of sinew or tendon, and of muscle in general. He then proceeds to describe with considerable precision the muscles of the abdomen, and illustrates their site and connexions by woodcuts which, though rude, are spirited, and show that anatomical drawing was in that early age beginning to be understood. In his account of the peritoneum he admits only the intestinal division of that membrane, and is at some pains to prove that Gentilis Fulgineus, who justly admits the muscular division also, is in error. In his account of the intestines he is the first who mentions the vermiform process of the caecum; he remarks the yellow tint communicated to the duodenum by the gall-bladder; and he recognizes the opening of the common biliary duct into the duodenum (*quidam porus portans choleram*). In the account of the stomach he describes the several tissues of which that organ is composed, and which he represents to be three, and a fourth from the peritoneum; and afterwards notices the *rugae* of its villous surface. He is at considerable pains to explain the organs of generation in both sexes, and gives a long account of the anatomy of the foetus. He was the first who recognized the larger proportional size of the chest in the male than in the female, and conversely the greater capacity of the female than of the male pelvis. In the larynx he discovered the two arytenoid cartilages. He gives the first good description of the thymus; distinguishes the oblique situation of the heart; describes the pericardium, and maintains the uniform presence of pericardial liquor. He then describes the cavities of the heart; but perplexes himself, as did all the anatomists of that age, about the spirit supposed to be contained. The aorta he properly makes to arise from the left ventricle; but confuses himself with the *arteria venalis*, the pulmonary vein, and the *vena arterialis*, the pulmonary artery. His account of the brain is better. He gives a minute and clear account of the ventricles, remarks the *corpus striatum*, and has the sagacity to perceive that the choroid plexus consists of veins and arteries; he then describes the middle or third ventricle, the infundibulum or *lacuna* of Mondino, and the pituitary gland; and lastly, the passage to the fourth ventricle, the *conarium* or pineal gland, and the fourth or posterior ventricle itself, the relations of which he had studied accurately. He rectifies the mistake of Mondino as to the olfactory or first pair of nerves, gives a good account of the optic and others, and is entitled to the praise of originality in being the first observer who contradicts the fiction of the wonderful net and indicates the principal divisions of the carotid arteries. He enumerates the tunics and humours of the eye, and gives an account of the internal ear, in which he notices the *malleus* and *incus*.

French school.

Italy long retained the distinction of giving birth to the first eminent anatomists in Europe, and the glory she acquired in the names of Mondino, Achillini, Berenger and N. Massa, was destined to become more conspicuous in the labours of R. Columbus, G. Fallopius and Eustachius. While Italy, however, was thus advancing the progress of science, the other nations of Europe were either in profound ignorance or in the most supine indifference to the brilliant career of their zealous neighbours. The 16th century had commenced before France began to acquire anatomical distinction in the names of Jacques Dubois, Jean Fernel and Charles Etienne; and even these celebrated teachers were less solicitous in the personal study of the animal body than in the faithful explanation of the anatomical writings of Galen. The infancy of the French school had to contend with other difficulties. The small portion of knowledge which had been hitherto diffused in the country was so inadequate to eradicate the prejudices of ignorance, that it was either difficult or absolutely impossible to procure human bodies for the purposes of science; and we are assured, on the testimony of A. Vesalius and other competent authorities, that the practical part of anatomical instruction was obtained entirely from the bodies of the lower animals. The works of the Italian anatomists were unknown; and it is a proof of the tardy communication of knowledge that, while the structure of the human body had been taught in Italy for more than a century by Mondino and his followers, these anatomists are never mentioned by Etienne, who flourished long after.

Dubois.

Such was the aspect of the times at the appearance of Jacques Dubois (1478–1555), who, under the Romanized name of Jacobus Sylvius, according to the fashion of the day, has been fortunate in acquiring a reputation to which his researches do not entitle him. For the name of Dubois the history of anatomy, it is said, is indebted to his inordinate love of money. At the instance of his brother Francis, who was professor of eloquence in the college of Tournay at Paris, he devoted himself to the study of the learned languages and mathematics; but discovering that these elegant accomplishments do not invariably reward their cultivators with the goods of fortune, Dubois betook himself to medicine. After the acquisition of a medical degree in the university of Montpellier, at the ripe age of fifty-one Dubois returned to Paris to resume a course of anatomical instruction. Here he taught anatomy to a numerous audience in the college of Trinquet; and on the departure of Vidus Vidius for Italy was appointed to succeed that physician as professor of surgery to the Royal College. His character is easily estimated. With greater coarseness in his manners and language than even the rude state of society in his times can palliate, with much varied learning and considerable eloquence, he was a blind, indiscriminate and irrational admirer of Galen, and interpreted the anatomical and physiological writings of that author in preference to giving demonstrations from the subject. Without talent for original research or discovery himself, his envy and jealousy made him detest every one who gave proofs of either. We are assured by Vesalius, who was some time his pupil, that his manner of teaching was calculated neither to advance the science nor to rectify the mistakes of his predecessors. A human body was never seen in the theatre of Dubois; the carcases of dogs and other animals were the materials from which he taught; and so difficult even was it to obtain human bones, that unless Vesalius and his fellow-students had collected assiduously from the Innocents and other cemeteries, they must have committed numerous errors in acquiring the first principles. This assertion, however, is contradicted by J. Riolan, and afterwards by K. P. J. Sprengel and T. Lauth, the last of whom decidedly censures Vesalius for this ungrateful treatment of his instructor. It is certain that opportunities of inspecting the human body were by no means so frequent as to facilitate the study of the science. Though his mention of injections has led some to suppose him the discoverer of that art, he appears to have made no substantial addition to the information already acquired; and the first acknowledged professor of anatomy to the university of Paris appears in history as one who lived without true honour and died without just celebrity. He must not be confounded with Franciscus Sylvius (de le Boe), who is mentioned by F. Ruysch and M. V. G. Malacarne as the author of a particular method of demonstrating the brain.

Etienne.

Almost coeval may be placed Charles Etienne (1503–1564), a younger brother of the celebrated printers, and son to Henry, who Hellenized the family name by the classical appellation of Stephen (Στέφανος). It is uncertain whether he taught publicly. But his tranquillity was disturbed, and his pursuits interrupted, by the oppressive persecutions in which their religious opinions involved the family; and Charles Etienne drew the last breath of a miserable life in a dungeon in 1564. Etienne, though sprung of a family whose classical taste has been their principal glory, does not betray the same servile imitation of the Galenian anatomy with which Dubois is charged. He appears to have been the first to detect valves in the orifice of the hepatic veins. He was ignorant, however, of the researches of the Italian anatomists; and his description of the brain is inferior to that given sixty years before by Achillini. His comparison of the cerebral cavities to the human ear has persuaded F. Portal that he knew the inferior *cornua*, the *hippocampus* and its prolongations; but this is no reason for giving him that honour to the detriment of the reputation of Achillini, to whom, so far as historical testimony goes, the first knowledge of this fact is due. The researches of Etienne into the structure of the nervous system are, however, neither useless nor inglorious; and the circumstance of demonstrating a canal through the entire length of the spinal cord, which had neither been suspected by contemporaries nor noticed by successors till J. B. Senac (1603–1770) made it known, is sufficient to place him high in the rank of anatomical discoverers.

Vesalius.

The French anatomy of the 16th century was distinguished by two circumstances unfavourable to the advancement of the science—extravagant admiration of antiquity, with excessive confidence in the writings of Galen, and the general practice of dissecting principally the bodies of the lower animals. Both these errors were much amended, if not entirely removed, by the exertions of a young Fleming, whose appearance forms a conspicuous era in the history of anatomy. Andreas Vesalius, (1514–1564), a native of Brussels, after acquiring at Louvain the ordinary classical attainments of the day, began at the age of fourteen to study anatomy under the auspices of Dubois. Though the originality of his mind soon led him to abandon the prejudices by which he was environed, and take the most direct course for attaining a knowledge of the structure of the human frame, he neither underrated the Galenian anatomy nor was indolent in the dissection of brute animals. The difficulties, however, with which the practical pursuit of human anatomy was beset in France, and the dangers with which he had to contend, made him look to Italy as a suitable field for the cultivation of the science; and in 1536 we find him at Venice, at once pursuing the study of human anatomy with the utmost zeal, and requested, ere he had attained his twenty-second year, to demonstrate publicly in the university of Padua. After remaining here about seven years, Vesalius went by express invitation to Bologna, and shortly afterwards to Pisa; and thus professor in three universities, he appears to have carried on his anatomical investigations and instructions alternately at Padua, Bologna and Pisa, in the course of the same winter. It is on this account that Vesalius, though a Fleming by birth and trained originally in the French school, belongs, as an anatomist, to the Italian, and may be viewed as the first of an illustrious line of teachers by whom the anatomical reputation of that country was in the course of the 16th century raised to the greatest eminence.

Vesalius is known as the first author of a comprehensive and systematic view of human anatomy. The knowledge with which his dissections had furnished him proved how many errors were daily taught and learned under the broad mantle of Galenian authority; and he perceived the necessity of a new system of anatomical instruction, divested of the omissions of ignorance and the misrepresentations of prejudice and fancy. The early age at which he effected this object has been to his biographers the theme of boundless commendation; and we are told that he began at the age of twenty-five to arrange the materials he had collected, and accomplished his task ere he had completed his 28th year.

Soon after this period we find him invited as imperial physician to the court of Charles V., where he was occupied in the duties of practice and answering the various charges which were unceasingly brought against him by the disciples of Galen. After the abdication of Charles he continued at court in great favour with his son Philip II. To this he seems to have been led principally by the troublesome controversies in which his anatomical writings had involved him. It is painful to think, however, that even imperial patronage bestowed on eminent talents does not ensure immunity from popular prejudice; and the fate of Vesalius will be a lasting example of the barbarism of the times, and of the precarious tenure of the safety even of a great physician. On the preliminary circumstances authors are not agreed; but the most general account states that when Vesalius was dissecting, with the consent of his kinsmen, the body of a Spanish grandee, it was observed that the heart still gave some feeble palpitations when divided by the knife. The immediate effects of this outrage to human feelings were the denunciation of the anatomist to the Inquisition; and Vesalius escaped the severe treatment of that tribunal only by the influence of the king, and by promising to perform a pilgrimage to the Holy Land. He forthwith proceeded to Venice, from which he sailed with the Venetian fleet, under James Malatesta, for Cyprus. When he reached Jerusalem, he received from the Venetian senate a message requesting him again to accept the Paduan professorship, which had become vacant by the death of his friend and pupil Fallopius. His destiny, however, which pursued him fast, suffered him not again to breathe the Italian air. After struggling for many days with the adverse winds in the Ionian Sea, he was wrecked on the island of Zante, where he quickly breathed his last in such penury that unless a liberal goldsmith had defrayed the funeral charges, his remains must have been devoured by beasts of prey. At the time of his death he was scarcely fifty years of age.

To form a correct estimate of the character and merits of Vesalius, we must not compare him, in the spirit of modern perfection, with the anatomical authors either of later times or of the present day. Whoever would frame a just idea of this anatomist must imagine, not a bold innovator without academical learning, not a genius coming from a foreign country, unused to the forms and habits of Catholic Europe, nor a wild reformer, blaming indiscriminately everything which accorded not with his opinion; but a young student scarcely emancipated from the authority of instructors, whose intellect was still influenced by the doctrines with which it had been originally imbued,—a scholar strictly trained in the opinions of the time, living amidst men who venerated Galen as the oracle of anatomy and the divinity of medicine,—exercising his reason to estimate the soundness of the instructions then in use, and proceeding, in the way least likely to offend authority and wound prejudice, to rectify errors, and to establish on the solid basis of observation the true elements of anatomical science. Vesalius has been denominated the founder of human anatomy; and though we have seen that in this career he was preceded with honour by Mondino and Berenger, still the small proportion of correct observation which their reverence for Galen and Arabian doctrines allowed them to communicate, will not in a material degree impair the original merits of Vesalius. The errors which he rectified and the additions which he made are so numerous, that it is impossible, in such a sketch as the present, to communicate a just idea of them.

Besides the first good description of the sphenoid bone, he showed that the sternum consists of three portions and the sacrum of five or six; and described accurately the vestibule in the interior of the temporal bone. He not only verified the observation of Etienne on the valves of the hepatic veins, but he described well the *vena azygos*, and discovered the canal which passes in the foetus between the umbilical vein and the *vena cava*, since named *ductus venosus*. He described the omentum, and its connexions with the stomach, the spleen and the colon; gave the first correct views of the structure of the pylorus; remarked the small size of the caecal appendix in man; gave the first good account of the mediastinum and pleura and the fullest description of the anatomy of the brain yet advanced. He appears, however, not to have understood well the inferior recesses; and his account of the nerves is confused by regarding the optic as the first pair, the third as the fifth and the fifth as the seventh.

The labours of Vesalius were not limited to the immediate effect produced by his own writings. His instructions and examples produced a multitude of anatomical inquirers of different characters and varied celebrity, by whom the science was extended and rectified. Of these we cannot speak in detail; but historical justice requires us to notice shortly those to whose exertions the science of anatomy has been most indebted.

Eustachius.

The first that claims attention on this account is Bartolomeo Eustachi of San Severino, near Salerno, who though greatly less fortunate in reputation than his contemporary Vesalius, divides with him the merit of creating the science of human anatomy. He extended the knowledge of the internal ear by rediscovering and describing correctly the tube which bears his name; and if we admit that G. F. Ingrassias anticipated him in the knowledge of the third bone of the tympanal cavity, the *stapes*, he is still the first who described the internal and anterior muscles of the *malleus*, as also the *stapedius*, and the complicated figure of the *cochlea*. He is the first who studied accurately the anatomy of the teeth, and the phenomena of the first and second dentition. The work, however, which demonstrates at once the great merit and the unhappy fate of Eustachius is his *Anatomical Engravings*, which, though completed in 1552, nine years after the impression of the work of Vesalius, the author was unable to publish. First communicated to the world in 1714 by G. M. Lancisi, afterwards in 1744 by Cajetan Petrioli, again in 1744 by B. S. Albinus, and subsequently at Bonn in 1790, the engravings show that Eustachius had dissected with the greatest care and diligence, and taken the utmost pains to give just views of the shape, size and relative position of the organs of the human body.

The first seven plates illustrate the history of the kidneys and some of the facts relating to the structure of the ear. The eighth represents the heart, the ramifications of the *vena azygos*, and the valve of the *vena cava*, named from the author. In the seven subsequent plates is given a succession of different views of the viscera of the chest and abdomen. The seventeenth contains the brain and spinal cord; and the eighteenth more accurate views of the origin, course and distribution of the nerves than had been given before. Fourteen plates are devoted to the muscles.

Eustachius did not confine his researches to the study of relative anatomy. He investigated the intimate structure of organs with assiduity and success. What was too minute for unassisted vision he inspected by means of glasses. Structure which could not be understood in the recent state, he unfolded by maceration in different fluids, or rendered more distinct by injection and exsiccation. The facts unfolded in these figures are so important that it is justly remarked by Lauth, that if the author himself had been fortunate enough to publish them, anatomy would have attained the perfection of the 18th century two centuries earlier at least. Their seclusion for that period in the papal library has given celebrity to many names which would have been known only in the verification of the discoveries of Eustachius.

Columbus.

M. R. Columbus and G. Fallopius were pupils of Vesalius. Columbus, as his immediate successor in Padua, and afterwards as professor at Rome, distinguished himself by rectifying and improving the anatomy of the bones; by giving correct accounts of the shape and cavities of the heart, of the pulmonary artery and aorta and their valves, and tracing the course of the blood from the right to the left side of the heart; by a good description of the brain and its vessels, and by correct understanding of the internal ear, and the first good account of the ventricles of the larynx.

Fallopius.

Fallopius, who, after being professor at Pisa in 1548, and at Padua in 1551, died at the age of forty, studied the general anatomy of the bones; described better than heretofore the internal ear, especially the tympanum and its osseous ring, the two *fenestrae* and their communication with the vestibule and cochlea; and gave the first good account of the stylo-mastoid hole and canal, of the ethmoid bone and cells, and of the lacrymal passages. In myology he rectified several mistakes of Vesalius. He also devoted attention to the organs of generation in both sexes, and discovered the utero-peritoneal canal which still bears his name.

Ingrassias.

Osteology nearly at the same time found an assiduous cultivator in Giovanni Filippo Ingrassias (1545–1580), a learned Sicilian physician, who, in a skilful commentary on the osteology of Galen, corrected numerous mistakes. He gave the first distinct account of the true configuration of the sphenoid and ethmoid bones, and has the merit of first describing (1546) the third bone of the tympanum, called *stapes*, though this is also claimed by Eustachius and Fallopius.

Aranzi.

The anatomical descriptions of Vesalius underwent the scrutiny of various inquirers. Those most distinguished by the importance and accuracy of their researches, as well as the temperate tone of their observations, were Julius Caesar Aranzi (1530–1589), anatomical professor for thirty-two years in the university of Bologna, and Constantio Varoli, physician to Pope Gregory XIII. To the former we are indebted for the first correct account of the anatomical peculiarities of the foetus, and he was the first to show that the muscles of the eye do not, as was falsely imagined, arise from the *dura mater* but from the margin of the optic hole. He also, after considering the anatomical relations of the cavities of the heart, the valves and the great vessels, corroborates the views of Columbus regarding the course which the blood follows in passing from the right to the left side of the heart. Aranzi is the first anatomist who describes distinctly the inferior cornua of the ventricles of the cerebrum, who recognizes the objects by which they are distinguished, and who gives them the name by which they are still known (*hippocampus*); and his account is more minute and perspicuous than that of the authors of the subsequent century. He speaks at large of the choroid plexus, and gives a particular description of the fourth ventricle, under the name of *cistern of the cerebellum*, as a discovery of his own.

Varolius.

Italy, though rich in anatomical talent, has probably few greater names than that of Constantio Varoli (b. 1543) of Bologna. Though he died at the early age of thirty-two, he acquired a reputation not inferior to that of the most eminent of his contemporaries. He is now known chiefly as the author of an epistle, inscribed to Hieronymo Mercuriali, on the optic nerves, in which he describes a new method of dissecting the brain, and communicates many interesting particulars relating to the anatomy of the organ. He observes the threefold division of the inferior surface or base, defines the limits of the anterior, middle and posterior eminences, as marked by the compartments of the skull, and justly remarks that the cerebral cavities are capacious, communicate with each other, extending first backward and then forward, near the angle of the pyramidal portion of the temporal bone, and that they are folded on themselves, and finally lost above the middle and inferior eminence of the brain. He appears to have been aware that at this point they communicate with the exterior or convoluted surface. He recognized the impropriety of the term *corpus callosum*, seems to have known the communication called afterwards *foramen Monroianum*, and describes the *hippocampus* more minutely than had been previously done.

Among the anatomists of the Italian school, as a pupil of Fallopius, Eustachius and U. Aldrovandus, is generally enumerated Volcher Coiter (b. 1534) of Groningen. He distinguished himself by accurate researches on the cartilages, the bones and the nerves, recognized the value of morbid anatomy, and made experiments on living animals to ascertain the action of the heart and the influence of the brain.

The *Frutefull and Necessary Briefe Worke* of John Halle[1] (1565) and *The Englisheman's Treasure* by Master Thomas Vicary (1586),[2] English works published at this time, are tolerable compilations from former authors, much tinged by Galenian and Arabian distinctions. A more valuable compendium than either is, however, that of John Banister (1578), entitled *The Historie of Man, from the most approved Anathomistes in this Present Age.*

Fabricius.

The celebrity of the anatomical school of Italy was worthily maintained by Hieronymo Fabricio of Acquapendente, who, in imitation of his master Fallopius, laboured to render anatomical knowledge more precise by repeated dissections, and to illustrate the obscure by researches on the structure of animals in general. In this manner he investigated the formation of the foetus, the structure of the oesophagus, stomach and bowels, and the peculiarities of the eye, the ear and the larynx. The discovery, however, on which his surest claims to eminence rest is that of the membranous folds, which he names *valves*, in the interior of veins. Several of these folds had been observed by Fernel, Sylvius and Vesalius; and in 1547 G. B. Canani observed those of the *vena asygos;* but no one appears to have offered any rational conjecture on their use, or to have traced them through the venous system at large, until Fabricius in 1574, upon this hypothesis, demonstrated the presence of these valvular folds in all the veins of the extremities.

Fabricius, though succeeded by his pupil Julius Casserius of Placenza, may be regarded as the last of that illustrious line of anatomical teachers by whom the science was so successfully studied and taught in the universities of Italy. The discoveries which each made, and the errors which their successive labours rectified, tended gradually to give anatomy the character of a useful as well as an accurate science, and to pave the way for a discovery which, though not anatomical but physiological, is so intimately connected with correct knowledge of the shape and situation of parts, that it exercised the most powerful influence on the future progress of anatomical inquiry. This was the knowledge of the circular motion of the blood—a fact which though obscurely conjectured by Aristotle, Nemesius, Mondino and Berenger, and partially taught by Servetus, Columbus, Andreas Caesalpinus and Fabricius, it was nevertheless reserved to William Harvey fully and satisfactorily to demonstrate.

Servetus.

Mondino believed that the blood proceeds from the heart to the lungs through the *vena arterialis* or pulmonary artery, and that the aorta conveys the spirit into the blood through all parts of the body. This doctrine was adopted with little modification by Berenger, who further demonstrated the existence and operation of the tricuspid valves in the right ventricle, and of the sigmoid valves at the beginning of the pulmonary artery and aorta, and that there were only two ventricles separated by a solid impervious septum. These were afterwards described in greater detail by Vesalius, who nevertheless appears not to have been aware of the important use which might be made of this knowledge. It was the Spaniard Michael Servet or Servetus (born in 1509, burnt in 1553) who in his treatise *De Trinitatis Erroribus*, published at Haguenau in 1531, first maintained the imperviousness of the septum, and the transition of the blood by what he terms an unknown route, namely, from the right ventricle by the *vena arteriosa* (pulmonary artery) to the lungs, and thence into the *arteria venosa* or pulmonary vein and left auricle and ventricle, from which, he adds afterwards, it is conveyed by the aorta to all parts of the body.[1]

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[1] An interesting article on the character and work of the Maidstone surgeon, John Halle, by E. Barclay Smith, will be found in the *J. Anat. and Phys.* vol. xxxiv. p. 275.

[2] It has been pointed out by Dr J. F. Payne that Vicary's work is merely an abridged copy of an unpublished English anatomical treatise of the 14th century. The name of the author is unknown, but internal evidence shows that he was a London surgeon. The manuscript was written in English in 1392. See *British Medical Journal*, January 25, 1896.

Though the leading outlines, not only of the pulmonary or small but even of the great circulation, were sketched thus early by one who, though a philosopher, was attached to the church, it was only in his work *De Re Anatomica*, published at Venice in 1559, that Columbus formally and distinctly announced the circular course of the blood as a discovery of his own; and maintained, in addition to the imperviousness of the septum, the fact that the *arteria venalis* (pulmonary vein) contains, not air, but blood mixed with air brought from the lungs to the left ventricle of the heart, to be distributed through the body at large.

Caesalpinus.

Soon after, views still more complete of the small or pulmonary circulation were given by Andreas Caesalpinus (1519–1603) of Arezzo, who not only maintained the analogy between the structure of the arterious vein or pulmonary artery and the aorta, and that between the venous artery or pulmonary veins and veins in general, but was the first to remark the swelling of veins below ligatures, and to infer from it a refluent motion of blood in these vessels. The discoveries of Aranzi and Eustachius in the vessels of the foetus tended at first to perplex and afterwards to elucidate some of these notions.

Harvey.

At length it happened that, between the years 1598 and 1600, a young Englishman, William Harvey, pursuing his anatomical studies at Padua under Fabricius, learnt from that anatomist the existence of the valves in the veins of the extremities, and undertook to ascertain the use of these valves by experimental inquiry. It is uncertain whether he learnt from the writings of Caesalpinus the fact observed by that author of the tumescence of a vein below the ligature, but he could not fail to be aware, and indeed he shows that he was aware, of the small circulation as taught by Servetus and Columbus. Combining these facts already known, he, by a series of well-executed experiments, demonstrated clearly the existence, not only of the small, but of a general circulation from the left side of the heart by the aorta and its subdivisions, to the right side by the veins. This memorable truth was first announced in the year 1619.

It is unnecessary here to consider the arguments and facts by which Harvey defended his theory, or to notice the numerous assaults to which he was exposed, and the controversies in which his opponents wished to involve him. It is sufficient to say that, after the temporary ebullitions of spleen and envy had subsided, the doctrine of the circular motion of the blood was admitted by all enlightened and unprejudiced persons, and finally was universally adopted as affording the most satisfactory explanation of many facts in anatomical structure which were either misunderstood or entirely overlooked. The inquiries to which the investigation of the doctrine gave rise produced numerous researches on the shape and structure of the heart and its divisions, of the lungs, and of the blood-vessels and their distribution. Of this description were the researches of Nicolas Steno on the structure of the heart, the classical work of Richard Lower, the dissertation of J. N. Pechlin, the treatise of Raymond Vieussens, the work of Marcello Malpighi on the structure of the lungs, several sketches in the writings of John Mayow, and other treatises of less moment. Systematic treatises of anatomy began to assume a more instructive form, and to breathe a more philosophical spirit. The great work of Adrian Spigelius, which appeared in 1627, two years after the death of the author, contains indeed no proof that he was aware of the valuable generalization of Harvey; but in the institutions of Caspar Bartholinus, as republished and improved by his son Thomas in 1651, the anatomical descriptions and explanations are given with reference to the new doctrine. A still more unequivocal proof of the progress of correct anatomical knowledge was given in the lectures delivered by Peter Dionis, at the Jardin Royal of Paris, in 1673 and the seven following years, in which that intelligent surgeon gave most accurate demonstrations of all the parts composing the human frame, and especially of the heart, its auricles, ventricles and valves, and the large vessels connected with it and the lungs. These demonstrations, first published in 1690, were so much esteemed that they passed through seven editions in the space of thirty years, and were translated into English.

Aselli.

The progress of anatomical discovery continued in the meantime to advance. In the course of the 16th century Eustachius, in studying minutely the structure of the vena azygos, had recognized in the horse a white vessel full of watery fluid, connected with the internal jugular vein, on the left side of the vertebral column, corresponding accurately with the vessel since named *thoracic duct*. Fallopius also described vessels belonging to the liver distinct from arteries and veins; and similar vessels appear to have been noticed by Nicolaus Massa (1499–1569). The nature and properties of these vessels were, however, entirely unknown. On the 23rd of July 1622 Gaspar Aselli, professor of anatomy at Pavia, while engaged in demonstrating the recurrent nerves in a living dog, first observed numerous white delicate filaments crossing the mesentery in all directions; and though he took them at first for nerves, the opaque white fluid which they shed quickly convinced him that they were a new order of vessels. The repetition of the experiment the following day showed that these vessels were best seen in animals recently fed; and as he traced them from the villous membrane of the intestines, and observed the valves with which they were liberally supplied, he inferred that they were genuine chyliferous vessels. By confounding them with the lymphatics, he made them proceed to the pancreas and liver—a mistake which appears to have been first rectified by Francis de le Boe. The discovery of Aselli was announced in 1627; and the following year, by means of the zealous efforts of Nicolas Peiresc, a liberal senator of Aix, the vessels were seen in the person of a felon who had eaten copiously before execution, and whose body was inspected an hour and a half after. In 1629 they were publicly demonstrated at Copenhagen by Simon Pauli, and the same year the thoracic duct was observed by Jacques Mentel (1599–1670) for the first time since it was described by Eustachius. Five years after (1634), John Wesling, professor of anatomy and surgery at Venice, gave the first delineation of the lacteals from the human subject, and evinced more accurate knowledge than his predecessors of the thoracic duct and the lymphatics. Nathaniel Highmore[1] in 1637 demonstrated unequivocally the difference between the lacteals and the mesenteric veins; and though some perplexity was occasioned by the discovery of the pancreatic duct by Christopher Wirsung, this mistake was corrected by Thomas Bartholinus; and the discovery by Jean Pecquet in 1647 of the common trunk of the lacteals and lymphatics, and of the course which the chyle follows to reach the blood, may be regarded as the last of the series of isolated facts by the generalization of which the extent, distribution and uses of the most important organs of the animal body were at length developed.

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[1] The passage of Servetus is so interesting that our readers may feel some curiosity in perusing it in the language of the author; and it is not unimportant to remark that Servetus appears to have been led to think of the course of the blood by the desire of explaining the manner in which the animal spirits were supposed to be generated:—"Vitalis spiritus in sinistro cordis ventriculo suam originem habet, juvantibus maxime pulmonibus ad ipsius perfectionem. Est spiritus tenuis, caloris vi elaboratus, flavo colore, ignea potentia, ut sit quasi ex puriore sanguine lucens, vapor substantiam continens aquae, aeris, et ignis. Generatur ex facta in pulmone commixtione inspirati aeris cum elaborato subtili sanguine, quem dexter ventriculus sinistro communicat. Fit autem communicatio haec, non per parietem cordis medium, ut vulgo creditur, sed magno artificio a dextro cordis ventriculo, longo per pulmones ductu agitatur sanguis subtilis; a pulmonibus praeparatur, flavus efficitur, et a vena arteriosa in arteriam venosam transfunditur. Deinde in ipsa arteria venosa, inspirato aeri miscetur et exspiratione a fuligine expurgatur; atque ita tandem a sinistro cordis ventriculo totum mixtum per diastolen attrahitur, apta supellex, ut fiat spiritus vitalis. Quod ita per pulmones fiat communicatio et praeparatio, docet conjunctio varia, et communicatio venae arteriosae cum arteria venosa in pulmonibus. Confirmat hoc magnitudo insignis venae arteriosae, quae nec talis nec tanta esset facta, nec tantam a corde ipso vim purissimi sanguinis in pulmones emitteret, ob solum eorum nutrimentum; nec cor pulmonibus hac ratione serviret, cum praesertim antea in embryone solerent pulmones ipsi aliunde nutriri, ob membranulas illas seu valvulas cordis, usque ad horum nativitatem; ut docet Galenus, &c. Itaque ille spiritus a sinistro cordis ventriculo arterias totius corporis deinde transfunditur, ita ut qui tenuior est, superiora petit, ubi magis elaboratur, praecipue in plexu retiformi, sub basi cerebri sito, ubi ex vitali fieri incipit animalis, ad propriam rationalis animae rationem accedens."—*De Trinitate*, lib. v.

[1] Highmore was a physician practising at Sherborne all his life (1613–1685).

Joyliffe.

To complete the history of this part of anatomical science one step yet remained—the distinction between the lacteals and lymphatics, and the discovery of the termination of the latter order of vessels. The honour of this discovery is divided between George Joyliffe (1621–1658), an English anatomist, and Olaus Rudbeck (1630–1702), a young Swede. The former, according to the testimony of Francis Glisson and Thomas Wharton, was aware of the distinct existence of the lymphatics in 1650, and demonstrated them as such in 1652. It is nevertheless doubtful whether he knew them much before the latter period; and it is certain that Rudbeck observed the lymphatics of the large intestines, and traced them to glands, on the 27th of January 1651, after he had, in the course of 1650, made various erroneous conjectures regarding them, and, like others, attempted to trace them to the liver. The following year he demonstrated them in presence of Queen Christina, and traced them to the thoracic duct, and the latter to the subclavian vein. Their course and distribution were still more fully investigated by Thomas Bartholinus, Wharton, J. Swammerdam and G. Blaes, the last two of whom recognized the existence of valves; while Antony Nuck of Leiden, by rectifying various errors of his predecessors, and adding several new and valuable observations, rendered this part of anatomy much more precise than formerly.

Willis.

After this period anatomists began to study more minutely the organs and textures. Francis Glisson[1] distinguished himself by a minute description of the liver (1654), and a clearer account of the stomach and intestines, than had yet been given. Thomas Wharton[2] investigated the structure of the glands with particular care; and though rather prone to indulge in fanciful generalization, he developed some interesting views of these organs; while Walter Charleton (1619–1707), who appears to have been a person of great genius, though addicted to hypothesis, made some good remarks on the communication of the arteries with the veins, the foetal circulation and the course of the lymphatics. But the circumstance which chiefly distinguished the history of anatomy at the beginning of the 17th century was the appearance of Thomas Willis[3] (1621–1675), who rendered himself eminent not only by good researches on the brain and nerves, but by many judicious observations on the structure of the lungs, the intestines, the blood-vessels and the glands. His anatomy of the brain and nerves is so minute and elaborate, and abounds so much in new information, that the reader is struck by the immense chasm between the vague and meagre notices of his predecessors and the ample and correct descriptions of Willis. This excellent work, however, is not the result of his own personal and unaided exertions; and the character of Willis derives additional lustre from the candid avowal of his obligations to Sir Christopher Wren and Thomas Millington, and, above all, to the diligent researches of his fellow-anatomist Richard Lower.

Willis was the first who numbered the cranial nerves in the order in which they are now usually enumerated by anatomists. His observation of the connexion of the eighth pair with the slender nerve which issues from the beginning of the spinal cord is known to all. He remarked the parallel lines of the mesolobe, afterwards minutely described by Felix Vicq d'Azyr (1748–1794). He seems to have recognized the communication of the convoluted surface of the brain and that between the lateral cavities beneath the fornix. He described the *corpora striata* and *optic thalami*; the four orbicular eminences, with the bridge, which he first named *annular protuberance*; and the white mammillary eminences, behind the infundibulum. In the cerebellum he remarks the arborescent arrangement of the white and grey matter, and gives a good account of the internal carotids, and the communications which they make with the branches of the basilar artery.

Malpighi.

About the middle of the 17th century R. Hooke and Nehemiah Grew employed the simple microscope in the minute examination of plants and animals; and the Dutch philosopher A. Leeuwenhoek with great acuteness examined microscopically the solids and fluids of the body, recognized the presence of scales in the cuticle, and discovered the corpuscles in the blood and milk, and the spermatozoa in the seminal fluid. The researches of Malpighi also tended greatly to improve the knowledge of minute structure. He gave the first distinct ideas on the organization of the lung, and the mode in which the bronchial tubes and vessels terminate in that organ. By the microscope he traced the transition of the arteries into the veins, and saw the movements of the blood corpuscles in the capillaries. He endeavoured to unfold, by dissection and microscopic observation, the minute structure of the brain. He studied the structure of bone, he traced the formation and explained the structure of the teeth; and his name is to this day associated with the discovery of the deeper layer of the cuticle and the Malpighian bodies in the spleen and kidney. In these difficult inquiries the observations of Malpighi are in general faithful, and he may be regarded as the founder of histological anatomy.

Nicolas Steno, or Stensen, described with accuracy (1660) the lacrymal gland and passages, and rediscovered the parotid duct. L. Bellini studied the structure of the kidneys, and described the tongue and tonsils with some care; and Charles Drelincourt laboured to investigate the changes effected on the uterus by impregnation, and to elucidate the formation of the foetus. The science might have derived still greater advantages from the genius of Regnier de Graaf, who investigated with accuracy the structure of the pancreas and of the organs of generation in both sexes, had he not been cut off at the early age of thirty-two. Lastly, Wepfer, though more devoted to morbid anatomy, made, nevertheless, some just observations on the anatomical disposition of the cerebral vessels, the glandular structure of the liver, and the termination of the common duct in the duodenum.

Ruysch.

The appearance of Frederic Ruysch, who was born in 1638, became professor of anatomy at Amsterdam in 1665 and died in that city in 1731, gave a new impulse to anatomical research, and tended not only to give the science greater precision, but to extend its limits in every direction. The talents of Ruysch are said to have been developed by accident. To repel the audacious and calumnious aspersions with which Louis de Bils attacked de le Boe and van Horne, Ruysch published his tract on the valves of the lymphatics, which completely established his character as an anatomist of originality and research. This, however, is the smallest of his services to the science. The art of injecting, which had been originally attempted by Eustachi and Varoli, and was afterwards rudely practised by Glisson, Bellini and Willis, was at length carried to greater perfection by de Graaf and Swammerdam, the former of whom injected the spermatic vessels with mercury and variously coloured liquors; while the latter, by employing melted wax with other ingredients, made the first approach to the refinements of modern anatomy. By improving this idea of using substances which, though solid, may be rendered fluid at the period of injecting, Ruysch carried this art to the highest perfection.

By the application of this happy contrivance he was enabled to demonstrate the arrangement of minute vessels in the interior of organs which had escaped the scrutiny of previous anatomists. Scarcely a part of the human body eluded the penetration of his syringe; and his discoveries were proportionally great. His account of the valves of the lymphatics, of the vessels of the lungs, and their minute structure; his researches on the vascular structure of the skin, of the bones, and their epiphyses, and their mode of growth and union; his observations on the spleen, the glans penis, the clitoris, and the womb impregnated and unimpregnated, were but a limited part of his anatomical labours. He studied the minute structure of the brain; he demonstrated the organization of the choroid plexus; he described the state of the hair when affected with Polish plait; he proved the vascular structure of the teeth; he injected the dura mater, the pleura, the pericardium and peritoneum; he unfolded the minute structure of the conglomerate glands; he investigated that of the synovial apparatus placed in the interior of the joints; and he discovered several curious particulars relating to the lacteals, the lymphatics and the lymphatic glands.

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[1] Glisson was for forty years professor of physic at Cambridge.

[2] Wharton was a graduate both of Oxford and Cambridge, and physician to St Thomas's Hospital.

[3] Willis was Sedleian professor of natural philosophy in Oxford in 1660. Later he practised in London.

Meanwhile, H. Meibomius rediscovered (1670) the palpebral glands, which were known to Casserius; Swammerdam studied the action of the lungs, described the structure of the human uterus, and made numerous valuable observations on the coeca and pancreatoid organs of fishes; and Th. Kerckring laid the foundation of a knowledge of the process of ossification. John Conrad Brunner, in the course of experiments on the pancreas, discovered (1687) the glands of the duodenum named after him, and J. Conrad Peyer (1677–1681) described the solitary and agminated glands of the intestinal canal. Leonard Tassin, distinguished for original observation, rendered the anatomical history of the brain more accurate than heretofore, and gave particular accounts of the intestinal tube, the pancreatic duct and the hepatic ligaments (1678).

Duverney.

That France might not be without participation in the glory of advancing the progress of anatomical knowledge, the names of Joseph Guichard Duverney and Vieussens are commemorated with distinction. Duverney, born in 1648, and first introduced into public life in 1676 in the Royal Academy of Sciences, decorated with the honorary title of professor of anatomy to the dauphin, and appointed in 1679 professor at the Jardin Royal, distinguished himself by the first accurate account of the organ of hearing, and by his dissections of several animals at the academy supplied valuable materials for the anatomical details of the natural history of animals published by that learned body. He appears to have been the first who demonstrated the fact that the cerebral sinuses open into the jugular veins, and to have been aware that the former receives the veins of the brain and are the venous receptacles of the organ. He understood the cerebral cavities and their mode of communication; distinguishes the posterior pillars of the vault from the pedes hippocampi; recognizes the two plates of the septum lucidum; and, what is still more remarkable, he first indicates distinctly the discussation of the anterior pyramids of the medulla oblongata—a fact afterwards verified by the researches of Mistichelli, F. P. du Petit and G.D. Santorini. He studied the ganglions attentively, and gives the first distinct account of the formation, connexions and distribution of the intercostal nerves. It is interesting to remark that his statement that the veins or sinuses of the spinal cord terminate in the vena azygos was verified by the subsequent researches of G. Dupuytren (1777–1835) and G. Breschet (1784–1845), which showed that the vertebral veins communicate by means of the intercostal and superior lumbar veins with the azygos and hemi-azygos. His account of the structure of bones and of the progress of ossification is valuable. He recognized the vascular structure of the spleen, and described the excretory ducts of the prostate gland, the verumontanum, and the anteprostates.

One of the circumstances which at this time tended considerably to the improvement of anatomical science was the attention with which Comparative Anatomy was beginning to be cultivated. In ancient times, and at the revival of letters, the dissection of the lower animals was substituted for that of the human body; and the descriptions of the organs of the latter were too often derived from the former. The obloquy and contempt in which this abuse involved the study of animal anatomy caused it to be neglected, or pursued with indifference, for more than two centuries, during which anatomists confined their descriptions, at least very much, to the parts of the human body. At this period, however, the prejudice against Comparative Anatomy began to subside; and animal dissection, though not substituted for that of the human body, was employed, as it ought always to have been, to illustrate obscurities, to determine doubts and to explain difficulties, and, in short, to enlarge and rectify the knowledge of the structure of animal bodies generally.

For this revolution in its favour, Comparative Anatomy was in a great measure indebted to the learned societies which were established about this time in the different countries of Europe. Among these, the Royal Society of London, embodied by charter by Charles II. in 1662, and the Academy of Sciences of Paris, founded in 1666 by J. B. Colbert, are undoubtedly entitled to the first rank. Though later in establishment, the latter institution was distinguished by making the first great efforts in favour of Comparative Anatomy; and Claude Perrault, Pecquet, Duverney and Jean Méry, by the dissections of rare animals obtained from the royal menagerie, speedily supplied valuable materials for the anatomical naturalist. In England, Nehemiah Grew, Edward Tyson[1] and Samuel Collins[2] cultivated the same department with diligence and success. Grew has left an interesting account of the anatomical peculiarities of the intestinal canal in various animals; Tyson, in the dissection of a porpoise, an opossum and an orang outang, adduces some valuable illustrations of the comparative differences between the structure of the human body and that of the lower animals; Collins has the merit of conceiving, and executing on an enlarged plan, a comprehensive system, embodying all the information then extant (1685). With the aid of Tyson and his own researches, which were both extensive and accurate, he composed a system of anatomical knowledge in which he not only gives ample and accurate descriptions of the structure of the human body, and the various morbid changes to which the organs are liable, but illustrates the whole by accurate and interesting sketches of the peculiarities of the lower animals. The matter of this work is so excellent that it can only be ascribed to ignorance that it has received so little attention. Though regarded as a compilation, and though indeed much of the human anatomy is derived from Vesalius, it has the advantage of the works published on the continent at that time, that it embodies most of the valuable facts derived from Malpighi, Willis and Vieussens. The Comparative Anatomy is almost all original, the result of personal research and dissection; and the pathological observations, though occasionally tinged with the spirit of the times, show the author to have been endowed with the powers of observation and judicious reflexion in no ordinary degree.

Collins.

About this time also we recognize the first attempts to study the minute constitution of the tissues, by the combination of the microscope and the effects of chemical agents. Bone furnished the first instance in which this method was put in use; and though Gagliardi, who undertook the inquiry, had fallen into some mistakes which it required the observation of Malpighi to rectify, this did not deter Clopton Havers[3] and Nesbitt,[4] in England, and Courtial, H. L. Duhamel-Dumonceau and Delasone, and afterwards Herissant, in France, from resuming the same train of investigation. The mistakes into which these anatomists fell belong to the imperfect method of inquiry. The facts which they ascertained have been verified by recent experiment, and constitute no unessential part of our knowledge of the structure of bone.

Ten years after the publication of the work of Collins, Ridley,[5] another English anatomist, distinguished himself by a monograph (1695) on the brain, which, though not free from errors, contains, nevertheless, some valuable observations. Ridley is the first who distinguishes by name the restiform processes, or the posterior pyramidal eminences. He recognized the figure of the four eminences in the human subject; he remarked the mammillary bodies; and he discovered the sinus which passes under his name.

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[1] Tyson was a graduate both of Oxford and Cambridge. He was reader of anatomy at Surgeons' Hall, London.

[2] Collins was an M. D. of Padua, Oxford and Cambridge. He was physician in ordinary to Charles II.

[3] Havers was a London physician, and died in 1702.

[4] Robert Nesbitt (d. 1761) studied at Leiden and practised as a physician in London.

[5] Humphrey Ridley (1653–1708) was a London physician who studied at Leiden.

Vieussens. Raymond Vieussens, by the publication of his great work on neurography in 1684, threw new light on the configuration and structure of the brain, the spinal cord and the nerves; and gave a description of the arrangement and distribution of the latter more precise than heretofore. Of the formation and connexions of the sympathetic nerve especially he gave views which have been generally adopted by subsequent anatomists. His new arrangement of the vessels, published in 1705, contains several curious opinions. His observations on the structure of the heart, published in 1706, and enlarged in 1715, exhibit the first correct views of the intimate structure of an organ which afterwards was most fully developed by the labours of G. M. Lancisi and J. B. Senac.

To the same period (1685–1697) belong the rival publications of G. Bidloo[1] and William Cowper, the latter of whom, however, stained a reputation otherwise good by publishing as his own the engravings of the former. Cowper further distinguished himself by a minute account of the urethral glands, already known to Columbus and Méry; by a good description of the intestinal glands, discovered by Brunner and Peyer; and by demonstrating the communication of the arteries and veins of the mesentery.

The anatomical genius of Italy, which had slumbered since the death of Malpighi, was destined once more to revive in Lancisi, A. M. Valsalva, and his illustrious pupils G. D. Santorini and J. B. Morgagni. Valsalva especially distinguished himself by his description of the structure of the ear, which, in possessing still greater precision and minuteness than that of Duverney, is valuable in setting the example of rendering anatomy altogether a science of description. **Santorini.** Santorini, who was professor at Venice, was no unworthy friend of Valsalva and Morgagni. His anatomical observations, which relate to the muscles of the face, the brain and several of the nerves, the ducts of the lachrymal gland, the nose and its cavities, the larynx, the viscera of the chest and belly, and the organs of generation in the two sexes, furnish beautiful models of essays, distinguished for perspicuity, precision and novelty, above anything which had then appeared. These observations, indeed, which bear the impress of accurate observation and clear conception, may be safely compared with any anatomical writings which have appeared since. Those on the brain are particularly interesting. **Morgagni.** Morgagni, though chiefly known as a pathological anatomist, did not neglect the healthy structure. His *Adversaria*, which appeared between 1706 and 1719, and his *Epistles*, published in 1728, contain a series of observations to rectify the mistakes of previous anatomists, and to determine the characters of the healthy structure of many parts of the human body. Many parts he describes anew, and indicates facts not previously observed. All his remarks show how well he knew what true anatomical description ought to be. In this respect, indeed, the three anatomists now mentioned may be said to have anticipated their contemporaries nearly a century; for, while other authors were satisfied with giving loose and inaccurate or meagre notices of parts, with much fanciful supposition, Valsalva, Santorini and Morgagni laboured to determine with precision the anatomical characters of the parts which they describe.

Winslow. The same character is due to J. B. Winslow (1669–1760), a native of Denmark, but, as pupil and successor of Duverney, as well as a convert to Catholicism, naturalized in France, and finally professor of anatomy at the Royal Gardens. His exposition of the structure of the human body is distinguished for being not only the first treatise of descriptive anatomy, divested of physiological details and hypothetical explanations foreign to the subject, but for being a close description derived from actual objects, without reference to the writings of previous anatomists. About the same time W. Cheselden in London, the first Alexander Monro in Edinburgh, and B. S. Albinus in Leiden, contributed by their several treatises to render anatomy still more precise as a descriptive science. The *Osteographia* of the first-mentioned was of much use in directing attention to the study of the skeleton and the morbid changes to which it is liable. **Albinus.** This work, however, magnificent as it was, was excelled by that of Albinus, who in 1747 published engravings, executed by Jan Wandelaar (1691–1759), of the bones and muscles, which had never been surpassed in accuracy of outline or beauty of execution. The several labours of Albinus, indeed, constitute an important era in the history of the science. He was the first who classified and exhibited the muscles in a proper arrangement, and applied to them a nomenclature which is still retained by the consent of the best anatomists. He gives a luminous account of the arteries and veins of the intestines, represents with singular fidelity and beauty the bones of the foetus, inquires into the structure of the skin and the cause of its colour in different races; represents the changes incident to the womb in different periods of pregnancy, and describes the relations of the thoracic duct and the vena azygos with the contiguous parts. Besides these large and magnificent works, illustrated by the most beautiful engravings, six books of Academical Annotations were the fruits of his long and assiduous cultivation of anatomy. These contain valuable remarks on the second structure and morbid deviations of numerous parts of the human body.

Haller. Albinus found a worthy successor in his pupil Albert von Haller (1708–1777), who, with a mind imbued with every department of literature and science, directed his chief attention, nevertheless, to the cultivation of anatomical and physiological knowledge. Having undertaken at an early age (twenty-one) to illustrate, with commentaries, the physiological prelections of his preceptor H. Boerhaave, he devoted himself assiduously to the perusal of every work which could tend to facilitate his purpose; and, as he found numerous erroneous or imperfect statements, and many deficiencies to supply, he undertook an extensive course of dissection of human and animal bodies to obtain the requisite information. During the seventeen years he was professor at Göttingen, he dissected 400 bodies, and inspected their organs with the utmost care. The result of these assiduous labours appeared at intervals in the form of dissertations by himself, or under the name of some one of his pupils, finally published in a collected shape between 1746 and 1751 (*Disputationes Anatomicae Selectiores*), and in eight numbers of most accurate and beautiful engravings, representing the most important parts of the human body, *e.g.* the diaphragm, the uterus, ovaries and vagina, the arteries of the different regions and organs, with learned and critical explanatory observations. He verified the observations that in the foetus the testicles lie in the abdomen, and showed that their descent into the scrotum may be complicated with the formation of congenital hernia. Some years after, when he had retired from his academical duties at Göttingen, he published between 1757 and 1765 the large and elaborate work which, with singular modesty, he styled *Elements of Physiology*. This work, though professedly devoted to physiology, rendered, nevertheless, the most essentially services to anatomy. Haller, drawing an accurate line of distinction between the two, gave the most clear, precise and complete descriptions of the situation, position, figure, component parts and minute structure of the different organs and their appendages. The results of previous and coeval inquiry, obtained by extensive reading, he sedulously verified by personal observation; and though he never rejected facts stated on credible authorities, he in all cases laboured to ascertain their real value by experiment. The anatomical descriptions are on this account not only the most valuable part of his work, but the most valuable that had then or for a long time after appeared. It is painful, nevertheless, to think that the very form in which this work is composed, with copious and scrupulous reference to authorities, made it be regarded as a compilation only; and that the author was compelled to show, by a list of his personal researches, that the most learned work ever given to the physiologist was also the most abundant in original information.

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[1] Bidloo was a Dutch anatomist and Cowper a London surgeon.

With the researches of Haller it is proper to notice those of his contemporaries, John Frederick Meckel, J. N. Lieberkühn, and his pupil John Godfrey Zinn. The first, who was professor of anatomy at Berlin, described the Casserian ganglion, the first pair of nerves and its distribution and that of the facial nerves generally, and discovered the spheno-palatine ganglion (1748–1751). He made some original and judicious observations on the tissue of the skin and the mucous net (1753–1757); and above all, he recognized the connexion of the lymphatic vessels with the veins—a doctrine which, after long neglect, was revived by Vincent Fohmann (1794–1837) and Lippi. He also collected several valuable observations on the morbid states of the heart and brain. Lieberkühn published in 1745 a dissertation on the villi and glands of the small intestines. Zinn, who was professor of medicine at Göttingen, published a classical treatise on the eye (1755), which demonstrated at once the defects of previous inquiries, and how much it was possible to elucidate, by accurate research and precise description, the structure of one of the most important organs of the human frame. It was republished after his death by H. A. Wrisberg (1780). About the same time J. Weitbrecht gave a copious and minute account of the ligaments, and J. Lieutaud (1703–1780), who had already laboured to rectify many errors in anatomy, described with care the structure and relations of the heart and its cavities, and rendered the anatomy of the bladder very precise, by describing the triangular space and the mammillary eminence at its neck.

W. Hunter.

The study of the minute anatomy of the tissues, which had originally been commenced by Leeuwenhoek, Malpighi and Ruysch, began at this period to attract more general attention. Karl August von Bergen had already demonstrated (1732) the general distribution of cellular membrane, and showed that it not only incloses every part of the animal frame, but forms the basis of every organ—a doctrine which was adopted and still more fully expanded (1757) by his friend Haller, in opposition to what was asserted by Albinus, who maintains that each part has a proper tissue. William Hunter at the same time gave a clear and ingenious statement of the difference between cellular membrane and adipose tissue (1757), in which he maintained the general distribution of the former, and represented it as forming the serous membranes, and regulating their physiological and pathological properties—doctrines which were afterwards confirmed by his brother John Hunter. A few years after, the department of general anatomy first assumed a substantial form in the systematic view of the membranes and their mutual connexions traced by Andrew Bonn of Amsterdam. In his inaugural dissertation *De Continuationibus Membranarum*, published at Leiden in 1763, this author, after some preliminary observations on membranes in general and their structure, and an exposition of that of the skin, traces its transition into the mucous membranes and their several divisions. He then explains the distribution of the cellular membrane, the aponeurotic expansions, and the periosteum and perichondrium, by either of which, he shows, every bone of the skeleton is invested and connected. He finally gives a very distinct view of the arrangement of the internal membranes of cavities, those named serous and fibro-serous, and the manner of their distribution over the contained organs. This essay, which is a happy example of generalization, is remarkable for the interesting general views of the structure of the animal body which it exhibits; and to Bonn belongs the merit of sketching the first outlines of that system which it was reserved for the genius of M. F. X. Bichat to complete and embellish. Lastly, T. de Bordeu, in an elaborate essay (1767) on the mucous tissue, or cellular organ, as he terms it, brought forward some interesting views of the constitution, nature and extent of the cellular membrane.

A. Bonn.

Though anatomy was hitherto cultivated with much success as illustrating the natural history and morbid states of the human body, yet little had been done for the elucidation of local diseases, and the surgical means by which they may be successfully treated. The idea of applying anatomical knowledge directly to this purpose appears to have originated with Bernardin Genga, a Roman surgeon, who published in 1672, at Rome, a work entitled *Surgical Anatomy, or the Anatomical History of the Bones and Muscles of the Human Body, with the Description of the Blood-vessels*. This work, which reached a second edition in 1687, is highly creditable to the author, who appears to have studied intimately the mutual relations of different parts. It is not improbable that the example of Genga led J. Palfyn, a surgeon at Ghent, to undertake a similar task about thirty years after (1718–1726). For this, however, he was by no means well qualified; and the work of Palfyn, though bearing the name of *Surgical Anatomy*, is a miserable compilation, meagre in details, inaccurate in description, and altogether unworthy of the honour of being republished, as it afterwards was by Antony Petit.

Camper.

While these two authors, however, were usefully employed in showing what was wanted for the surgeon, others were occupied in the collection of new and more accurate facts. Albinus, indeed, ever assiduous, had, in his account of the operations of Rau, given some good sketches of the relative anatomy of the bladder and urethra; and Cheselden had already, in his mode of cutting into the urinary bladder, shown the necessity of an exact knowledge of the relations of contiguous parts. The first decided application, however, of this species of anatomical research it was reserved for a Dutch anatomist of the 18th century to make. Peter Camper, professor of anatomy at Amsterdam, published in 1760 and 1762 his anatomico-pathological demonstrations of the parts of the human arm and pelvis, of the diseases incident to them, and the mode of relieving them by operation, and explained with great clearness the situation of the blood-vessels, nerves and important muscles. His remarks on the lateral operation of lithotomy, which contain all that was then known on the subject, are exceedingly interesting and valuable to the surgeon. It appears, further, that he was the first who examined anatomically the mechanism of ruptures, his delineations of which were published in 1801 by S. T. Sömmerring. Camper also wrote some important memoirs on Comparative Anatomy, and he was the author of a well-known work on the *Relations of Anatomy to the Fine Arts*.

W. and J. Hunter.

Hewson.

The attention of anatomists was now directed to the elucidation of the most obscure and least explored parts of the human frame—the lymphatic vessels and the nerves. Although, since the first discovery of the former by Aselli, Rudbeck and Pecquet, much had been done, especially by Ruysch, Nuck, Meckel and Haller, many points, notwithstanding, relating to their origin and distribution in particular organs, and in the several classes of animals, were imperfectly ascertained or entirely unknown. William Hunter investigated their arrangement, and proposed the doctrine that they are absorbents; and John Hunter, who undertook to demonstrate the truth of this hypothesis by experiment, discovered, in 1758, lymphatics in the neck in birds. As the doctrine required the existence of this order of vessels, not only in quadrupeds and birds but in reptiles and fishes, the inquiry attracted attention among the pupils of Hunter; and William Hewson[1] at length communicated, in December 1768, to the Royal Society of London an account of the lacteals and lymphatics in birds, fishes and reptiles, as he had discovered and demonstrated them. The subject was about the same time investigated by the second Alexander Monro, who indeed claimed the merit of discovering these vessels in the classes of animals now mentioned. But whatever researches this anatomist may have instituted, Hewson, by communicating his observations to the Royal Society, must be allowed to possess the strongest as well as the clearest claim to discovery. The same author, in 1774, gave the first complete account of the anatomical peculiarities of the lymphatic system in man and other animals, and thereby supplied an important gap in this department. Hewson is the first who distinguishes the lymphatics into two orders—the superficial and the deep—both in the extremities and in the internal organs. He also studied the structure of the intestinal villi, in which he verified the observations of Lieberkühn; and he made many important observations on the corpuscles of the lymph and blood. He finally applied his anatomical discoveries to explain many of the physiological and pathological phenomena of the animal body. Ten years after, John Sheldon, another pupil of Hunter, gave a second history and description of the lymphatics, which, though divested of the charm of novelty, contains many interesting anatomical facts. He also examined the structure of the villi.

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[1] Hewson was a partner with William Hunter in the Windmill Street School of Anatomy.

Cruikshank.

Lastly, Cruikshank,[1] in 1786, published a valuable history of the anatomy of the lymphatic system, in which he maintains the accuracy of the Hunterian doctrine, that the lymphatics are the only absorbents; gave a more minute account than heretofore of these vessels, of their coats and valves; and explained the structure of the lymphatic glands. He also injected the villi, and examined them microscopically, verifying most of the observations of Lieberkühn. The origin of the lymphatics he maintains rather by inference than direct demonstration. To these three works, though in other respects very excellent, it is a considerable objection that the anatomical descriptions are much mixed with hypothetical speculation and reasonings on properties, and that the facts are by no means always distinguished from mere matters of opinion. At the same time J. G. Haase published an account of the lymphatics of the skin and intestines, and the plexiform nets of the pelvis.

Mascagni.

To complete this sketch of the history of the anatomy of the lymphatic system, it may be added that Paolo Mascagni, who had been engaged from the year 1777 to 1781 in the same train of investigation, first demonstrated to his pupils several curious facts relating to the anatomy of the lymphatic system. When at Florence in 1782 he made several preparations, at the request of Peter Leopold, grand duke of Tuscany; and when the Royal Academy of Sciences at Paris announced the anatomy of this system for their prize essay appointed for March 1784, Mascagni resolved on communicating to the public the results of his researches—the first part of his commentary, with four engravings. Anxiety, however, to complete his preparations detained him at Florence till the close of 1785; and from these causes his work did not appear till 1787. These delays, however, unfavourable as they were to his claims of priority to Sheldon and Cruikshank, were on the whole advantageous to the perfection of his work, which is not only the most magnificent, but also the most complete that ever was published on the lymphatics. In his account of the vessels and their valves he confirms some of Hewson's observations and rectifies others. Their origin he proves by inference much in the same manner as Cruikshank; but he anticipates this author in the account of the glands, and he gives the most minute description of the superficial and deep lymphatics, both in the members and in the internal organs.

General accounts of the nerves had been given with various degrees of accuracy by Willis, Vieussens, Winslow, and the first Monro; and the subject had been much rectified and improved by the indefatigable Haller. The first example of minute descriptive neurography was given in 1748 by John Frederick Meckel, whose account of the fifth pair and of the nerves of the face will long remain a lasting proof of accuracy and research. The same subject was investigated in 1765 by Hirsch and in 1777 by Wrisberg. In 1766 Metzger examined the origin, distribution and termination of the first pair—a point which was afterwards very minutely treated by A. Scarpa[2] in his anatomical disquisitions, published in 1780; and the internal nerves of the nostrils were examined in 1791 by Haase. The optic nerve, which had been studied originally by Varoli, and afterwards by Méry, Duverney, J. F. Henkel, Moeller, Hein and Kaldschmid, was examined with extreme accuracy, with the other nerves of the organ of vision, by Zinn in his elaborate treatise. The phrenic nerves and the oesophageal branches of the vagus were studied by Haase; the phrenic, the abdominal and the pharyngeal nerves, by Wrisberg; those of the heart most minutely by Andersch; and the origins, formation and distribution of the intercostal nerves, by Iwanov, C. G. Ludwig, and Girardi. The labours of these anatomists, however, were eclipsed by the splendid works of Walter (1783) on the nerves of the chest and belly; and those of Scarpa (1794) on the distribution of the eighth pair and splanchnic nerves in general. In minuteness of description and in beauty of engraving these works have not yet been equalled, and will never perhaps be surpassed. About the same time, Scarpa, so distinguished in every branch of anatomical research, investigated the minute structure of the ganglions and plexuses. The anatomy of the brain itself was also studied (1780) with great attention by the second Monro, M. V. G. Malacarne and Vicq d'Azyr.

Lastly, the anatomy of the gravid uterus, which had been originally studied by Albinus, Roederer and Smellie, was again illustrated (1774) most completely by William Hunter, whose engravings will remain a lasting memorial of scientific zeal and artistic talent.

19th century.

The perfection which anatomical science attained in the last ten years of the 18th and during the 19th century is evinced not only in the improved character of the systems published by anatomists, but in the enormous advance which has taken place in the knowledge of the minute structure of the animal tissues, of the development of the tissues and organs, and of the modifications in form and structure exhibited by various groups of animals.

Sömmerring.

The first who gave a good modern system was R. B. Sabatier; but his work was speedily eclipsed by the superior merits of the treatises of Sömmerring, Bichat and Portal. The excellent work by Samuel Thomas Sömmerring, originally published in the German language, between the years 1791 and 1796; then in the Latin language, between the years 1794 and 1800; and in a second edition in the German language in 1800 and 1801, maintaining the high character which it first possessed for clear arrangement, accurate description and general precision, was, between the years 1841 and 1844, republished in eight volumes at Leipzig by Th. L. W. Bischoff, F. G. J. Henle, E. H. Huschke, Theile, G. G. Valentin, Vogel, and R. Wagner, with suitable additions, and a large amount of new and accurate information. In this edition Rudolph Wagner gives, in the first division of the first volume, the life, correspondence and literary writings of Sömmerring; and in the second volume the anatomy of the bones and ligaments. The third volume contains the anatomy of the muscles and the vascular system by Theile. G. G. Valentin devotes one volume, the fourth, to the minute anatomy of the nervous system and its parts, as disclosed by careful examination by the microscope; and it must be allowed that the author has been at great pains to present just views of the true anatomy of the brain, the spinal cord, the nervous branches and the ganglia. In the fifth volume, E. H. Huschke of Jena gives the anatomical history of the viscera and the organs of the senses, a department which had been left in some degree incomplete in the original, but for one division of which the author had left useful materials in his large figures already mentioned. In the sixth volume, an entire and complete system of general anatomy, deduced from personal observation and that of other careful observers, the materials being in general new, and in all instances confirmed and rectified, is given by F. G. J. Henle. The seventh volume contains the history of the process of development in mammalia and man, by Th. L. W. Bischoff. The eighth volume treats of the pathological anatomy of the human body, by Julius Vogel, but contains only the first division, relating to the generalities of the subject. This, which is probably the most accurate as it is the most elaborate system of anatomical knowledge up to the date of its publication in 1844, was translated into the French language by Jourdan, and published in 1846 under the name of *Encyclopédie anatomique*. The eighth volume was translated into English in the year 1847.

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[1] W. Cruikshank followed W. Hunter as lecturer at the Windmill Street school.

[2] Scarpa was professor of anatomy at Modena and Pavia.

Bichat.

French systematic anatomists.

The *Anatomie générale* of M. F. X. Bichat is a monument of his philosophical genius which will last as long as the structure and functions of the human body are objects of interest. His *Anatomie descriptive* is distinguished by clear and natural arrangement, precise and accurate description, and the general ingenuity with which the subject is treated. The physiological observations are in general correct, often novel, and always highly interesting. It is unfortunate, however, that the ingenious author was cut off prematurely during the preparation of the third volume. The later volumes are, however, pervaded with the general spirit by which the others are impressed, and are highly creditable to the learning, the judgment and the diligence of P. J. Roux and M. F. R. Buisson. The system of A. Portal is a valuable and correct digest of anatomical and pathological knowledge, which, in exact literary information, is worthy of the author of the *Histoire de l'anatomie et de la chirurgie*, and, in accuracy of descriptive details, shows that Portal trusted not to the labours of his predecessors only. A. Boyer published in 1803 a complete treatise on descriptive anatomy. H. Cloquet formed, on the model of the *Anatomie descriptive* of Bichat, a system in which he avails himself of the literature and precision of Sömmerring and the details of Portal. An English translation of this work was prepared by Dr Robert Knox. Jean Cruveilhier published in 1834–1835 a good general treatise on descriptive anatomy, which was translated into English, and published as a part of *The Library of Medicine*. Cruveilhier's treatise has passed through several editions. The most elaborate work of the French school is the great treatise of M. J. Bourgery, consisting of four divisions, on descriptive, general, surgical and philosophical anatomy (1832–1854). These are beautifully illustrated.

MODERN HUMAN ANATOMY (*Anthropotomy*)

The history of modern human anatomy in Great Britain begins with the time at which the dissection of the human body became part of the training of students of medicine, and this is one of the greatest debts, though by no means the best recognized, of the many which medical science owes to that remarkable man William Hunter. Before his time the anatomy professors of the most celebrated schools both at home and abroad used one or at most two subjects to illustrate their courses of lectures, and were in the habit of demonstrating the performance of surgical operations not on human bodies but on those of lower animals. Few students dissected the human body, because for such dissection they had no opportunities. The English law, since the time of Henry VIII., allowed only the bodies of persons executed for murder to be dissected, and the supply seems to have been sufficient for the humble needs of the time. The reformation of this antiquated and imperfect system took place in 1747, when Hunter established complete courses of anatomical lectures and opened a school for dissection. The practice of dissection grew so rapidly that by about 1793 there were 200 regular anatomy students in London, while in 1823 their number was computed at about 1000. Of course the supply of murderers was not enough for all these students, and the very fact that only murderers were allowed for this purpose made people bitterly hostile to the bodies of their relations and friends being dissected. In accounting for the great aversion which there has always been from dissection in England, it should be remembered that, although capital punishment was the penalty for very many offences at the beginning of the 19th century, only the bodies of murderers were handed over to the anatomists.

When once the absolute necessity of a surgeon's having a good knowledge of anatomy was realized, bodies had to be procured at any hazard, and the chief method was to dig them up as soon as possible after their burial. This practice of exhumation or "body-snatching" on a large scale seems to have been peculiar to Great Britain and America, and not to have been needed on the continent of Europe. In France, Italy, Portugal and Austria no popular objection was raised to the bodies of friendless people, who died in hospitals, or of those whose burial was paid for by the state, being dissected, provided a proper religious service was held over them. In Germany it was obligatory that the bodies of all people unable to pay for their burials, all dying in prisons, all suicides and public women should be given up. In all these countries the supply was most ample, exhumation was unknown, and the cost of learning anatomy to the students was very moderate. In Great Britain the earlier exhumations seem to have caused very little popular concern; Hunter, it is said, could manage to get the body of any person he wanted, were it that of giant, dwarf, hunchback or lord, but later, when the number of students increased very rapidly, the trade of "resurrection man" became commoner, and attracted the lowest dregs of the vicious classes. It is computed that in 1828 about 200 people were engaged in it in London alone, though only a few gained their entire livelihood by it. In the first half of the 18th century, and for some time afterwards, the few dissections which were undertaken were carried out in the private houses of medical men. In 1702 a rule was passed at St Thomas's Hospital preventing the surgeons or pupils from dissecting bodies there without the express permission of the treasurer, but by 1780 this rule seems to have lapsed, and a definite dissecting-room was established, an example which was soon followed by Guy's and St Bartholomew's.

In the early years of the 19th century the number of students increased so rapidly that a good many private anatomy schools grew up, and in 1828 we find that the total list of London dissecting rooms comprised those of Guy's, London, St Bartholomew's and St Thomas's hospitals, the Webb Street school of Mr Grainger, the Aldersgate school of Mr Tyrrell, the Windmill Street school where Caesar Hawkins and Herbert Mayo lectured, and the schools of Messrs. Bennett, Carpue, Dermott and Sleigh. These schools needed and, it seems, obtained nearly 800 bodies a year in the years about 1823, when there were nearly 1000 students in London, and it is recorded that bodies were even sent to Edinburgh and Oxford.

When it is realised that the greater number of these were exhumed, it is easy to understand how hostile the public feeling became to the body-snatchers or "resurrection men," and also in a modified form to the teachers of anatomy and medical students. This was increased by the fact that it soon became well known that many of the so-called resurrection men only used their calling as a cloak for robbery, because, if they were stopped with a horse and cart by the watch at night, the presence of a body on the top of stolen goods was sufficient to avert suspicion and search. It is in many places suggested, though not definitely stated, that the Home Office authorities understood how absolutely necessary it was that medical students should learn the details of the human body, on which they would be called to operate, and that the police had instructions not to interfere more than was necessary with the only method by which that education could be supplied, however unlawful it might be. So emboldened and careless did these body-snatchers become, and so great was the demand for bodies, that they no longer confined themselves to pauper graves, but took the remains of the wealthier classes, who were in a position to resent it more effectually; often they did not even take the trouble to fill in the graves after rifling their contents, and, in consequence, many sextons, who no doubt had been bribed, lost their posts, and men armed with firearms watched the London burial-places at night. The result of this was that the "resurrection men" had to go farther afield, and their occupation was attended with considerable danger, so that the price of a body gradually rose from £2 to about £14, which seems the maximum ever paid. In addition to this heavy sum the anatomical teachers had to pay the fines of the exhumers when they were caught, or to support their families when they were imprisoned. By 1828 the annual supply of bodies had dropped to about 450, and about 200 English students were forced each year to go to Paris for their anatomical instruction. There they could get a body for about seven francs and could also be taught by English anatomists who settled in that city for the purpose.

As early as about 1810 an anatomical society was formed, to impress on the government the necessity for an alteration in the law, and among the members we find the names of John Abernethy, Charles Bell, Everard Home, Benjamin Brodie, Astley Cooper and Henry Cline. It was owing to the exertions of this body that in 1828 a select committee was appointed by the government to report on the whole question, and to the minutes of evidence taken before this body the reader is referred for further details.

The report of this committee led to the Anatomy Act of 1832, but there can be little doubt that its passage through the House was expedited by the recent discovery and arrest of the infamous William Burke and William Hare, who, owing to the extreme difficulty of procuring subjects for dissection in Edinburgh and the high price paid for them, had made a practice of enticing men to their lodgings and then drugging and suffocating them in order to sell their bodies to Dr Knox. Hare turned king's evidence but Burke was executed. (See MacGregor's *History of Burke and Hare*, 1884, Lonsdale's *Life and Writings of Robert Knox*, 1870. Many further details connected with the condition of anatomy, especially in Dublin, before the passing of the Anatomy Act, will be found in *Memoirs of James Macartney* by Professor A. Macalister, F.R.S.) The bill to legalize and regulate the supply of subjects for dissection did not pass without considerable opposition. In 1829 the College of Surgeons petitioned against it, and it was withdrawn in the House of Lords owing to the opposition of the archbishop of Canterbury, but in 1832 a new Anatomy Bill was introduced, which, though violently opposed by Messrs Hunt, Sadler and Vyvyan, was supported by Macaulay and O'Connell, and finally passed the House of Lords on the 19th of July 1832.

This is the act which governs the practice of anatomy in the British Isles up to the present day, and which has only been slightly modified as to the time during which bodies may be kept unburied in the schools. It provides that any one intending to practise anatomy must obtain a licence from the home secretary. As a matter of fact only one or two teachers in each institution take out this licence and are known as licensed teachers, but they accept the whole responsibility for the proper treatment of all bodies dissected in the building for which their licence is granted. Watching over these licensed teachers, and receiving constant reports from them, are four inspectors of anatomy, one each for England, Scotland, Ireland and London, who report to the home secretary and know the whereabouts of every body which is being dissected. The main clause of the act is the seventh, which says that a person having lawful possession of a body may permit it to undergo anatomical examination provided no relative objects; the other clauses are subsidiary and detail the methods of carrying this into effect. In clause 16, however, the old act of Henry VIII. is repealed and the bodies of murderers are no longer to be given up for dissection after execution.

There can be little doubt that this act has worked well and with a minimum of friction; it at once did away with body-snatching and crimes like those of Burke and Hare. No licensed teacher now could or would receive a body without a medical certificate and a warrant from the inspector of anatomy, and, when the bodies are buried, a proper religious service, according to the creed professed during life, is provided. The great majority of bodies are those of unclaimed poor in the workhouse infirmaries, but a few are obtained each year from the general hospitals. Occasionally a well-to-do person, following the example of Jeremy Bentham, leaves his body for the advancement of science, but even then, if his relatives object, it is not received.

The ample supply of subjects obtained by legitimate means which the anatomy act provided was followed by the opening of anatomical schools at all the great London hospitals and the universities, with the result that anatomical research was stimulated and text-books embodying the latest discoveries were brought out. It is wonderful, however, how much descriptive anatomy was taught in the days before text-books were common and how much of what is essential to the study of surgery and medicine the students knew. In looking through an old book of anatomical questions and answers dated 1812, one is struck by the fact that any one working through them with the body would probably pass an average modern anatomical examination to-day.

The various phases which anatomy in the British Isles has passed through have also been experienced in America, though it is difficult to compare the two countries owing to the fact that each state in the Union makes its own laws as to dissection, and that these vary considerably. The first anatomy act worthy of the name was that of Massachusetts, and was passed in 1831, one year before the British act. There is reason to believe, however, that, in some states, all the evils of body-snatching existed up to the end of the 19th century. In some more enlightened states, such as Pennsylvania and Massachusetts, the modern acts are in advance of the British in that they are mandatory instead of permissive, and their compulsory nature is found rather to reduce than to increase public opposition to dissection. A study of the history of anatomy in the United States during the 19th century furnishes an instructive lesson on the futility of attempting to suppress dissection by legislation and on the serious and sometimes terrible crimes to which any such attempt naturally leads. It also teaches that, when unclaimed bodies *must* be given up and *must* be treated reverently and buried decently, there is less friction than when public boards have the right of arbitrarily refusing to allow their unclaimed dead to be used for the service of the living.

In all the important countries of Europe, with the exception of Russia and Turkey, anatomy acts exist. They almost all differ from the British act in being mandatory instead of permissive; in other words, certain unclaimed bodies must be given up to the schools of anatomy. As a rule these come from the general hospitals, but sometimes, as in Germany, Austria and Sweden, suicides are received and form a considerable part of the whole number. Even where executed criminals are available they nowadays form a negligible contribution, but the unclaimed bodies of people dying in prison are provided for in the French, Belgian, Norwegian, Swedish, German and Italian regulations, and in Paris they form an important element of the supply. In Russia several attempts to gain an anatomy act have been made, but have always been opposed by those in authority, and there is good reason to believe that bodies are procured by bribing hospital and mortuary attendants. It is said that the army contributes a large percentage of the total number. In Turkey no facilities for dissecting the dead body exist, as the practice is against the Mahommedan religion; the German pathologists in Turkey, however, insist on making *post mortem* examinations. In the British colonies anatomical regulations vary a good deal; sometimes, as in New South Wales, the act is founded on that of Great Britain and is permissive, but in Victoria the minister may authorize the medical officer of any public institution supported wholly or in part by funds from the general revenue to permit unclaimed bodies to be dissected, provided the persons, during life had not expressed a wish against it. This act in its working is equivalent to a mandatory one, since the power of refusing bodies is not left in the hands of, in this respect, uneducated poor law guardians.

In the early years of the 19th century Sir Charles Bell's work on human anatomy is by far the most important in the British Isles. He wrote the article on the nerves in his brother John Bell's work on the anatomy of the human body, as well as his own classical works on the anatomy of expression, the hand and the arteries; but his chief work was the discovery of the difference between motor and sensory nerves. Sir Astley Cooper brought out his beautifully illustrated monograph on hernia in 1807. Besides these, the Edinburgh school had contributed the systematic treatises of Andrew Fyfe, John Bell, the third Monro and John Gordon. In 1828 appeared the first edition of Quain's *Anatomy*, written by Jones Quain. This monumental work, which is still among the very first of English text-books, has run through ten editions, and is of even greater value to the teacher and researcher than to the medical student, because of its excellent bibliographies and the way in which it has been kept abreast of modern morphological knowledge by its various editors. Hardly any of the original work now remains. In 1858 another famous text-book on systematic anatomy appeared, written by Henry Gray, and this has always been particularly popular with students both in Great Britain and in America; it pays more attention to the surgical applications of anatomy than to the scientific and morphological side, and has reached its sixteenth edition.

The *Cyclopedia of Anatomy and Physiology*, edited by Dr Robert Todd from 1835 to 1859, which contained articles on both human and comparative anatomy, is now somewhat out of date, but did much for the advancement of the science when it appeared.

In 1893 a text-book written by several authors and edited by Henry Morris appeared. It has run through three editions and is especially popular in America. The latest English systematic work of first-rate importance is the splendid compilation edited by D. J. Cunningham (1902) and written, with one or two exceptions, by pupils of the veteran anatomist Sir William Turner. It is dedicated to him and will long serve as a memento of the work which he has done in training anatomists for the whole of the British empire. Besides these systematic treatises, many dissecting manuals have been published. The earliest were the *Dublin Dissector* and the *London Dissector*; others still in use are those of G. V. Ellis, C. Heath, D. J. Cunningham, and J. Cleland and J. Mackay. In 1889 Professor A. Macalister published a book on anatomy, which combined the advantages of a text-book with those of a dissecting guide.

In America the English text-books are largely used in addition to that edited by F. H. Gerrish. There is a special American edition of Gray.

Many systematic works on modern anatomy have come from Germany. J. F. Meckel, J. C. Rosenmüller, C. F. Krause, G. F. Hildebrandt, J. Hyrtl, H. Luschka and A. Meyer have all published works which have made their mark, but by far the most important, and, as some consider, still the best of all anatomical text-books, is that of F. G. J. Henle, professor of anatomy in Göttingen, which was completed in 1873. The beautiful illustrations of frozen specimens of the body brought out by W. Braune added a great deal to the student's opportunities of learning the relations of the various structures, and are largely used all over the world. Rudinger's *Anatomy* also contains many plates showing various sections, but the most complete text-book in the German language is that by Prof. Karl von Bardeleben of Jena; this is in eight volumes and contains notices of the latest literature on descriptive and morphological anatomy by the most prominent German anatomists. In addition to these W. Spalteholz and C. Toldt have brought out valuable atlases. In France J. Testut's and Poirier's anatomies, both of great excellence and beautifully illustrated, are the ones in common use.

There are two epoch-making dates in the history of modern English anatomy besides that of the passing of the Anatomy Act in 1832. The first of these is 1867, when the first volume of the *Journal of Anatomy and Physiology* appeared. This afforded a medium for English anatomists to publish their original work, besides containing valuable reviews and notices of books and work published abroad; it has appeared quarterly without a break since that time, and was long under the immediate direction of Sir William Turner.

The second date is 1887, when the Anatomical Society of Great Britain and Ireland was founded through the exertions of Mr C. B. Lockwood. It meets three times a year in London and once, in the summer, at some provincial school. It numbers some one hundred and fifty members, and enables anatomists from the whole British empire to meet one another and discuss subjects of common interest. Its first president was Prof. Murray Humphry of Cambridge, and its official organ is the *Journal of Anatomy and Physiology*.

No account of modern anatomical work would be complete without drawing attention to the great mass of special periodical literature containing the records of original work which are being published. It is said that some three or four thousand articles on anatomy appear in six hundred journals each year. To mention a few of these, in addition to the British *Journal of Anatomy and Physiology* there is an American *Journal of Anatomy*, the French *Bulletin et mémoires de la société anatomique*, and *La journal de l'anatomie et de la physiologie*, and the German *Internationale Monatschrift für Anatomie und Physiologie*, *Anatomischer Anzeiger*, Waldeyer's *Archiv für Anatomie und Physiologie*, Schwalbe's *Zeitschrift für Morphologie und Anthropologie*, Gegenbaur's *Morphologisches Jahrbuch*, edited by Ruge, and Merkel's *Anatomische Hefte*.

Unfortunately the outlook of anatomy in Great Britain is not altogether satisfactory. The number of subjects for dissection has since 1895 been steadily diminishing, especially in London. This is due partly to the modern system of insuring lives for small sums and so decreasing the number of unclaimed bodies, and partly to the fact that, owing to the permissive nature of the British Anatomy Act, several boards of guardians will not allow even unclaimed bodies to be used for dissection and for the teaching of operative surgery. It is not popularly understood that a dearth of bodies means not only a check to abstract science, but a serious handicap to medical education, which must react more upon the poor than upon the rich, since the latter can afford to pay for the services of medical men educated abroad, where no difficulties are placed in the way of their learning fully the structure of the body they have to treat in disease. (F. G. P.)

ANATOMY—SUPERFICIAL AND ARTISTIC

The objects of the study of superficial anatomy are to show, first, the form and proportions of the human body and, second, the surface landmarks which correspond to deeper structures hidden from view. This study blends imperceptibly with others, such as physical anthropology, physiognomy, phrenology and palmistry, but whereas these deal chiefly with variations, superficial anatomy is concerned with the type.

With regard to the proportions of the body the artist and anatomist approach the subject from a slightly different point of view. The former, by a process of artistic selection, seeks the ideal and adopts the proportions which give the most pleasing effect, while the latter desires to know only the mean of a large series of measurements.

The scheme which Dr Paul Richer suggests (*Anatomie artistique*, Paris, 1890), and Professor Arthur Thomson approves (*Anatomy for Art Students*, 1896), is to divide the whole body into head-lengths, of which seven and a half make up the stature. Four of these are above the fork and three and a half below (see figs. 1 and 2). Of the four above, one forms the head and face, the second reaches from the chin to the level of the nipples, the third from the nipples to the navel, and the fourth from there to the fork. By dividing these into half-heads other points can be determined; for instance the middle of the first head-length corresponds to the eyes, the middle of the second to the shoulder, of the fourth to the top of the hip-joint, and of the fifth to the knee-joint.

The elbow-joint, when the arms are by the side, is a little above the lower limit of the third head-length, whilst the wrist is opposite the very centre of the stature, three head-lengths and three-quarters from the crown or the soles. The tips of the fingers reach a little below the middle of the fifth head-length. (In fig. 1 the fingers are bent.) By making the stature eight head-lengths instead of seven and a half the artistic effect is increased, as it is also by slightly lengthening the legs in proportion to the body. Approximate average breadth measurements are two heads for the greatest width of the shoulders, one and a half for the greatest width of the hips, one for the narrowest part of the waist, and three-quarters for the breadth of the head on a level with the eyes.

The relation of superficial landmarks to deep structures cannot be treated here in full detail, but the chief points may be indicated. Certain parts of the head may easily be felt through the skin. If the finger is run along the upper margin of the orbit, the notch for the supraorbital nerve may usually be felt at the junction of the inner and middle thirds. At the outer end of the margin is its junction with the malar bone, and this easily felt point is known as the external angular process. The junction of the frontal and nasal bones at the root of the nose is the nasion, while at the back of the skull the external occipital protuberance or inion is felt and marks the position of the torcular Herophili, where the venous sinuses meet. The zygoma may be felt running back from the malar bone to just in front of the ear, and two fingers' breadth above the middle of it marks the pterion, a very important point in the localization of intracranial structures. It corresponds to the anterior branch of the middle meningeal artery, to the Sylvian point where the three limbs of the fissure of Sylvius diverge, to the middle cerebral artery, the central lobe of the brain or island of Reil, and the anterior part of the corpus striatum. The fissure of Sylvius can be marked out by drawing a line from the external angular process back through the Sylvian point to the lower part of the parietal eminence.

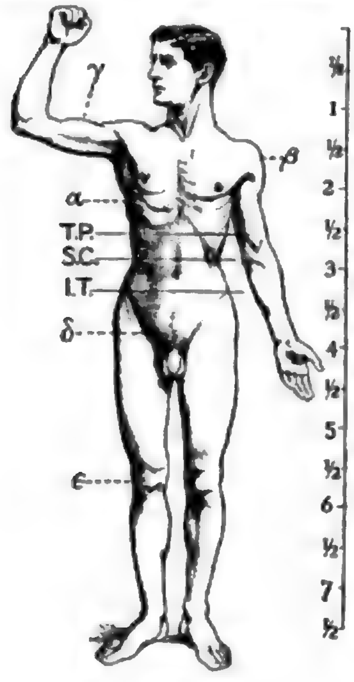

FIG. 1.

- α, Serratus magnus.
- β, Deltoid.
- γ, Biceps.
- δ, Poupart's ligament.
- ε, Patella.
- T.P. Transpyloric plane.
- S.C. Subcostal plane.
- I.T. Intertubercular plane.

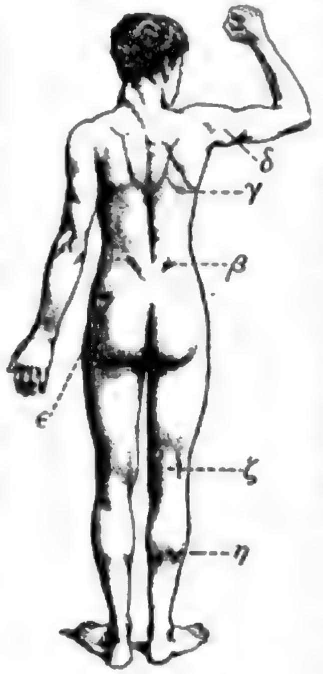

FIG. 2.

- β, Dimple over posterior superior spine of ilium.
- γ, Lower angle of scapula.
- δ, External head of triceps.
- ε, Depression over great trochanter.
- ζ, Popliteal space.
- η, Gastrocnemius.

The scale between the figures represents head-lengths.

The position of the sulcus of Rolando is important because of the numerous cortical centres which lie close to it. For practical purposes it may be mapped out by taking the superior Rolandic point, ½ in. behind the bisection of a line drawn from the nasion to the inion over the vault of the skull, and joining that to the inferior Rolandic point, which is just above the line of the fissure of Sylvius and 1 in. behind the Sylvian point. The external parieto-occipital fissure, which forms the boundary between the parietal and occipital lobes of the brain, is situated practically at the lambda, which is a hand's breadth (2¾ in.) above the inion. The lateral sinus can be mapped out by joining the inion to the asterion, a point two-thirds of the distance from the lambda to the tip of the mastoid process; thence the sinus curves downward and forward toward the tip of the mastoid process. A point 1 in. horizontally backward from the top of the external auditory meatus will always strike it.

Cranio-cerebral topography has been dealt with by Broca, Bischoff, Turner, Feré, Pozzi, Giacomini, Ecker, Hefftler and Hare. Among the more recent papers are those of R. W. Reid (*Lancet*, 27th September 1884), W. Anderson and G. Makins (*Lancet*, 13th July 1889), Prof. Chiene (detailed in Cunningham's *Text-Book of Anatomy*), V. Horsley (*Am. Journal Med. Sci.*, 1887), G. Thane and R. Godlee (Quain's *Anatomy*—appendix to 10th edition). D. J. Cunningham discusses the whole question in his "Contribution to the Surface Anatomy of the Cerebral Hemispheres" (Cunningham *Memoirs*, No. vii. R. Irish Academy, Dublin, 1892), and he has prepared a series of casts to illustrate it.

The Face.—On the front of the face a line drawn down from the supraorbital notch between the bicuspid teeth to the side of the chin will cut the exit of the second division of the fifth nerve from the infraorbital foramen, a quarter of an inch below the infraorbital margin, and also the exit of the third division of the fifth at the mental foramen, midway between the upper and lower margins of the body of the jaw. In practice it will be found that the angle of the mouth at rest usually corresponds to the interval between the bicuspid teeth. The skin of the eyelids is very thin, and is separated from the subjacent fibrous tarsal plates by the orbicularis palpebrarum muscle. On everting the lids the delicate conjunctival membrane is seen, and between this and the tarsal plates lie the meibomian glands, which can be faintly seen as yellowish streaks. From the free edges of the eyelids come the eyelashes, between which many large sweat-glands open, and when one of these is inflamed it causes a "stye." Internally the two eyelids form a little recess called the internal canthus, occupied by a small red eminence, the caruncula lachrymalis, just external to which a small vertical fold of conjunctiva may often be seen, called the plica semilunaris, representing the third eyelid of birds and many mammals. By gently drawing down the lower eyelid the lower punctum may be seen close to the caruncula; it is the pinhole opening into the lower of the two canaliculi which carry away the tears to the lachrymal sac and duct. On the side of the face the facial artery may be felt pulsating about an inch in front of the angle of the jaw; it runs a tortuous course to near the angle of the mouth, the angle of the nose and the inner angle of the eye; in the greater part of its course its vein lies some distance behind it. The parotid gland lies between the ramus of the jaw and the mastoid process; anteriorly it overlaps the masseter to form the socia parotidis, and just below this its duct, the duct of Stensen, runs forward to pierce the buccinator and open into the mouth opposite the second upper molar tooth. The line of this duct may be marked out by joining the lower margin of the tragus to a point midway between the lower limit of the nose and the mouth. The facial or seventh nerve emerges from the skull at the stylomastoid foramen just in front of the root of the mastoid process; in the parotid gland it forms a network called the pes anserinus, after which it divides into six branches which radiate over the face to supply the muscles of expression.

The Neck.—In the middle line below the chin can be felt the body of the hyoid bone, just below which is the prominence of the thyroid cartilage called "Adam's apple," better marked in men than in women. Still lower the cricoid cartilage is easily felt, while between this and the suprasternal notch the trachea and isthmus of the thyroid gland may be made out. At the side the outline of the sterno-mastoid muscle is the most striking mark; it divides the anterior triangle of the neck from the posterior. The upper part of the former contains the submaxillary gland, which lies just below the posterior half of the body of the jaw. The line of the common and the external carotid arteries may be marked by joining the sterno-clavicular articulation to the angle of the jaw. The eleventh or spinal accessory nerve corresponds to a line drawn from a point midway between the angle of the jaw and the mastoid process to the middle of the posterior border of the sterno-mastoid muscle and thence across the posterior triangle to the deep surface of the trapezius. The external jugular vein can usually be seen through the skin; it runs in a line drawn from the angle of the jaw to the middle of the clavicle, and close to it are some small lymphatic glands. The anterior jugular vein is smaller, and runs down about half an inch from the middle line of the neck. The clavicle or collar-bone forms the lower limit of the neck, and laterally the outward slope of the neck to the shoulder is caused by the trapezius muscle.

The Chest.—It is important to realize that the shape of the chest does not correspond to that of the bony thorax which encloses the heart and lungs; all the breadth of the shoulders is due to the shoulder girdle, and contains the axilla and the head of the humerus. In the middle line the suprasternal notch is seen above, while about three fingers' breadth below it a transverse ridge can be felt, which is known as Ludovic's angle and marks the junction between the manubrium and gladiolus of the sternum. Level with this line the second ribs join the sternum, and when these are found the lower ribs may be easily counted in a moderately thin subject. At the lower part of the sternum, where the seventh or last true ribs join it, the ensiform cartilage begins, and over this there is often a depression popularly known as the pit of the stomach. The nipple in the male is situated in front of the fourth rib or a little below; vertically it lies a little external to a line drawn down from the middle of the clavicle; in the female it is not so constant. A little below it the lower limit of the great pectoral muscle is seen running upward and outward to the axilla; in the female this is obscured by the breast, which extends from the second to the sixth rib vertically and from the edge of the sternum to the mid-axillary line laterally. The female nipple is surrounded for half an inch by a more or less pigmented disc, the areola. The apex of a normal heart is in the fifth left intercostal space, three and a half inches from the mid-line.

The Abdomen.—In the mid-line a slight furrow extends from the ensiform cartilage above to the symphysis pubis below; this marks the linea alba in the abdominal wall, and about its middle point is the umbilicus or navel. On each side of it the broad recti muscles can be seen in muscular people. The outline of these muscles is interrupted by three or more transverse depressions indicating the lineae transversae in the recti; there is usually one about the ensiform cartilage, one at the umbilicus, and one between; sometimes a fourth is present below the umbilicus. The upper lateral limit of the abdomen is the subcostal margin formed by the cartilages of the false ribs (8, 9, 10) joining one another; the lower lateral limit is the anterior part of the crest of the ilium and Poupart's ligament running from the anterior superior spine of the ilium to the spine of the pubis (see fig. 1, δ); these lower limits are marked by definite grooves. Just above the pubic spine is the external abdominal ring, an opening in the muscular wall of the abdomen for the spermatic cord to emerge in the male. The most modern method of marking out the abdominal contents is to draw three horizontal and two vertical lines; the highest of the former is the transpyloric line of C. Addison (fig. 1, T.P.), which is situated half-way between the suprasternal notch and the top of the symphysis pubis; it often cuts the pyloric opening of the stomach an inch to the right of the mid-line. The hilum of each kidney is a little below it, while its left end approximately touches the lower limit of the spleen. It corresponds to the first lumbar vertebra behind. The second line is the subcostal (fig. 1, S.C.), drawn from the lowest point of the subcostal arch (tenth rib); it corresponds to the upper part of the third lumbar vertebra, and is an inch or so above the umbilicus; it indicates roughly the transverse colon, the lower ends of the kidneys, and the upper limit of the transverse (3rd) part of the duodenum. The third line is called the intertubercular (fig. 1, I.T.), and runs across between the two rough tubercles, which can be felt on the outer lip of the crest of the ilium about two and a half inches from the anterior superior spine. This line corresponds to the body of the fifth lumbar vertebra, and passes through or just above the ileo-caecal valve where the small intestine joins the large. The two vertical or mid-Poupart lines are drawn from the point midway between the anterior superior spine and the pubic symphysis on each side vertically upward to the costal margin. The right one is the most valuable, as the ileo-caecal valve is situated where it cuts the intertubercular line, while the orifice of the vermiform appendix is an inch lower down. At its upper part it meets the transpyloric line at the lower margin of the ribs, usually the ninth, and here the gall-bladder is situated. The left mid-Poupart line corresponds in its upper three-quarters to the inner edge of the descending colon. The right subcostal margin corresponds to the lower limit of the liver, while the right nipple is about half an inch above the upper limit of this viscus.

The Back.—There is a well-marked furrow stretching all the way down the middle line of the back from the external occipital protuberance to the cleft of the buttocks. In this the spinous processes of the vertebrae can be felt, especially if the model bend forward. The cervical spines are difficult to feel, except the seventh and sometimes the second, and although the former is called the vertebra prominens, its spine is less easily felt than is that of the first thoracic. In practice it is not very easy to identify any one spine with certainty: one method is to start from the prominent first thoracic and to count down; another is to join the lower angles of the two scapulae (fig. 2, γ) when the arms are hanging down, and to take the spine through which the line passes as the seventh.

The spinal furrow is caused by the prominence of the erector spinae muscles on each side; these become less well marked as they run upward. The outlines of the scapulae can be well seen; they cover the ribs from the second to the seventh inclusive. The scapular spine is quite subcutaneous, and can be followed upward and outward from the level of the third thoracic spine to the acromion, and so to the outer end of the clavicle. On the lower margin of the acromion is a little tubercle known as the metacromial process or acromial angle, which is very useful for taking measurements from. The tip of the twelfth rib may usually be felt about two inches above the middle of the iliac crest, but this rib is very variable in length. The highest point of the iliac crest corresponds to the fourth lumbar spine, while the posterior superior iliac spine is on a level with the second sacral vertebra. This posterior superior spine is not easily felt, owing to the ligaments attached to it, but there is usually a little dimple in the skin over it (fig. 2, β). By drawing horizontal lines through the 1st, 3rd and 5th lumbar spines, the transpyloric, subcostal and intertubercular lines or planes may be reproduced behind and the same viscera localized.

The Arm.—Running downward and outward from the inner half of the clavicle, where that bone is convex forward, is the clavicular part of the pectoralis major, while from the outer third of the bone, where it is concave forward, is the clavicular part of the deltoid; between these two muscles is an elongated triangular gap with its base at the clavicle, and here the skin is somewhat depressed, while the cephalic vein sinks between the two muscles to join the axillary vein. The tip of the coracoid process is situated just under cover of the inner edge of the deltoid, one inch below the junction between the outer and middle thirds of the clavicle. The deltoid muscle (fig. 1, β) forms the prominence of the shoulder, and its convex outline is due to the presence of the head of the humerus deep to it; when this is dislocated the shoulder becomes flattened. The pectoralis major forms the anterior fold of the axilla or armpit, the posterior being formed by the latissimus dorsi and teres major muscles. The skin of the floor of this space is covered with hair in the adult, and contains many large sweat glands. The axillary vessels and brachial plexus of nerves lie in the outer wall, while on the inner wall are the serrations of the serratus magnus muscle, the outlines of some of which are seen on the side of the thorax, through the skin, when the arm is raised (fig. 1, α). Below the edge of the pectoralis major, the swelling of the biceps (fig. 1, γ) begins to be visible, and this can easily be traced into its tendon of insertion, which reaches below the level of the elbow joint. On each side of the biceps is the external and internal bicipital furrow, in the latter of which the brachial artery may be felt and compressed. The median nerve is here in close relation to the artery. At the bend of the elbow the two condyles of the humerus may be felt; the inner one projects beneath the skin, but the outer one is obscured by the rounded outline of the brachio-radialis muscle. The superficial veins at the bend of the elbow are very conspicuous; they vary a good deal, but the typical arrangement is an M, of which the radial and ulnar veins form the uprights, while the outer oblique bar is the median cephalic and the inner oblique the median basilic vein. At the divergence of these two the median vein comes up from the front of the forearm, while the two vertical limbs are continued up the arm as the cephalic and basilic, the former on the outer side, the latter on the inner. On the back of the arm the three heads of the triceps are distinguishable, the external forming a marked oblique swelling when the forearm is forcibly extended and internally rotated (fig. 2, δ). In the upper part of the front of the forearm the antecubital fossa or triangle is seen; its outer boundary is the brachio-radialis, its inner the pronator radii teres, and where these two join below is the apex. In this space are three vertical structures—externally the tendon of the biceps, just internal to this the brachial artery, and still more internally the median nerve. Coming from the inner side of the biceps tendon the semi-lunar fascia may be felt; it passes deep to the median basilic vein and superficial to the brachial artery, and in former days was a valuable protection to the artery when unskilful operators were bleeding from the median basilic vein. About the middle of the forearm the fleshy parts of the superficial flexor muscles cease, and only the tendons remain, so that the limb narrows rapidly. In front of the wrist there is a superficial plexus of veins, while deep to this two tendons can usually be made to start up if the wrist be forcibly flexed; the outer of these is the flexor carpi radialis, which is the physician's guide to the radial artery where the pulse is felt. If the finger is slipped to the outer side of this tendon, the artery, which here is very superficial, can be felt beating. The inner of the two tendons is the palmaris longus, though it is not always present. On cutting down between these two the median nerve is reached.

The wrist joint may be marked out by feeling the styloid process of the radius on the outer side, and the styloid process of the ulna on the inner side behind, and joining these two by a line convex upward. The superficial appearance of the palm of the hand is described in the article on PALMISTRY; with regard to anatomical landmarks the superficial palmar arterial arch is situated in the line of the abducted thumb, while the deep arch is an inch nearer the wrist. The digital nerves correspond to lines drawn from the clefts of the fingers toward the wrist. On the back of the forearm the olecranon process of the ulna is quite subcutaneous, and during extension of the elbow is in a line with the two condyles, while between it and the inner condyle lies the ulnar nerve, here known popularly as the "funny bone." From the olecranon process the finger may be run down the posterior border of the ulna, which is subcutaneous as far as the styloid process at the lower end. On the dorsum of the hand is a plexus of veins, deep to which the extensor tendons are seen on extending the fingers. When the thumb is extended, two tendons stand out very prominently, and enclose a triangular space between them which is sometimes known as the "anatomical snuff box"; the outer of these is the tendon of the extensor brevis, the inner of the extensor longus pollicis. Situated deeply in the space is the radial artery, covered by the radial vein. On the dorsum of the hand there is a plexus of veins, and deep to these the tendons of the extensor longus digitorum stand out when the wrist and fingers are extended.

The Leg.—Just below Poupart's ligament (fig. 1, δ), a triangular depression with its apex downward may be seen in muscular subjects; it corresponds to Scarpa's triangle, and its inner border is the tendon of the adductor longus, which is easily felt if the model forcibly adducts the thigh. In this triangle the superficial inguinal glands may be made out. The head of the femur lies just below the centre of Poupart's ligament. The sartorius muscle forms the outer boundary of the triangle, and may be traced from the anterior superior spine obliquely downward and inward, across the front of the thigh, to the inner side of the knee. The two vasti muscles are well marked, the internal being the lower and forming with the sartorius the rounded bulging above the inner side of the knee. The internal saphenous vein runs superficially up the inner side of the thigh from behind the internal condyle to the femur to the saphenous opening in the deep fascia, the top of which is an inch horizontally outward from the spine of the pubis. On the other side of the thigh a groove runs down which corresponds to the ilio-tibial band, a thickening of the fascia lata or deep fascia; the lower end of this leads to the head of the fibula. On the front of the thigh, below the sartorius, the rectus muscle makes a prominence which leads down to the patella, the outlines of which bone are very evident (fig. 1, ε). The only part of the femur besides the great trochanter which is superficial is the lower end, and this forms the two condyles for articulation with the tibia. If the posterior part of the inner condyle be joined to the mid-point between the anterior superior spine and the symphysis pubis, when the thigh is externally rotated, the line will correspond in its upper two-thirds to that of the common and superficial femoral arteries, the former occupying the upper inch and a half. The common femoral vein lies just internal to its artery, while the anterior crural nerve is a quarter of an inch external to the latter. The rounded mass of the buttock is formed by the gluteus maximus muscle covered by fat; the lower horizontal boundary is called the fold of the nates, and does not correspond exactly to the lower edge of the muscle. At the side of the buttock is a depression (fig. 2, ε) where the great trochanter of the femur can be felt; a line, named after Nelaton, drawn from the anterior superior spine to the tuberosity of the ischium, passes through the top of this. On the back of the thigh the hamstrings form a distinct swelling; below the middle these separate to enclose the diamond-shaped popliteal space (fig. 2, ζ), the outer hamstrings or biceps being specially evident, while, on the inner side, the tendons of the semi-tendinosus and semi-membranosus can be distinguished. The external popliteal nerve may be felt just behind the biceps tendon above the head of the fibula.

On the front of the leg, below the knee, the ligamentum patellae is evident, leading down from the patella (fig. 1, ε) to the tubercle of the tibia. From this point downward the anterior border of the tibia or shin is subcutaneous, as is also the internal surface of the tibia. Internal to the skin is the fleshy mass made by the tibialis anticus and extensor longus digitorum muscles. At the inner side of the ankle the internal malleolus is subcutaneous, while on the outer side the tip of the external malleolus is rather lower and farther back. Both this malleolus and the lower quarter of the shaft of the fibula are subcutaneous, and this area, if traced upward, is continuous with a furrow on the outer side of the leg which separates the anterior tibial from the peroneal groups of muscles, and eventually leads to the subcutaneous head of the fibula. At the back of the leg the two heads of the gastrocnemius form the calf, the inner one (fig. 2, η) being larger than the outer. Between the two, in the mid-line of the calf, the external saphenous vein and nerve lie, while lower down they pass behind the external malleolus to the outer side of the foot. The internal saphenous vein and nerve lie just behind the internal border of the tibia, and below pass in front of the internal malleolus. At the level of the ankle-joint the tibialis posticus and flexor longus digitorum tendons lie just behind the internal malleolus, while the peroneus longus and brevis are behind the external. Running down to the heel is the tendo Achillis with the plantaris on its inner side. On the dorsum of the foot the musculo-cutaneous nerve may be seen through the skin in thin people when the toes are depressed; it runs from the anterior peroneal furrow, already described, to all the toes, except the cleft between the two inner ones. There is also a venous arch to be seen, the two extremities of which pass respectively into the external and internal saphenous veins. The long axis of the great toe, even in races unaccustomed to boots, runs forward and outward, away from the mid-line between the two feet, so that perfectly straight inner sides to boots are not really anatomical. The second toe in classical statues is often longer than the first, but this is seldom seen in Englishmen. On the outer side of the sole the skin is often in contact with the ground all along, but on the inner side the arch is more marked, and, except in flat-footed people, there is an area in which the sole does not touch the ground at all.

For further details of surface anatomy see *Anatomy for Art Students*, by A. Thomson (Oxford, 1896); Harold Stiles's article in Cunningham's *Text-Book of Anatomy* (Young J. Pentland, 1902); G. Thane and R. Godlee's Appendix to *Quain's Anatomy* (Longmans, Green & Co., 1896); *Surface Anatomy*, by B. Windle and Manners Smith (H. K. Lewis, 1896); *Landmarks and Surface Markings of* *the Human Body*, by L. B. Rawling (H. K. Lewis, 1906); *Surface Anatomy*, by T. G. Moorhead (Baillière, Tindall & Cox, 1905). No one interested in the subject should omit to read an article on "Art in its relation to Anatomy," by W. Anderson, *British Medical Journal*, 10th August 1895. (F. G. P.)

ANATTO (possibly a native American name, with many variants such as *annatto*, *arnotto*), a colouring matter produced from the seeds of *Bixa orellana* (natural order *Flacourtiaceae*), a small tree which grows in Central and South America. The seeds are surrounded with a thin coating of a waxy pulp, which is separated from them by washing in water, passing the liquid through a sieve and allowing the suspended pulp to deposit. The water is then drained away and the paste dried, till it is a thick, stiff, unctuous mass. In this state it has a dark orange-red colour and is known as "roll" or "flag" arnotto, according to the form in which it is put up, but when further dried it is called "cake" arnotto. Arnotto is much used by South American Indians for painting their bodies; among civilized communities its principal use is for colouring butter, cheese and varnishes. It yields a fugitive bright orange colour, and is to some extent used alone, or in conjunction with other dyes, in the dyeing of silks and in calico printing. It contains a yellow colouring matter, bixin, $C_{16}H_{20}O_2$.

ANAXAGORAS, Greek philosopher, was born probably about the year 500 B.C. (Apollodorus *ap*. Diog. Laert. ii. 7.) At his native town of Clazomenae in Asia Minor, he had, it appears, some amount of property and prospects of political influence, both of which he surrendered, from a fear that they would hinder his search after knowledge. Nothing is known of his teachers; there is no reason for the theory that he studied under Hermotimus of Clazomenae, the ancient miracle-worker. In early manhood (*c*. 464–462 B.C.) he went to Athens, which was rapidly becoming the headquarters of Greek culture. There he is said to have remained for thirty years. Pericles learned to love and admire him and the poet Euripides derived from him an enthusiasm for science and humanity. Some authorities assert that even Socrates was among his disciples. His influence was due partly to his astronomical and mathematical eminence, but still more to the ascetic dignity of his nature and his superiority to ordinary weaknesses—traits which legend has embalmed. It was he who brought philosophy and the spirit of scientific inquiry from Ionia to Athens. His observations of the celestial bodies led him to form new theories of the universal order, and brought him into collision with the popular faith. He attempted, not without success, to give a scientific account of eclipses, meteors, rainbows and the sun, which he described as a mass of blazing metal, larger than the Peloponnesus; the heavenly bodies were masses of stone torn from the earth and ignited by rapid rotation. The ignorant polytheism of the time could not tolerate such explanation, and the enemies of Pericles used the superstitions of their countrymen as a means of attacking him in the person of his friend.

Anaxagoras was arrested on a charge of contravening the established dogmas of religion (some say the charge was one of Medism), and it required all the eloquence of Pericles to secure his acquittal. Even so he was forced to retire from Athens to Lampsacus (434–433 B.C.), where he died about 428 B.C., honoured and respected by the whole city.

It is difficult to present the cosmical theory of Anaxagoras in an intelligible scheme. All things have existed in a sort of way from the beginning. But originally they existed in infinitesimally small fragments of themselves, endless in number and inextricably combined throughout the universe. All things existed in this mass, but in a confused and indistinguishable form. There were the seeds (*σπέρματα*) or miniatures of corn and flesh and gold in the primitive mixture; but these parts, of like nature with their wholes (the *ὁμοιομερῆ* of Aristotle), had to be eliminated from the complex mass before they could receive a definite name and character. The existing species of things having thus been transferred, with all their specialities, to the prehistoric stage, they were multiplied endlessly in number, by reducing their size through continued subdivision; at the same time each one thing is so indissolubly connected with every other that the keenest analysis can never completely sever them. The work of arrangement, the segregation of like from unlike and the summation of the *ὁμοιομερῆ* into totals of the same name, was the work of Mind or Reason; *πάντα χρήματα ἦν ὁμοῦ · εἶτα νοῦς ἐλθὼν αὐτὰ διεκόσμησε.* This peculiar thing, called Mind (*νοῦς*), was no less illimitable than the chaotic mass, but, unlike the Intelligence of Heraclitus (*q.v.*), it stood pure and independent (*μοῦνος ἐφ' ἑωυτοῦ*), a thing of finer texture, alike in all its manifestations and everywhere the same. This subtle agent, possessed of all knowledge and power, is especially seen ruling in all the forms of life. Its first appearance, and the only manifestation of it which Anaxagoras describes, is Motion. It originated a rotatory movement in the mass (a movement far exceeding the most rapid in the world as we know it), which, arising in one corner or point, gradually extended till it gave distinctness and reality to the aggregates of like parts. But even after it has done its best, the original intermixture of things is not wholly overcome. No one thing in the world is ever abruptly separated, as by the blow of an axe, from the rest of things. The name given to it signifies merely that in that congeries of fragments the particular "seed" is preponderant. Every *a* of this present universe is only *a* by a majority, and is also in lesser number *b*, *c*, *d*. It is noteworthy that Aristotle accuses Anaxagoras of failing to differentiate between *νοῦς* and *ψυχή*, while Socrates (Plato, *Phaedo*, 98 B) objects that his *νοῦς* is merely a *deus ex machina* to which he refuses to attribute design and knowledge.

Anaxagoras proceeded to give some account of the stages in the process from original chaos to present arrangements. The division into cold mist and warm ether first broke the spell of confusion. With increasing cold, the former gave rise to water, earth and stones. The seeds of life which continued floating in the air were carried down with the rains and produced vegetation. Animals, including man, sprang from the warm and moist clay. If these things be so, then the evidence of the senses must be held in slight esteem. We seem to see things coming into being and passing from it; but reflection tells us that decease and growth only mean a new aggregation (*σύγκρισις*) and disruption (*διάκρισις*). Thus Anaxagoras distrusted the senses, and gave the preference to the conclusions of reflection. Thus he maintained that there must be blackness as well as whiteness in snow; how otherwise could it be turned into dark water?

Anaxagoras marks a turning-point in the history of philosophy. With him speculation passed from the colonies of Greece to settle at Athens. By the theory of minute constituents of things, and his emphasis on mechanical processes in the formation of order, he paved the way for the atomic theory. By his enunciation of the order that comes from reason, on the other hand, he suggested, though he seems not to have stated explicitly, the theory that nature is the work of design. The conception of reason in the world passed from him to Aristotle, to whom it seemed the dawn of sober thought after a night of disordered dreams. From Aristotle it descended to his commentators, and under the influence of Averroes became the engrossing topic of speculation.

AUTHORITIES.—The fragments of Anaxagoras have been collected by E. Schaubach (Leipzig, 1827), and W. Schorn (Bonn, 1829); see also F. W. A. Mullach, *Fragmenta Philos. Graec.* i. 243-252; A. Fairbanks, *The First Philosophers of Greece* (1898). For criticism see T. Gomperz, *Greek Thinkers* (Eng. trans., L. Magnus, 1901), bk. ii. chap. 4; E. Bersot, *De controversis quibusdam Anaxagorae doctrinis* (Paris, 1844); E. Zeller, *Die Philosophie der Griechen* (Eng. trans., S. F. Alleyne, 2 vols., London, 1881); J. M. Robertson, *Short History of Freethought* (London, 1906); W. Windelband, *History of Philosophy* (Eng. trans., J. H. Tufts, 1893); J. I. Beare, *Greek Theories of Elementary Cognition* (1906); L. Parmentier, *Euripide et Anaxagore* (1892); F. Lortzing, "Bericht über die griechischen Philosophen vor Sokrates" (for the years 1876–1897) in Bursian's *Jahresbericht über die Fortschritte der classischen Altertumswissenschaft*, cxvi. (1904), with references to important articles in periodicals.

(W. W.; J. M. M.)

ANAXARCHUS (*c*. 340 B.C.), a Greek philosopher of the school of Democritus, was born at Abdera. He was the companion and friend of Alexander in his Asiatic campaigns. He checked the vainglory of Alexander, when he aspired to the honours of divinity, by pointing to his wounded finger, saying, "See the blood of a mortal, not of a god." The story that at Bactra in 327 B.C. in a public speech he advised all to worship Alexander as a god even during his lifetime, is with greater probability attributed to the Sicilian Cleon. It is said that Nicocreon, tyrant of Cyprus, commanded him to be pounded to death in a mortar, and that he endured this torture with fortitude; but the story is doubtful, having no earlier authority than Cicero. His philosophical doctrines are not known, though some have inferred from the epithet *εὐδαιμονικός* ("fortunate"), usually applied to him, that he held the end of life to be *εὐδαιμονία*.

ANAXILAUS, of Larissa, a physician and Pythagorean philosopher, who was banished from Rome by Augustus, B.C. 28, on the charge of practising the magic art. This accusation appears to have originated in his superior skill in natural philosophy, by which he produced effects that the ignorant attributed to magic.

Euseb., *Chron. ad Olymp.* clxxxviii.; St Iren. i. 13; Pliny xix. 4, xxv. 95, xxviii. 49, xxxii. 52, xxxv. 50.

ANAXIMANDER, the second of the physical philosophers of Ionia, was a citizen of Miletus and a companion or pupil of Thales. Little is known of his life. Aelian makes him the leader of the Milesian colony to Amphipolis, and hence some have inferred that he was a prominent citizen. The computations of Apollodorus have fixed his birth in 611, and his death shortly after 547 B.C. Tradition, probably correct in its general estimate, represents him as a successful student of astronomy and geography, and as one of the pioneers of exact science among the Greeks. He taught, if he did not discover, the obliquity of the ecliptic, is said to have introduced into Greece the gnomon (for determining the solstices) and the sundial, and to have invented some kind of geographical map. But his reputation is due mainly to his work on nature, few words of which remain. From these fragments we learn that the beginning or first principle (*ἀρχή*, a word which, it is said, he was the first to use) was an endless, unlimited mass (*ἄπειρον*), subject to neither old age nor decay, and perpetually yielding fresh materials for the series of beings which issued from it. He never defined this principle precisely, and it has generally (*e.g.* by Aristotle and Augustine) been understood as a sort of primal chaos. It embraced everything, and directed the movement of things, by which there grew up a host of shapes and differences. Out of the vague and limitless body there sprung a central mass,—this earth of ours, cylindrical in shape, poised equidistant from surrounding orbs of fire, which had originally clung to it like the bark round a tree, until their continuity was severed, and they parted into several wheel-shaped and fire-filled bubbles of air. Man himself and the animals had come into being by like transmutations. Mankind was supposed by Anaximander to have sprung from some other species of animals, probably aquatic. But as the measureless and endless had been the prime cause of the motion into separate existences and individual forms, so also, according to the just award of destiny, these forms would at an appointed season suffer the vengeance due to their earlier act of separation, and return into the vague immensity whence they had issued. Thus the world, and all definite existences contained in it, would lose their independence and disappear in the "indeterminate." The blazing orbs, which have drawn off from the cold earth and water, are the temporary gods of the world, clustering round the earth, which, to the ancient thinker, is the central figure.

See Histories of the Ionian School by Ritten, Mallet; Schleiermacher, "Dissert. sur la philosophie d'Anaximandre," in the *Mémoires de l'acad. des sciences de Berlin* (1815); J. Burnet, *Early Greek Philosophy* (Lond. 1892); A. W. Benn, *Greek Philosophers* (Lond. 1883 foll.); A. Fairbanks, *First Philosophers of Greece* (Lond. 1898); Ritter and Preller, *Historia Phil.* §§ 17-22; Mullach, *Fragmenta Phil. Graec.* i. 237-240, and IONIAN SCHOOL OF PHILOSOPHY.

ANAXIMENES, of Lampsacus (*fl.* 380–320 B.C.), Greek rhetorician and historian, was a favourite of Alexander the Great, whom he accompanied in his Persian campaigns. He wrote histories of Greece and of Philip, and an epic on Alexander (fragments in Müller, *Scriptores Rerum Alexandri Magni*). As a rhetorician, he was a determined opponent of Isocrates and his school. The *Rhetorica ad Alexandrum*, usually included among the works of Aristotle, is now generally admitted to be by Anaximenes, although some consider it a much later production (edition by Spengel, 1847).

See P. Wendland, *Anax. von Lampsakos* (1905); also RHETORIC.

ANAXIMENES, of Miletus, Greek philosopher in the latter half of the 6th century, was probably a younger contemporary of Anaximander, whose pupil or friend he is said to have been. He held that the air, with its variety of contents, its universal presence, its vague associations in popular fancy with the phenomena of life and growth, is the source of all that exists. Everything is air at different degrees of density, and under the influence of heat, which expands, and of cold, which contracts its volume, it gives rise to the several phases of existence. The process is gradual, and takes place in two directions, as heat or cold predominates. In this way was formed a broad disk of earth, floating on the circumambient air. Similar condensations produced the sun and stars; and the flaming state of these bodies is due to the velocity of their motions.

See Schmidt, *Dissertatio de Anaximensis psychologia* (Jena, 1869); Ritter and Preller, *Historia Phil.* §§ 23-27; A. Fairbanks, *First Philosophers of Greece* (1898); Mullach, *Fragmenta Phil. Graec.* i. 241-243; also IONIAN SCHOOL OF PHILOSOPHY; EVOLUTION.

ANAZARBUS (med. *Ain Zarba*; mod. *Navarza*), an ancient Cilician city, situated in the Alcian plain about 10 m. W. of the main stream of the Pyramus (Jihun) and near its tributary the Sempas Su. A lofty isolated ridge formed its acropolis. Though some of the masonry in the ruins is certainly pre-Roman, Suidas's identification of it with *Cyinda*, famous as a treasure city in the wars of Eumenes of Cardia, cannot be accepted in the face of Strabo's express location of Cyinda in *western* Cilicia. Under the early Roman empire the place was known as *Caesarea*, and was the metropolis of Cilicia Secunda. Rebuilt by the emperor Justin after an earthquake, it became *Justinopolis* (A.D. 525); but the old native name persisted, and when Thoros I., king of Lesser Armenia, made it his capital early in the 12th century, it was known as Anazarva. Its great natural strength and situation, not far from the mouth of the Sis pass, and near the great road which debouched from the Cilician gates, made Anazarbus play a considerable part in the struggles between the Byzantine empire and the early Moslem invaders. It had been rebuilt by Harun al-Rashid in 796 A.D., refortified at great expense by Saif addaula, the Hamdanid (10th century) and Saiked, and ruined by the crusaders.

The present wall of the lower city is of late construction, probably Armenian. It encloses a mass of ruins conspicuous in which are a fine triumphal arch, the colonnades of two streets, a gymnasium, &c. A stadium and a theatre lie outside on the south. The remains of the acropolis fortifications are very interesting, including roads and ditches hewn in the rock; but beyond ruins of two churches and a fine tower built by Thoros I. there are no notable structures in the upper town. For picturesqueness the site is not equalled in Cilicia, and it is worth while to trace the three fine aqueducts to their sources. (D. G. H.)

ANBAR, originally called FIRUZ SHAPUR, or PERISAPORA, a town founded about A.D. 350 by Shapur (Sapor) II. Sassanid, king of Persia, on the east bank of the Euphrates, just south of the Nahr Isa, or Sakhlawieh canal, the northernmost of the canals connecting that river with the Tigris, in lat. 33° 22′ N., long. 43° 49′ E. It was captured and destroyed by the emperor Julian in A.D. 363, but speedily rebuilt. It became a refuge for the Christian and Jewish colonies of that region, and there are said to have been 90,000 Jews in the place at the time of its capture by Ali in 657. The Arabs changed the name of the town to Anbar ("granaries"). Abū 'l-'Abbās as-Saffāḥ, the founder of the Abbasid caliphate, made it his capital, and such it remained until the founding of Bagdad in 762. It continued to be a place of much importance throughout the Abbasid period. It is now entirely deserted. The site is occupied only by ruin mounds, as yet unexplored. Their great extent indicates the former importance of the city. (J. P. Pe.)

ANCACHS, a coast province of central Peru, lying between the departments of Lima and Libertad, and W. of the Marañon river. Area, 16,562 sq. m.; pop. (1896) 428,703. The department was created in 1835, and received its present name in 1839, and its last accession of territory in 1861. Lying partly on the arid coast, partly in the high Cordilleras and partly in the valley of the Marañon, it has every variety of climate and productions. Rice, cotton, sugar-cane, yucas (*Manihot aipi*) and tropical fruits are produced in the irrigated valleys of the coast, and wheat, Indian corn, barley, potatoes, coffee, coca, &c., in the upland regions. Cattle and sheep are also raised for the coast markets. Mining is likewise an important industry. The capital, Huaráz (est. pop. 8000 in 1896), on the Rio Santa or Huaráz, is a large mining centre in the sierras, 9931 ft. above sea-level, from which a railway runs to the small seaports of Santa and Chimbote, 172 m. distant. Other noteworthy towns are Caraz (6000) and Carhuaz (5000) in the sierra region, and Huarmey (1500) on the coast.

ANCAEUS, in Greek legend, son of Zeus or Poseidon, king of the Leleges of Samos. In the Argonautic expedition, after the death of Tiphys, helmsman of the "Argo," he took his place. It is said that, while planting a vineyard, he was told by a soothsayer that he would never drink of its wine. As soon as the grapes were ripe, he squeezed the juice into a cup, and, raising it to his lips, mocked the seer, who retorted with the words, Πολλὰ *μεταξὺ πέλει κύλικος καὶ χείλεος ἄκρου* ("there is many a slip between the cup and the lip"). At that moment it was announced that a wild boar was ravaging the land. Ancaeus set down the cup, leaving the wine untasted, hurried out, and was killed by the boar.

Apollonius Rhodius, i. 188 (and Scholiast), ii. 867-900.

ANCASTER AND KESTEVEN, Duke of, an English title borne by the well-known Lincolnshire family of Bertie from 1715 to 1809. Robert Bertie (1660–1723), son and heir of Robert, third earl of Lindsey (d. 1701), who succeeded his father as lord great chamberlain of England, was created marquess of Lindsey in 1706, being made duke of Ancaster and Kesteven in July 1715. His eldest surviving son, Peregrine (1686–1742), who had been a member of parliament for Lincolnshire from 1708 to 1714, succeeded to the dukedom and also to the lord-lieutenancy of Lincolnshire, which had been held by his father. His son and successor, Peregrine (1714–1778), who was also lord great chamberlain and lord-lieutenant of Lincolnshire, attained the rank of general in the British army. The fourth duke was Robert (1756–1779), son of the third duke, who died in July 1779, when his barony of Willoughby de Eresby and the hereditary office of lord great chamberlain fell into abeyance until 1780. The dukedom, however, and other honours came to his uncle Brownlow (1729–1809), on whose death in February 1809 the dukedom of Ancaster and Kesteven became extinct; but the earldom of Lindsey descended to a distant kinsman, Albemarle Bertie (1744–1818). After a second period of abeyance the barony of Willoughby de Eresby was revived in 1871 in favour of Clementina Elizabeth (d. 1888), a descendant of the Berties, who was the widow of Gilbert John Heathcote, 1st Baron Aveland (d. 1867). Her son and successor, Gilbert Henry Heathcote-Drummond-Willoughby (b. 1830), 23rd Baron Willoughby de Eresby, and joint hereditary lord great chamberlain, was created earl of Ancaster in 1898.

ANCELOT, JACQUES ARSÈNE FRANÇOIS POLYCARPE (1794–1854), French dramatist and *littérateur*, was born at Havre, on the 9th of February 1794. He became a clerk in the admiralty, and retained his position until the revolution of 1830. In 1816 his play *Warwick* was accepted by the Théâtre Français, but never produced, and three years later a five-act tragedy, *Louis IX.*, was staged. Three editions of the play were speedily exhausted; it had a run of fifty representations, and brought him a pension of 2000 francs from Louis XVIII. His next work, *Le Maire du palais*, was played in 1825 with less success; but for it he received the cross of the legion of honour. In 1824 he produced *Fiesque*, a clever adaptation of Schiller's *Fiesco*. In 1828 appeared *Olga, ou l'orpheline russe*, the plot of which had been inspired by a voyage he made to Russia in 1826. About the same period he produced in succession *Marie de Brabant* (1825), a poem in six cantos; *L'Homme du monde* (1827), a novel in four volumes, afterwards dramatized with success; and in 1829 a play, *Elisabeth d'Angleterre*. By the revolution of July 1830 he lost at once his royal pension and his office as librarian at Meudon; and he was chiefly employed during the next ten years in writing vaudevilles and light dramas and comedies. A tragedy, *Maria Padilla* (1838), gained him admission to the French Academy in 1841. Ancelot was sent by the French government in 1849 to Turin, Florence, Brussels and other capitals, to negotiate on the subject of international copyright; and the treaties which were concluded soon after were the result, in a great measure, of his tact and intelligence.

ANCESTOR-WORSHIP, a general name for the cult of deceased parents and forefathers. Aristotle in his *Ethics* stigmatizes as "extremely unloving" (*λίαν ἄφιλον*) the denial that ancestors are interested in or affected by the fortunes of their descendants; and in effect ancestor-worship is the staple of most religions, ancient or modern, civilized or savage. The ancient Jews were a striking exception; for though the frequent mention of ancestral graves on hilltops or in caves, and in connexion with sacred trees and pillars, and the resemblance of the "elohim" in Exod. xxi. 4-6 to household gods, may suggest that cults of the dead preceded that of Yahweh, nevertheless in the classical age of their religion (see Hebrew Religion) as reflected in the Old Testament, ancestor-worship has already vanished. "The Semitic nomads," remarks Renan in his *History of Israel* (*tome* 1, p. 50), "were the religious race *par excellence*, because in fact they were the least superstitious of the families of mankind, the least duped by the dream of a beyond, by the phantasmagory of a double or a shadow surviving in the nether regions. . . . They suppressed the chimeras which went with belief in a complete survival after death, chimeras which were homicidal at the time, in so far as they robbed man of the true notion of death and led him to multiply murders."

Renan here refers to the burial rite of an ancient Scythian king (as described by Herodotus, iv. 71), at whose tomb were strangled his concubine, cup-bearer, cook, groom, lackey, envoy, and several of his horses. Such cruel customs were, of course, and still are associated in many lands with the cult of the dead; but, on the other hand, there are gentler and more beneficial aspects observable to-day in China and Japan. There the mighty dead are present with the living, protect them and their houses and crops, are their strength in battle, and teach their hands to war and their fingers to fight. In the Russo-Japanese War in 1904–5 the greatest incentive to deeds of patriotic valour was for Japanese soldiers the belief that the spirits of their ancestors were watching them; and in China it is not the man himself that is ennobled for his philanthropic virtues or learning, but his ancestor. No more solemn duty weighs upon the Chinaman than that of tending the spirits of his dead forefathers. Confucius, it is recorded, sacrificed to the dead, as if they were present, and to the spirits, as if they were there. In view of such Chinese sacrifices the names of the dead are inscribed on wooden plaques called spirit-tablets, into which the spirits are during the ceremony supposed to enter, having quitted the very heaven and presence of God in order to commune with posterity. Twice a year, in spring and autumn,[1] a Chinese ruler goes in state to the imperial college in Pekin, and presents the appointed offerings before the spirit-tablets of Confucius and of the worthies who have been associated with him in his temples. He greets the sage's spirit with this prayer:—"This year, in this month, on this day, I, the emperor, offer sacrifice to the philosopher K'ung, the ancient teacher, the perfect sage, and say, O teacher, in virtue equal to heaven and earth. . . Now in this second month of spring, in reverent observance of the old statutes, with victims, silks, spirits, and fruits, I offer sacrifice to thee."

In ancient Rome painted wax images of ancestors who had served the state in its highest offices were preserved in the *atria* or halls of their descendants, inscribed, like the Chinese tablets, with titles recording their dignity and exploits. Whether the departed spirits tenanted them according to the Chinese belief is not recorded; though it probably was so, for at funerals they might be carried, like the images of the gods in *Lectisternia* (see IMAGE WORSHIP), on couches before the corpse. Oftener, however, they were mere masques worn at funerals by men who personated the ancestors and wore their robes of office. Perhaps the vulgar regarded these men as temporary reincarnations of those whom they thus represented.

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[1] Prof. J. Legge, in *Religious Systems of the World*, London, 1892, p. 72.

The word *Manes* signified the friendly ancestral ghosts of a Roman household. To them, under the name of *Lares*, it was the solemn preoccupation of male descendants to offer food and sacrifice and to keep alight the hearth fire which cooked the offerings. Small waxen images of the Manes called *Lares*, clothed in dogskin, and on feast days crowned with garlands, stood round the family hearth of which they were the unseen guardians (but see LARES). To lack such care and tendance was—along with want of regular burial—the most dreadful fate that could overtake an ancient; and a Roman, like a Hindu, in case he was childless, adopted a male child whose duty it would be, as if his own son, to continue after his death the family rites or *sacra*. On this side the ancestor-worship of the Aryans has been productive of the most important institutions of adoption and will or testament. Sir Henry Maine (*Ancient Law*, ch. v.) has justly observed that "the history of political ideas begins with the assumption that kinship in blood is the sole possible ground of community in political functions," and that in early commonwealths "citizens considered all the groups in which they claimed membership to be founded on common lineage." A man only shared in house, tribe and state, so far as he was descended from particular ancestors and eponymous heroes, and due cult of these illustrious dead was the condition of his enjoying any rights or inheriting any property. Yet if society was to grow, men of alien descent had to be admitted into the original brotherhood and amalgamated therewith. "Adverting to Rome singly," adds the same author, "we perceive that the primary group, the family, was being constantly adulterated by the practice of adoption." Thus transition was made possible from an agnatic society based on blood ties to one based on contiguity.

In the worship of the Lares the head of a Roman household commemorated and reinforced the blood tie which made one flesh of all its members living and dead. The *gens* in turn was regarded as an expansion of the family, as was the state of the *gens*; and members of these larger units by worship of common ancestors—usually mythical—kept alive the feeling that they were a single organic whole animated by a common soul and joined in consanguinity. Outcasts alone, the offspring of irregular unions, could be ignorant of the blood which ran in their veins, of the unseen ancestors to be fed and tended in family and gentile rites.[1] Such considerations help us to understand the enormous importance attached in ancient societies to the right of intermarriage, as also to grasp the origin of wills and testaments. For a will was to begin with but a mode of indicating (not necessarily in writing) on whom devolved the duty of conducting a parent's funeral, and together with that duty the right of inheriting his property. The due performance of funeral rites re-created the blood tie and renewed the kinship of living and dead at the moment when death seemed specially to endanger it by removal of that representative of the household whose special duty it had been to keep up the family *sacra*. In Hindostan, as Maine remarks (*op. cit. ch.* vi.), we have a parallel to the Roman system; for there "the right to inherit a dead man's property is exactly co-extensive with the duty of performing his obsequies. If the rites are not properly performed or not performed by the proper person, no relation is considered as established between the deceased and anybody surviving him; the law of succession does not apply, and nobody can inherit the property. Every great event in the life of a Hindu seems to be regarded as leading up to and bearing on these solemnities. If he marries, it is to have children who may celebrate them after his death; if he has no children, he lies under the strongest obligation to adopt them from another family, 'with a view,' writes the Hindu doctor, 'to the funeral cake, the water and the solemn sacrifice.'" "May there be born in our lineage," so the Indian Manes are supposed to say, "a man to offer to us, on the thirteenth day of the moon, rice boiled in milk, honey and ghee."[2]

It is then in connexion with the history of inheritance and adoption, and of the gradual evolution from societies held together only by blood-kinship to societies consolidated on other bases, especially on that of local contiguity, that ancestor-worship chiefly calls for investigation.

We must now pass on to other aspects of it less important for the student of ancient law, but interesting to the folklorist.

In ancient Rome the *Di manes*, or as we should say the blessed dead, who reposed in their necropolis outside the walls, were specially commemorated on the *dies parentales* or days of placating them (*placandis Manibus*). These began on the 13th of February and ended on the 22nd with the *Caristia* or feast of *Cara Cognatio*. The family have on the preceding days solemnly visited the grave, and offered to the shades gifts of water, wine, milk, honey, oil, and the blood of black victims; they have decked the tomb with flowers, have renewed the feast and farewell of the funeral, and have prayed to the ancestors to watch over their welfare. Now the survivors return home and hold a love-feast, in which all quarrels are healed, all trespasses forgiven. The Lares are brought out to preside over this solemn feast, and for the occasion are *incincti* or clothed in tunics girt at the loins.

It is doubtful whether we should dignify by the name of ancestor-worship the older Roman festival of the *Lemuria*, which was held on the 9th, 11th and 13th of May. For the *lemures* were, like our unlaid ghosts, unburied, mischievous or inimical spirits, and these three days were *nefasti* or unlucky, because their malign influence was abroad. The ghosts had to be driven out of the house, and Ovid (*Fasti*, v. 432) relates how the head of the family arose at midnight, and with feet unfettered by shoon or sandals, and with washen hands traversed his house beckoning against the ghosts with fingers joined to thumb. Nine times with averted glance he spat a black bean out of his mouth and cried: "With these I redeem me and mine." The ghosts followed and picked up, or perhaps entered into the beans. Then he washed afresh, and rattled his brass vessels, and nine times over bade them begone with the polite formula, *Manes exite paterni*, "Go forth, O paternal manes."

The gesture described was probably the same as that with which a Christian priest averts demonic influences from the heads of his congregation in the act of blessing them. The many hands of Zeus Sabazios turned up in ancient excavations observe a similar gesture. All over the earth we meet with such periodically recurrent ceremonies of expelling demons and ghosts, who usually are given a meal before being hunted back into their graves. But an account of such ceremonies belongs rather to demonology than to the history of the worship of Manes, which are peaceful, well-conducted and beneficent beings, endowed and, so to speak on the foundation, like the Christian souls for whose masses money has been left. Ancestor-worship has its parallels in Christian cults of the dead and of the saints; it must be remembered, however, that a saint is not as a rule an ancestor, and that his cult is not based upon family feeling and love of kinsmen, nor tends to stimulate and encourage the same. Such cults have never prevented those who participated in them from fighting one another. Ancestor-worship on this side is also in strong contrast with the teaching of the Gospel, for it is an apotheosis of family affections and supplies a real cement wherewith to bind society together; whereas the Christian Messiah taught that, "If any cometh to me, and hateth not his father and his mother, and his wife and his children, and his brethren and his sister, yea, and his own life also, he cannot be my disciple." To the ordinary good citizen of antiquity, whose religion was the consecration of family ties, such a precept was no less scandalous than it is to a Chinaman or Hindu of to-day. Was not the duty of following the Messiah to supersede even that of burying one's parents, the most sacred of all ancient obligations? The Church when it had once conquered the world allowed such precepts to lapse and fall into the background, and no one save monks or Manichaean heretics remembered them any more; indeed modern divines affect to believe that marriage rites and family ties were the peculiar concern of the Church from the very first; and few moderns will fail to sympathize with the misgivings of the barbarian chief who, having been converted and being about to receive Christian baptism, paused as he stepped down into the font, and asked the priests if in the heaven to which their rites admitted him he would meet and converse with his pagan ancestors. On being assured that he would not, he stepped out again and declined their methods of salvation.

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[1] Livy iv. 2:—"Quam enim aliam vim connubia promiscua habere, nisi ut ferarum prope ritu vulgentur concubitus plebis Patrumque? ut qui natus sit, ignoret, cujus sanguinis, quorum sacrorum sit."

[2] E. B. Tylor, *Primitive Culture*, ii. p. 119.

In the above paragraphs we have drawn examples only from races organized on a patriarchal basis among whom the headship passes from father to son. But many primitive societies do not trace descent through males and yet may be said to worship ancestors. The aborigines of Australia furnish an example. The Aruntas among them are said to have no idea of paternity, but believe that local spirits of tree, rock or stream enter women as they pass by their haunts. In doing so they drop a wooden soul-token called a *Churinga*. This the elders of the tribe pick up or pretend to find, and carefully store up in a cleft of the hills or in a cave which no woman may approach. The souls of members of the tribe who have died survive in these slips of wood, which are treasured up for long generations and repaired if they decay. They are carried into battle to assist the tribe, are regularly anointed, fondled and invoked; for it is believed that the souls present in them are powerful to work weal and woe to friend and enemy respectively. They thus resemble the Chinese spirit tablet.

Reference has been made above to the possibility that the Roman *imago* of an ancestor actually embodied his ghost, at least on solemn occasions. The custom of providing a material abode or *nidus* for the ghost is found all over the earth; *e.g.* in New Ireland a carved chalk figure of the deceased, indicating the sex, is procured, and entrusted to the chief of a village, who sets it up in a funeral hut in the middle of a large *taboo* house adorned with plants. The survivors believe that the ghostly ogre, being so well provided for, will abstain from haunting them.

The Romans, as we remarked above, distinguished between the *Lemures* or wandering mischievous ghosts and the *Manes* snugly interred and tended in the cemetery which was part of every Italian settlement. The distinction, however, is one for which survivors alone are responsible and not one inherent in the nature of ghosts. No race at all, it would seem, except the Jews, has ever been able to regard a man's death as the end of him; and except in the higher forms of Christianity the dead are everywhere supposed to need the same sort of food, equipment, tenement and gear which they enjoyed in life, and to molest the living unless they obtain it. It may be affection, or it may be fear, which prompts the survivor to feed and tend his dead; in general no doubt it is a mixture of both feelings.

In Africa and other savage countries a third motive sometimes operates, namely the desire to consult the dead—as Odysseus, anxious about his return home, was constrained to do—or to use them against the living; for negro magicians are reputed even to murder remarkable individuals in order to possess themselves of their power and to be able to use them as familiar spirits.

The question has often been raised, what is the relation of private cults of ancestors to public religion? Do men after death become gods? Euhemerus of Messenia tried of old to rationalize the Greek myths by supposing that the Olympian gods were deified men. Such a theory, like its modern rival of the sun-myth, may of course be pushed till it becomes absurd; yet in India critical observers, like Sir Alfred C. Lyall, attest innumerable examples of the gradual elevation into gods of human beings, the process even beginning in their lifetime. There a man wins local fame as an ascetic with abnormal powers, or a wife, because Alcestis-like she sacrificed herself for her husband and immolated herself on his pyre. Miracles occur at their shrines, and the surviving relatives who guard them wax rich off the offerings brought. "In the course of a very few years, as the recollection of the man's personality becomes misty, his origin grows mysterious, his career takes a legendary hue, his birth and death were both supernatural; in the next generation the names of the elder gods get introduced into the story, and so the marvellous tradition works itself into a myth, until nothing but a personal incarnation can account for such a series of prodigies. The man was an *Avatár* of Vishnu or Siva; his supreme apotheosis is now complete, and the Brahmins feel warranted in providing for him a niche in the orthodox pantheon."[1]

AUTHORITIES.—H. S. Maine, *Ancient Law* (London, 1906); E. B. Tylor, *Primitive Culture* (London, 1903); and article on the "Matriarchal Family System," in the *Nineteenth Century*, xl. 81 (1896); W. W. Fowler, *The Roman Calendar* (London, 1906); Fustel de Coulanges, *La Cité antique* (17th ed., 1900); L. André, *Le Culte des morts chez les Hébreux* (1895); C. Grüneisen, *Der Ahnenkultus und die Urreligion Israels* (Halle, 1900); Grant Allen, *The Evolution of the Idea of God* (London, 1897); F. B. Jevons, *Introduction to the History of Religion* (London, 1896); Sir A. C. Lyall, *Asiatic Studies* (London, 1899 and 1907); D. G. Brinton, *Religions of Primitive Peoples* (New York, 1897); H. Oldenberg, *Die Religion des Veda* (Berlin, 1894). (F. C. C.)

ANCHISES, in Greek legend, Trojan hero, son of Capys and Themis, grandson (according to Hyginus, son) of Assaracus, connected on both sides with the royal family of Troy, was king of Dardanus on Mt. Ida. Here Aphrodite met him and, enamoured of his beauty, bore him Aeneas. For revealing the name of the child's mother, in spite of the warnings of the goddess, he was killed or struck blind by lightning (Hyginus, *Fab.* 94). In the more recent legend, adopted by Virgil in the *Aeneid*, he was conveyed out of Troy on the shoulders of his son Aeneas, whose wanderings he followed as far as Sicily, where he died and was buried on Mt. Eryx. On the other hand, there was a grave on Mt. Ida at Troy pointed out as his. From the name Assaracus, from the intercourse between the Phoenicians and the early inhabitants of the Troad, and from the connexion of Aphrodite, the protecting goddess of the Phoenicians, with Anchises, it has been inferred that his family was originally of Assyrian origin. His flight on the shoulders of Aeneas is frequently represented on engraved gems of the Roman period; and his visit from Aphrodite is rendered in a beautiful bronze relief, engraved in Millingen's *Unedited Gems*.

ANCHOR (from the Greek ἄγκυρα, which Vossius considers is from ὄγκη, a crook or hook), an instrument of iron or other heavy material used for holding ships or boats in any locality required, and preventing them from drifting by winds, tides, currents or other causes. This is done by the anchor, after it is let go from the ship by means of the cable, fixing itself in the ground and there holding the vessel fast.

The word "anchor" is also used figuratively for anything which gives security, or for any ornament or appendage which takes the same form. Owing to a vessel's safety depending upon the anchor, it is obviously an appliance of great importance, and too much care cannot be expended on its manufacture and proper construction. The most ancient anchors consisted of large stones, baskets full of stones, sacks filled with sand, or logs of wood loaded with lead. Of this kind were the anchors of the ancient Greeks, which, according to Apollonius Rhodius and Stephen of Byzantium, were formed of stone; and Athenaeus states that they were sometimes made of wood. Such anchors held the vessel merely by their weight and by the friction along the bottom. Iron was afterwards introduced for the construction of anchors, and an improvement was made by forming them with teeth or "flukes" to fasten themselves into the bottom;

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[1] A. C. Lyall, *Asiatic Studies* (reprinted by Watts and Co., London, 1907), p. 19.

whence the words *ὀδόντες* and *dentes* are frequently taken for anchors in the Greek and Latin poets. The invention of the teeth is ascribed by Pliny to the Tuscans; but Pausanias gives the credit to Midas, king of Phrygia. Originally there was only one fluke or tooth, whence anchors were called *ἑτερόστομοι*; but a second was added, according to Pliny, by Eupalamus, or, according to Strabo, by Anacharsis, the Scythian philosopher. The anchors with two teeth were called *ἀμφίβολοι* or *ἀμφίστομοι*, and from ancient monuments appear to have resembled generally those used in modern days, except that the stock is absent from them all. Every ship had several anchors; the largest, corresponding to our sheet anchor, was only used in extreme danger, and was hence peculiarly termed *ἱερά* or *sacra*, whence the proverb *sacram anchoram solvere*, as flying to the last refuge.

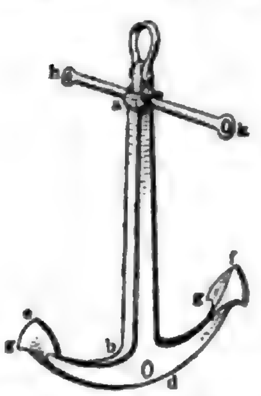

FIG. 1.—Rodger's Anchor.

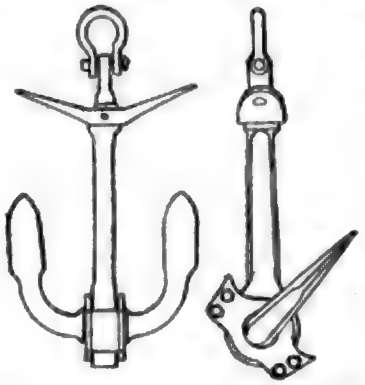
FIG. 2.—Improved Martin Anchor.

Until the beginning of the 19th century anchors were of imperfect manufacture, the means of effecting good and efficient welding being absent and the iron poor, whilst the arms, being straight, generally parted at the crown, when weighing from good holding-ground. A clerk in Plymouth Yard, named Pering, in the early part of that century (1813) introduced curved arms; and after 1852 the Admiralty anchor, under the direction of the Board, was supplied to H.M. ships, followed by Lieutenant (afterwards Captain) Rodger's anchor (fig. 1). This marked a great departure from the form of previous anchors. The arms, *de*, *df* were formed in one piece, and were pivoted at the crown *d* on a bolt passing through the forked shank *ab*. The points or pees *e*, *f*, to the palms *g* were blunt. This anchor had an excellent reputation amongst nautical men of that period, and by the committee on anchors, appointed by the admiralty in 1852, it was placed second only to the anchor of Trotman. Later came the self-canting and close-stowing Martin anchor, which, passing through successive improvements, became the improved Martin anchor (fig. 2) made of forged iron. A projection in the centre of the arms works in a recess at the hub of the shank; the vacancies outside the shank are filled by blocks bolted through on each side, and are flush with the side plates, which keep the flukes in position. The introduction of cast steel in 1894 led to the improved Martin-Adelphi pattern (fig. 3), in which the crown and arms are cast in one, and, with the stock, are made of cast steel, the shank remaining of forged iron. A projection in the crown works in a recess (right, fig. 3), and is secured in its place by a forged steel pin, fitted with a nut and washer, which passes through the crown and the heel of the shank. All the above anchors were provided with a stock (fig. 1, *hk*), the use of which is to "cant" the anchor. If it falls on the ground, resting on one arm and one stock, when a strain is brought on the cable, the stock cants the anchor, causing the arms to lie at a downward angle to the holding ground; and the pees enter and bury themselves below the surface of the soil.

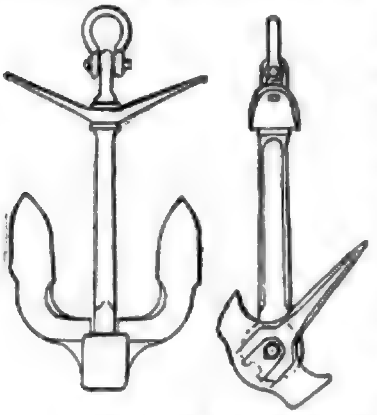
FIG. 3.—Improved Martin-Adelphi Anchor.

To stow a stocked anchor on the forecastle, it is hove up close to the forefoot, and by means of a ground chain (secured to a balancing or gravity band on the anchor), which is joined to a catting chain rove through a cat davit, the anchor is hove up horizontally and placed on its bed, where it is secured by chains passing over a rod fitted with a lever for "letting go." The cat davit is hinged at its base, and can be laid flat on the deck for right ahead fire or when at sea. Ground and catting chains have been superseded in some ships by a wire pendant and cat hook; the anchor is then hove close up to the hawse-pipe. To avoid cutting away a portion of the forecastle, in the "Cressy," "Terrible" and "Diadem" classes of the British navy, the anchors, secured by chains, are stowed a-cock-bill, outside the ship, with their crowns resting on iron shoes secured to the ship's side and the flukes fore and aft. A difficulty is experienced in stowing the anchors when the ship is pitching or rolling heavily. Fig. 4 illustrates an anchor with cat davit or anchor crane used in the P. and O. Company's steamers ("India" class, 8000 tons); for sea the anchor is stowed on board by the anchor crane.

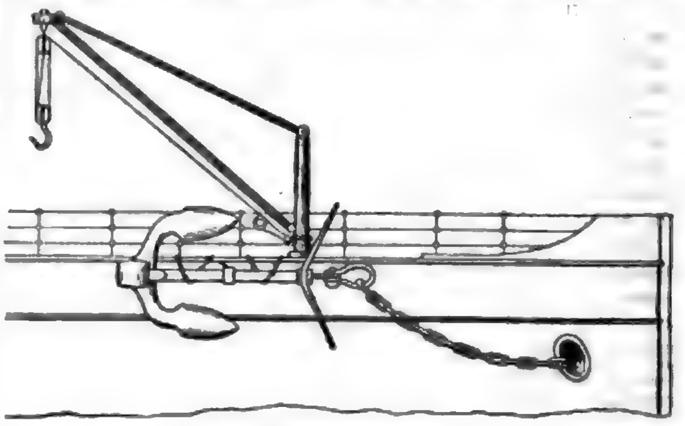
FIG. 4.—Anchor Crane.

Stockless anchors have been extensively used in the British mercantile marine and in some foreign navies. In 1903 they were adopted generally for the British navy, after extensive anchor trials, begun in 1885. Their advantages are:—handiness combined with a saving of time and labour; absence of davits, anchor-beds and other gear, with a resulting reduction in weight; and a clear forecastle for "right ahead" gun fire or for working ship. On the other hand a larger hawse-pipe is required, and there appears to be a consensus of opinion that a stockless anchor

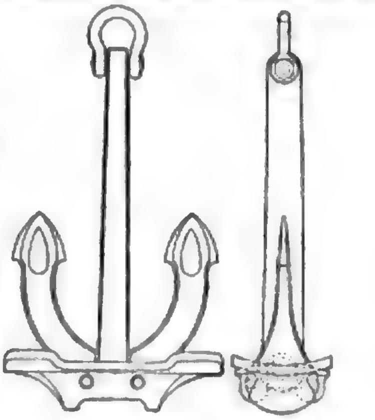
FIG. 5.—Hall's Improved Stockless Anchor.

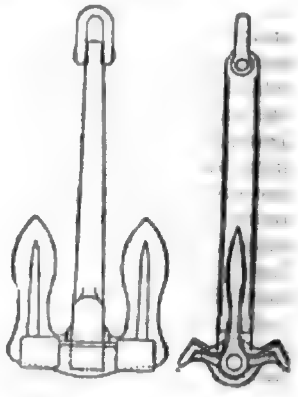
FIG. 6.—W. L. Byer's Stockless Anchor.

when "let go" does not hold so quickly as a stocked one, is more uncertain in its action over uneven ground, and is more liable to "come home" (drag). The stockless anchors principally in use in the British navy are Hall's improved, Byer's, and Wasteneys Smith's. In Hall's improved (fig. 5) the arms and crown of cast steel are in one piece, and the shank of forged steel passes up through an aperture in the crown to which it is secured by two cross bolts. Two trunnions or lugs are forged to the lower end of the shank. In Byer's plan (fig. 6) the flukes and crown consist of a steel-casting secured to a forged shank by a through bolt of mild steel, the axis of which is parallel to the points of the flukes; one end of the bolt has a head, but the other is screwed and fitted with a phosphor bronze nut to allow the bolt to be withdrawn for examination. A palm is cast on each side of the crown to trip the flukes when the anchor is on the ground, and for bringing them snug against the ship's side when weighing. Wasteneys Smith's anchor (fig. 7) is composed of three main parts, the shank and crown which form one forging, and the two flukes or arms which are separate castings. A bolt passes through the crown of the anchor, connecting the flukes to it; to prevent the flukes working off the connecting through bolt, two smaller bolts pass through the flukes at right angles to the through bolt and are recessed half their diameter into it.

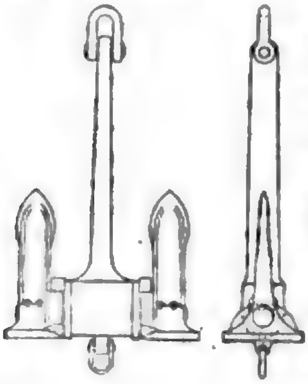
FIG. 7.—Wasteneys Smith's Stockless Anchor.

Fig. 8 represents the starboard bow of H.M.S. "New Zealand" (16,350 tons) with lower and sheet (spare) anchors stowed. To let go a stockless anchor (fig. 9) the cable or capstan holder C is unscrewed, and in practice it is found desirable to knock off the bottle screw-slip A, allowing the weight of the anchor to be taken by the inner slip A′ (Blake's stopper). Stern, stream and kedge anchors are usually stowed with special davits. A portable anchor suitable for small yachts is the invention of Mr Louis Moore; the shank passes through the crown of the anchor like the handle of a pickaxe and the stock over the head of the shank. At the end of the stock are loose pawls. There are no keys or bolts, and the only fastening is for the cable. The anchor takes to pieces readily and stows snugly. In 1890 Colonel Bucknill also invented a portable anchor for small yachts.

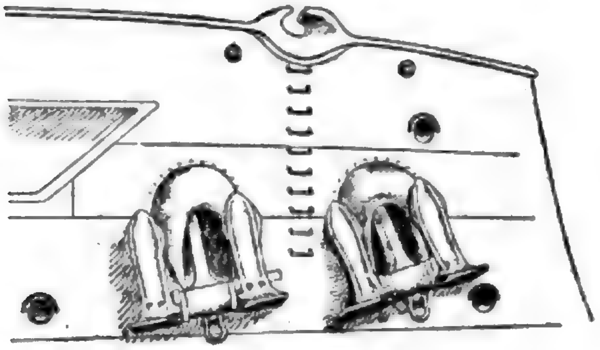
FIG. 8.—Starboard Bow of H.M.S. "New Zealand."

Iron buoy-sinkers (fig. 10), as used by the London Trinity House Corporation, weigh from 8 to 40 cwt.; the specified weight is cast on them in large raised figures, and the cast and wrought irons used are of special quality, of which samples are previously submitted to the engineer-in-chief.

The anchors supplied to ships of the British navy are required to withstand a certain tensile strain, expressed in tons, proportionate to their weights in cwts. New anchors are supplied by contractors, but repairs are made in H.M. dockyards, a record of its repairs being stamped on each anchor. In the Anchors and Cables Act 1899 a list is given of authorized testing-establishments, with their distinctive marks and charges, and testing-houses for foreign-owned vessels are enumerated in Table 22 of *Lloyd's Register of British and Foreign Shipping*. Cast-steel anchors, in addition to the statutory tests, are subjected to percussive, hammering and bending tests, and are stamped "annealed steel." (J. W. D.)

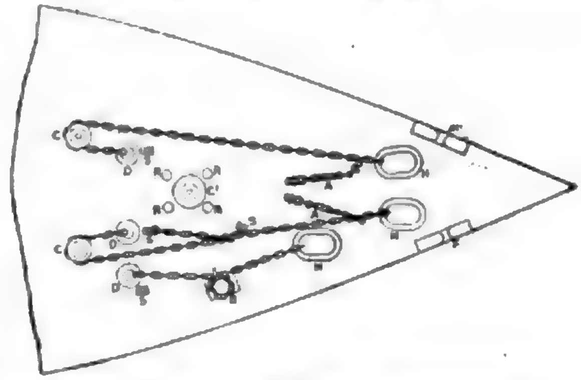
FIG. 9.—Forecastle of H.M.S. "New Zealand."

A. Bottle or screw-slip.
A′. Slip or Blake's stopper.
E. Bitts.
C. Cable or Capstan-holders.
C′. Centre line capstan.
B. Deck or navel pipes.
F. Fairleads for wire hawsers.
H. Hawse-pipes.
S. Stopper-bolts.
R. Rollers.

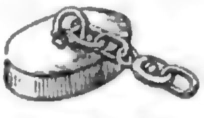
FIG. 10.—Iron Buoy-Sinker.

ANCHOVY (*Engraulis encrasicholus*), a fish of the herring family, easily distinguished by its deeply-cleft mouth, the angle of the gape being behind the eyes. The pointed snout extends beyond the lower jaw. The fish resembles a sprat in having a forked tail and a single dorsal fin, but the body is round and slender. The maximum length is 8¼ in. Anchovies are abundant in the Mediterranean, and are regularly caught on the coasts of Sicily, Italy, France and Spain. The range of the species also extends along the Atlantic coast of Europe to the south of Norway. In winter it is common off Devon and Cornwall, but has not hitherto been caught in such numbers as to be of commercial importance. Off the coast of Holland in summer it is more plentiful, entering the Zuider Zee in such numbers as to give rise to a regular and valuable fishery. It is also taken in the estuary of the Scheldt. There is reason to believe that the anchovies found at the western end of the English Channel in November and December are those which annually migrate from the Zuider Zee and Scheldt in autumn, returning thither in the following spring; they must be held to form an isolated stock, for none come up from the south in summer to occupy the English Channel, though the species is resident on the coast of Portugal. The explanation appears to be that the shallow and landlocked waters of the Zuider Zee, as well as the sea on the Dutch coast, become raised to a higher temperature in summer than any part of the sea about the British coasts, and that therefore anchovies are able to spawn and maintain their numbers in these waters. Their reproduction and development were first described by a Dutch naturalist from observations made on the shores of the Zuider Zee. Spawning takes place in June and July, and the eggs, like those of the majority of marine fishes, are buoyant and transparent, but they are peculiar in having an elongated, sausage-like shape, instead of being globular. They resemble those of the sprat and pilchard in having a segmented yolk and there is no oil globule. The larva is hatched two or three days after the fertilization of the egg, and is very minute and transparent. In August young specimens 1½ to 3½ in. in length have been taken in the Zuider Zee, and these must be held to have been derived from the spawning of the previous summer. There is no evidence to decide the question whether all the young anchovies as well as the adults leave the Zuider Zee in autumn, but, considering the winter temperature there, it is probable that they do. The eggs have also been obtained from the Bay of Naples, and near Marseilles, also off the coast of Holland, and once at least off the coast of Lancashire. The occurrence of anchovies in the English Channel has been carefully studied at the laboratory of the Marine Biological Association at Plymouth. They were most abundant in 1889 and 1890. In the former year considerable numbers were taken off Dover in drift nets of small mesh used for the capture of sprats. In the following December large numbers were taken together with sprats at Torquay. In November 1890 a thousand of the fish were obtained in two days from the pilchard boats fishing near Plymouth; these were caught near the Eddystone. When taken in British waters anchovies are either thrown away or sent to the market fresh with the sprats. If salted in the proper way, they would doubtless be in all respects equal to Dutch anchovies, if not to those imported from Italy. The supply, however, is small and inconstant, and for this reason English fish-curers have not learnt the proper way of preparing them. The so-called "Norwegian anchovies" imported into England in little wooden kegs are nothing but sprats pickled in brine with bay-leaves and whole pepper. (J. T. C.)

ANCIEN RÉGIME, The, a French phrase commonly used, even by English writers, to denote the social and political system established in France under the old monarchy, which was swept away by the Revolution of 1789. The phrase is generally applicable only to France, for in no other country, with perhaps the exception of Japan, has there been in modern times so clearly marked a division between "the old order" and the new.

ANCIENT (also spelt Antient; derived, through the Fr. *ancien*, old, from the late Lat. *antianum*, from *ante*, before), old or in olden times. "Ancient history" is distinguished from medieval and modern, generally as meaning before the fall of the western Roman empire. In English legal history, "ancient" tenure or demesne refers to what was crown property in the time of Edward the Confessor or William the Conqueror. "The Ancient of days" is a Biblical phrase for God. In the London Inns of Court the senior barristers used to be called "ancients." From the 16th to the 18th century the word was also used, by confusion with "ensign," *i.e.* flag or standard-bearer, for that military title, as in the case of Shakespeare's "ancient Pistol"; but this use has nothing to do with "ancient" meaning "old."

ANCIENT LIGHTS, a phrase in English law for a negative easement (*q.v.*) consisting in the right to prevent the owner or occupier of an adjoining tenement from building or placing on his own land anything which has the effect of illegally obstructing or obscuring the light of the dominant tenement. At common law a person, who opens a window in his house, has a natural right to receive the flow of light that passes through it. But his neighbour is not debarred thereby from building on his own land even though the effect of his action is to obstruct the flow of light thus obtained. Where, however, a window had been opened for so long a time as to constitute immemorial usage in law, the light became an "ancient light" which the law protected from disturbance. The Prescription Act 1832 created a statutory prescription for light. It provided (s. 3) that "when the access and use of light to and for" (any building) "shall have been actually enjoyed therewith for the full period of 20 years without interruption, the right thereto shall be deemed absolute and indefeasible, any local usage or custom to the contrary notwithstanding, unless it shall appear that the same was enjoyed by some consent or agreement, expressly made or given for that purpose by deed or writing." The statute does not create an absolute or indefeasible right immediately on the expiration of twenty years. Unless and until the dominant owner's claim is brought into question (s. 4) no absolute or indefeasible title can arise under the act. The dominant owner has only an inchoate right to avail himself under the act of the twenty years' uninterrupted enjoyment, if his claim is brought into question. But in the meantime, however long the enjoyment may have been, his right is just the same, and the origin of his right is just the same as if the act had never been passed. These principles were laid down in 1904 by the House of Lords in the leading case of *Colls* v. *Home & Colonial Stores Ltd*. (1904 A.C. 179). They overrule an earlier view propounded by Lord Westbury in 1865 (*Tapling* v. *Jones*, 11 H.L.C. 290) that the Prescription Act 1832 had abrogated the common law prescription as to light, that the right to "ancient lights" now depends upon positive enactment alone, and does not require, and ought not to be rested on, any fiction of a "lost grant" (see Easement). There has been much difference of judicial opinion as to what constitutes an actionable interference with "ancient lights." On the one hand, the test has been prescribed that if an angle of 45°—uninterrupted sky light—was left, the easement was not interfered with, and, while this is not a rule of law, it is a good rough working criterion. On the other hand, it was held in effect by the Court of Appeal in the case of *Colls* v. *Home & Colonial Stores Ltd*. (1902; 1 Ch. 302) that to constitute an actionable obstruction of ancient lights it was sufficient if the light was sensibly less than it was before. The House of Lords, however, in the same case (1904 A. C. 179) overruled this view, and held that there must be a substantial privation of light enough to render the occupation of the house or building uncomfortable according to the ordinary notions of mankind and (in the case of business premises) to prevent the plaintiff from carrying on his business as beneficially as before. See also *Kine* v. *Jolly* (1905; 1 Ch. 480).

There is, in Scots law, no special doctrine as to "ancient lights." The servitude of light in Scotland is simply the Roman servitude *non officiendi luminibus vel prospectui* (see Easement and Roman Law). The same observation applies to the Code Civil and other European Codes based on it. The doctrine as to ancient lights does not prevail generally in the United States (consult *Ruling Cases*, under "Air").

ANCILLARY (from the Lat. *ancilla*, a handmaid), an adjective meaning "subordinate to" or "merely helping," as opposed to "essential." By Thackeray and some other writers it is also employed rather affectedly in its primary meaning of "pertaining to a maid-servant."

ANCILLON, CHARLES (1659–1715), one of a distinguished family of French Protestants, was born on the 28th of July 1659, at Metz. His father, David Ancillon (1617–1692), was obliged to leave France on the revocation of the edict of Nantes, and became pastor of the French Protestant community in Berlin. Charles Ancillon studied law at Marburg, Geneva, and Paris, where he was called to the bar. At the request of the Huguenots at Metz, he pleaded its cause at the court of Louis XIV., urging that it should be excepted in the revocation of the edict of Nantes, but his efforts were unsuccessful, and he joined his father in Berlin. He was at once appointed by the elector Frederick "juge et directeur de colonie de Berlin." He had before this published several works on the revocation of the edict of Nantes and its consequences, but his literary capacity was mediocre, his style stiff and cold, and it was his personal character rather than his reputation as a writer that earned him the confidence of the elector. In 1687 he was appointed head of the so-called *Académie des nobles*, the principal educational establishment of the state; later on, as councillor of embassy, he took part in the negotiations which led to the assumption of the title of king by the elector. In 1699 he succeeded Pufendorf as historiographer to the elector, and the same year replaced his uncle Joseph Ancillon as judge of all the French refugees in Brandenburg. He died on the 5th of July 1715. Ancillon's chief claim to remembrance is the work that he did for education in Prussia, and the share he took, in co-operation with Leibnitz, in founding the Academy of Berlin. Of his fairly numerous works the only one still of value is the *Histoire de l'établissement des Français réfugiés dans les États de Brandebourg* (Berlin, 1690).

ANCILLON, JOHANN PETER FRIEDRICH (1766–1837), Prussian historian and statesman, great-grandson of Charles Ancillon, was born at Berlin on the 30th of April 1766. He studied theology at Geneva, and after finishing his course was appointed minister to the French community at Berlin. At the same time his reputation as a historical scholar secured him the post of professor of history at the military academy. In 1793 he visited Switzerland, and in 1796 France, and published the impressions gathered during his travels in a series of articles which he afterwards collected under the title of *Mélanges de littérature et de philosophie* (1801). Ancillon took rank among the most famous historians of his day by his next work, *Tableau des révolutions du système politique de l'Europe depuis le XVe siècle* (1803, 4 vols.; new ed., 1824), which gained him the eulogium of the Institute of France, and admission to the Academy of Berlin. It was the first attempt to recognize psychological factors in historical movements, but otherwise its importance was exaggerated. Its "sugary optimism, unctuous phraseology and pulpit logic" appealed, however, to the reviving pietism of the age succeeding the Revolution, and these qualities, as well as his eloquence as a preacher, early brought Ancillon into notice at court. In 1808 he was appointed tutor to the royal princes, in 1809 councillor of state in the department of religion, and in 1810 tutor of the crown prince (afterwards Frederick William IV.), on whose sensitive and dreamy nature he was to exercise a powerful but far from wholesome influence. In October 1814, when his pupil came of age, Ancillon was included by Prince Hardenberg in the ministry, as privy councillor of legation in the department of foreign affairs, with a view to utilizing his supposed gifts as a philosophical historian in the preparation of the projected Prussian constitution. But Ancillon's reputed liberalism was of too invertebrate a type to survive the trial of actual contact with affairs. The practical difficulty of the constitutional problem gave the "court parson"—as Gneisenau had contemptuously called him—excuse enough for a change of front which, incidentally, would please his exalted patrons. He covered his defection from Hardenberg's liberal constitutionalism by a series of "philosophical" treatises on the nature of the state and of man, and became the soul of the reactionary movement at the Berlin court, and the faithful henchman of Metternich in the general politics of Germany and of Europe.

In 1817 Ancillon became a councillor of state, and in 1818 director of the political section of the ministry for foreign affairs under Count Bernstorff. In his chief's most important work, the establishment of the Prussian *Zollverein*, Ancillon had no share, while the entirely subordinate rôle played by Prussia in Europe during this period, together with the personal part taken by the sovereign in the various congresses, gave him little scope for the display of any diplomatic talents he may have possessed. During this time he found plentiful leisure to write a series of works on political philosophy, such as the *Nouveaux essais de politique et de philosophie* (Paris, 1824). In May 1831 he was made an active privy councillor, was appointed chief of the department for the principality of Neuchâtel, in July became secretary of state for foreign affairs, and in the spring of 1832, on Bernstorff's retirement, succeeded him as head of the ministry.

By the German public, to whom Ancillon was known only through his earlier writings and some isolated protests against the "demagogue-hunting" in fashion at Berlin, his advent to power was hailed as a triumph of liberalism. They were soon undeceived. Ancillon had convinced himself that the rigid class distinctions of the Prussian system were the philosophically ideal basis of the state, and that representation "by estates" was the only sound constitutional principle; his last and indeed only act of importance as minister was his collaboration with Metternich in the Vienna Final Act of the 12th of June 1834, the object of which was to rivet this system upon Germany for ever. He died on the 19th of April 1837, the last of his family. His historical importance lies neither in his writings nor in his political activity, but in his personal influence at the Prussian court, and especially in its lasting effect on the character of Frederick William IV.

See C. A. L. P. Varnhagen von Ense, *Blätter aus der preussischen Geschichte*, 5 vols. (Leipzig, 1868–1869); *ib. Tagebücher*, vol. i. (Leipzig, 1861); H. O. Treitschke, *Deutsche Geschichte* (Leipzig, 1879–1894), and essay on Ancillon in *Preussische Jahrbücher* for April 1872; *Allgemeine Deutsche Biographie*, s.v. (Leipzig, 1875).

ANCÓN, a small village and bathing-place on the coast of Peru, 22 m. N. of Lima by rail. The bay is formed by two projecting headlands and is one of the best on the coast. It has a gently sloping beach of fine sand and has been a popular bathing-place since the time of President Balta, although the country behind it is arid and absolutely barren. At some time previous to the discovery of America, Ancón had a large aboriginal population. Traces of terraces on the southern headland can still be seen, and the sand-covered hills and slopes overlooking the bay contain extensive burial-grounds which were systematically explored in 1875 by Messrs W. Reiss and A. Stübel (see Reiss and Stübel's *The Necropolis of Ancón in Peru*, translated by A. H. Keane, 3 vols., Berlin, 1880–1887). In modern times Ancón has been the scene of several important historical events. Its anchorage was used by Lord Cochrane in 1820 during his attacks on Callao; it was the landing-place of an invading Chilean army in 1838; it was bombarded by the Chileans in 1880; and in 1883 it was the meeting-place of the Chilean and Peruvian commissioners who drew up the treaty of Ancón, which ended the war between Chile and Peru.

ANCON (from the Gr. ἀγκών), the anatomical name for "elbow"; "ancones" in architecture are the projecting bosses left on stone blocks or on drums of columns, to allow of their being either hoisted aloft or rubbed backwards and forwards to obtain a fine joint; the term is also given by Vitruvius to the trusses or console brackets on each side of the doorway of a Greek or Roman building which support the cornice over the same. A particular sort of sheep, with short crooked forelegs, is called "ancon" sheep.

ANCONA, ALESSANDRO (1835–), Italian critic and man of letters, was born at Pisa on the 20th of February 1835, of a wealthy Jewish family, and educated in Florence; at the age of eighteen he published his essay on the life and work of the philosopher Tommaso Campanella. In 1855 Ancona went to Turin, nominally to study law, but in reality to act as intermediary between the Tuscan Liberals and Cavour; he was an intimate friend of Luigi Carlo Farini (*q.v.*) and represented Tuscany in the Società Nazionale. On the fall of the Austrian dynasty in Tuscany (April 27, 1859) he returned to Florence, where he edited the newly founded newspaper *La Nazione*. In 1861 he was appointed professor of Italian literature at the university of Pisa. Among his works the following may be mentioned: *Opera di Tommaso Campanella*, 2 vols. (Turin, 1854); *Sacre Rappresentazioni dei secoli XIV., XV., e XVI.* (3 vols., Florence, 1872); *Origini del Teatro in Italia* (2 vols., Florence, 1877); *La Poesia popolare italiana* (Livorno, 1878), besides several volumes of literary essays, editions of the works of Dante and other early Italian writers, &c.

ANCONA, a seaport and episcopal see of the Marches, Italy, capital of the province of Ancona, situated on the N.E. coast of Italy, 185 m. N.E. of Rome by rail and 132 m. direct, and 127 m. S.E. of Bologna. Pop. (1901) 56,835. The town is finely situated on and between the slopes of the two extremities of the promontory of Monte Conero, Monte Astagno to the S., occupied by the citadel, and Monte Guasco to the N., on which the cathedral stands (300 ft.). The latter, dedicated to S. Ciriaco, is said to occupy the site of a temple of Venus, who is mentioned by Catullus and Juvenal as the tutelary deity of the place. It was consecrated in 1128 and completed in 1189. Some writers suppose that the original church was in the form of a Latin cross and belonged to the 8th century. An early restoration was completed in 1234. It is a fine Romanesque building in grey stone, built in the form of a Greek cross, with a dodecagonal dome over the centre slightly altered by Margaritone d'Arezzo in 1270. The façade has a Gothic portal, ascribed to Giorgio da Como (1228), which was intended to have a lateral arch on each side. The interior, which has a crypt in each transept, in the main preserves its original character. It has ten columns which are attributed to the temple of Venus, and there are good screens of the 12th century, and other sculptures. In the dilapidated episcopal palace Pope Pius II. died in 1464. An interesting church is S. Maria della Piazza, with an elaborate arcaded façade (1210). The Palazzo del Comune, with its lofty arched substructures at the back, was the work of Margaritone d' Arezzo, but has been since twice restored. There are also several fine late Gothic buildings, among them the churches of S. Francesco and S. Agostino, the Palazzo Benincasa, and the Loggia dei Mercanti, all by Giorgio Orsini, usually called da Sebenico (who worked much at Sebenico, though he was not a native of it), and the prefecture, which has Renaissance additions. The portal of S. Maria della Misericordia is an ornate example of early Renaissance work. The archaeological museum contains interesting pre-Roman objects from tombs in the district, and two Roman beds with fine decorations in ivory (E. Brizio, in *Notizie degli scavi*, 1902, 437, 478).

To the east of the town is the harbour, now an oval basin of 990 by 880 yards, the finest harbour on the S. W. coast of the Adriatic, and one of the best in Italy. It was originally protected only by the promontory on the N., from the elbow-like shape of which (Gk. ἀγκών) the ancient town, founded by Syracusan refugees about 390 B.C., took the name which it still holds. Greek merchants established a purple factory here (Sil. Ital. viii. 438). Even in Roman times it kept its own coinage with the punning device of the bent arm holding a palm branch, and the head of Aphrodite on the reverse, and continued the use of the Greek language. When it became a Roman colony is doubtful.[1] It was occupied as a naval station in the Illyrian war of 178 B.C. (Liv. xli. 1). Caesar took possession of it immediately after crossing the Rubicon. Its harbour was of considerable importance in imperial times, as the nearest to Dalmatia,[2] and was enlarged by Trajan, who constructed the north quay, his architect being Apollodorus of Damascus. At the beginning of it stands the marble triumphal arch with a single opening, and without bas-reliefs, erected in his honour in A.D. 115 by the senate and people. Pope Clement II. prolonged the quay, and an inferior imitation of Trajan's arch was set up; he also erected a lazaretto at the south end of the harbour, now a sugar refinery, Vanvitelli being the architect-in-chief. The southern quay was built in 1880, and the harbour is now protected by forts on the heights, while the place is the seat of the 7th army corps.

The port of Ancona was entered in 1904 by 869 steamships and 600 sailing vessels, with a total tonnage of 961,612 tons. The main imports were coal, timber, metals, jute. The main exports were asphalt and calcium carbide. Sugar refining and shipbuilding are carried on.

Ancona is situated on the railway between Bologna and Brindisi, and is also connected by rail with Rome, via Foligno and Orte.

After the fall of the Roman empire Ancona was successively attacked by the Goths, Lombards and Saracens, but recovered its strength and importance. It was one of the cities of the Pentapolis under the exarchate of Ravenna, the other four being Fano, Pesaro, Senigallia and Rimini, and eventually became a semi-independent republic under the protection of the popes, until Gonzaga took possession of it for Clement VII. in 1532. From 1797 onwards, when the French took it, it frequently appears in history as an important fortress, until Lamoricière capitulated here on the 29th of September 1860, eleven days after his defeat at Castelfidardo. (T. As.)

ANCREN RIWLE, a Middle English prose treatise written for a small community of three religious women and their servants at Tarent Kaines (Tarrant Crawford), at the junction of the Stour and the Tarrant, Dorset. It was generally supposed to date from the first quarter of the 13th century, but Professor E. Kölbing is inclined to place the Corpus Christi MS. about the middle of the 12th century. The house of Tarrant was founded by Ralph de Kahaines, and greatly enriched about 1230 by Richard Poor, bishop successively of Chichester, Salisbury and Durham, who was born at Tarrant and died there in 1237. At the time when the *Ancren Riwle* was addressed to them the anchoresses did not belong to any of the monastic orders, but the monastery was under the Cistercian rule before 1266.[3] There are extant seven English MSS. of the work, and one Latin, the Latin version being generally supposed to be a translation. The Latin MS., *Regula Anachoritarum sive de vita solitaria* (Magdalen College, Oxford, No. 67, fol. 50) has a prefatory note:—*Hic incipit prohemium venerabilis patris magistri Simonis de Gandavo, episcopi Sarum, in librum de vita solitaria, quem scripsit sororibus suis anachoritis apud Tarente.* But Bishop Simon of Ghent, who died in 1315, could not have written the book, if it dates, at latest, from the early 13th century. It has been tentatively attributed to Richard Poor, who was connected with Tarrant, and was actually a benefactor of the monastery. But the adoption of Prof. Kölbing's early date would almost destroy Poor's claim.

The Ancren Riwle is written in a simple, non-rhetorical style. The severity of the doctrine of self-renunciation is softened by the affectionate tone in which it is inculcated. The book contains rules for the conduct of the anchoresses, and gives liturgical directions for divine service; but the greater part of it is taken up with the purely spiritual side of religion. The rules for the restraint of the senses, for confession and penance, are subordinated to the central idea of the supreme importance of purity of heart and the love of Christ. The last chapter deals with the domestic affairs and administration of the monastery. Incidentally the writer gives a picture of the manners and ideas of the time, and provides an account of the doctrine then generally accepted in the English church.

Ancren Riwle was edited for the Camden Society by the Rev. James Morton in 1843 from the Cotton MS. (Nero A xiv.). A collation of this text with the MS. by E. Kölbing is printed in the *Jahrbuch für romanische u. engl. Spr. und Lit.* xv. 180 seq. (1876). The *Ancren Riwle* (ed. Abbot F. A. Gasquet, 1905) is available for the ordinary reader in *The King's Classics*. There are three English MSS. of *Ancren Riwle* in the Cottonian collection in the British Museum, numbered Nero A xiv., Titus D xviii., and Cleopatra C vi. Nero A xiv. is written in pure south-western dialect. Portions of this text are printed in Henry Sweet's *First Middle English Primer* (Oxford, 2nd ed., 1895), which contains a grammatical introduction. MS. 402 in the library of Corpus Christi College, Cambridge, contains the earliest version of *Ancren Riwle*, entitled *Ancren Wissé*, and dating (according to E. Kölbing in *Englische Studien*, 1886, vol. ix. 116) from about 1150. The language shows considerable traces of the Midland dialect. MS. 234 in Caius College, Cambridge, contains a considerable portion of the *Ancren Riwle*, but does not follow the order of the other MSS. For its exact contents see Kölbing, in *Englische Studien*, iii. 535 (1880). A more recently discovered version in Magdalene College, Cambridge, in MS. Pepys 2498, is entitled *The Recluse*, and is abridged and differently arranged. It is written in English of the latter half of the 14th century (see A. C. Paues in *Englische Studien*, xxx. 344-346, 1902). A Latin version (Cotton MS. Vitellius E vii.), and a French copy (*ibid.* F vii.) were seriously damaged in the fire at Ashburnham House, but both MSS. have been recently restored. The Latin MS. (Codex lxvii.) at Magdalen College, Oxford, is probably a copy of another Latin text, for it contains obvious slips.

See also R. Wülker, "Ueber die Sprache der *Ancren Riwle* und die der Homilie: *Hali Meidenhad*," in *Beiträge zur Geschichte der deutschen Sprache und Literatur* (Halle, 1874, i. 209), giving an analysis of the differences in dialect between the two works; and Edgar Elliott Bramlette, "The Original Language of the *Ancren Riwle*," in *Anglia*, xv. 478-498, arguing in favour of a Latin original.

ANCRUM, a village on Ale or Alne Water (a tributary of the Teviot), Roxburghshire, Scotland, 2 m. W. of Jedfoot Bridge station on the Roxburgh-Jedburgh branch of the North British railway. Pop. (1901) 973. The earlier forms of the name, "Alnecrumba," "Ankrom" and "Alnecrom," indicate its Gaelic derivation from *crom*, "crooked"—"the crook or bend of the

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[1] Scanty remains of the ancient town walls, of a gymnasium near the harbour and of the amphitheatre are still extant.

[2] It was connected by a road with the Via Flaminia at Nuceria (Norcera), a distance of 70 m.

[3] For information on the subject of Tarent Kaines see Sir W. Dugdale, *Monasticon Anglicanum* (new ed., 1846), vol. v. 619 et seq.

Alne." The village is of considerable antiquity, and was formerly held by the see of Glasgow. Its cross, said to date from the time of David I., is one of the best preserved crosses in the Border counties. Ancrum Moor, 2 m. N.W., was the scene of the battle in which, on the 17th of February 1545, the Scots under the earl of Angus, Sir Walter Scott of Buccleuch, and Norman Leslie, defeated 5000 English, whose leaders, Sir Ralph Evers or Eure and Sir Brian Latoun or Layton, were slain. A Roman road, 24 ft. broad, forms the N.E. boundary of the parish of Ancrum.

ANCUS MARCIUS (640–616 B.C.), fourth legendary king of Rome. Like Numa, his reputed grandfather, he was a friend of peace and religion, but was obliged to make war to defend his territories. He conquered the Latins, and a number of them he settled on the Aventine formed the origin of the Plebeians. He fortified the Janiculum, threw a wooden bridge across the Tiber, founded the port of Ostia, established salt-works and built a prison.

Ancus Marcius is merely a duplicate of Numa, as is shown by his second name, Numa Marcius, the confidant and pontifex of Numa, being no other than Numa Pompilius himself, represented as priest. The identification with Ancus is shown by the legend which makes the latter a bridge-builder (*pontifex*), the constructor of the first wooden bridge over the Tiber. It is in the exercise of his priestly functions that the resemblance is most clearly shown. Like Numa, Ancus died a natural death.

See Livy i. 32, 33; Dion Halic. iii. 36-45; Cicero, *De Republica*, ii. 18. For a critical examination of the story see Schwegler, *Römische Geschichte*, bk. xiii.; Sir G. Cornewall Lewis, *Credibility of Early Roman History*, ch. xi.; W. Ihne, *History of Rome*, i.; R. Pais, *Storia di Roma*, i. (1898), who considers that the name points to the personification of the cult of Mars, and that the military achievements of Ancus are anticipations of later events.

ANCYLOPODA, or ANCYLODACTYLA, an apparently primitive extinct subordinal group of Ungulata showing certain resemblances to the Perissodactyla, both as regards the cheek-teeth and the skeleton, but broadly distinguished by the feet being of an edentate type, carrying long curved and cleft terminal claws. From this peculiar structure of the feet it would seem that the weight of the body was mainly carried on their outer sides, as in Edentates. The group is typified by *Chalicotherium*, of which the original species was discovered in the Lower Pliocene strata of Eppelsheim, Hesse-Darmstadt, in 1825, and named on the evidence of the teeth, the limbs being subsequently described as *Macrotherium*. The skull is short, with a dental formula of *i.* $\frac{3}{3}$, *c.* $\frac{0}{1}$, *p.* $\frac{4}{3}$. *m.* $\frac{3}{3}$, but in fully adult animals most of the front teeth were shed. The molar teeth recall those of *Palaeosyops* (see TITANOTHERIIDAE). Remains referred to *Chalicotherium* have been also obtained from the Lower Pliocene and Upper Miocene strata of Greece, Hungary, India, China and North America. A skull from Pikermi, near Mt. Pentelikon, Attica, shows the absence in the adult state of upper and lower incisors and upper canines, much the same condition being indicated in an Indian skull. There were three toes to each foot, and the femur lacked a third trochanter.

Macrotherium, which is typically from the Middle Miocene of Sansan, in Gers, France, may indicate a distinct genus. Limb-bones nearly resembling those of *Macrotherium*, but relatively stouter, have been described from the Pliocene beds of Attica and Samos as *Ancylotherium*. In America the names *Morotherium* and *Moropus* have been applied to similar bones, on the belief that they indicated edentates. *Macrotherium magnum* must have been an animal of about 9 ft. in length.

The South American genus *Homalodontotherium* is often placed in the Ancylopoda, but reasons against this view are given in the article LITOPTERNA. Professor H. F. Osborn considers that the Ancylopoda are directly descended from the Condylarthra.

See also H. F. Osborn, "The Ancylopoda Chalicotherium and Artionyx," *Amer. Nat.* (1893), p. 118, and "Artionyx, a New Genus of Ancylopoda," *Bull. Amer. Mus.* vol. v. p. 1 (1893). [*N.B.—Artionyx* was subsequently found to be an Artiodactyle.] (R. L.*)

ANCYRA (mod. *Angōra, q.v.*), an ancient city of Galatia in Asia Minor, situated on a tributary of the Sangarius. Originally a large and prosperous Phrygian city on the Persian Royal Road, Ancyra became the centre of the Tectosages, one of the three Gaulish tribes that settled permanently in Galatia about 232 B.C. The barbarian occupation dislocated civilization, and the town sank to a mere village inhabited chiefly by the old native population who carried on the arts and crafts of peaceful life, while the Gauls devoted themselves to war and pastoral life (see GALATIA). In 189 B.C. Ancyra was occupied by Cn. Manlius Vulso, who made it his headquarters in his operations against the tribe. In 63 B.C. Pompey placed it (together with the Tectosagan territory) under one chief, and it continued under native rule till it became the capital of the Roman province of Galatia in 25 B.C. By this time the population included Greeks, Jews, Romans and Romanized Gauls, but the town was not yet Hellenized, though Greek was spoken. Strabo (*c.* A.D. 19) calls it not a city, but a fortress, implying that it had none of the institutions of the Graeco-Roman city. Inscriptions and coins show that its civilization consisted of a layer of Roman ideas and customs superimposed on Celtic tribal characteristics, and that it is not until *c.* A.D. 150 that the true Hellenic spirit begins to appear. Christianity was introduced (from the N. or N.W.) perhaps as early as the 1st century, but there is no shred of evidence that the Ancyran Church (first mentioned A.D. 192) was founded by St Paul or that he ever visited northern Galatia. The real greatness of the town dates from the time when Constantinople became the metropolis of the Roman world: then its geographical situation raised it to a position of importance which it retained throughout the middle ages. See further ANGORA (1).

The modern town contains many remains of the Roman and Byzantine periods. The most important monument is the *Augusteum*, a temple of white marble erected to "Rome and Augustus" during the lifetime of that emperor by the common council or diet of the three Galatian tribes. The temple was afterwards converted into a church, and in the 16th century a fine mosque was built against its S. face. On the walls of the temple is engraved the famous *Monumentum Ancyranum*, a long inscription in Latin and Greek describing the *Res gestae divi Augusti*; the Latin portion being inscribed on the inner left-hand wall of the *pronaos*, the Greek on the outside wall of the *naos* (*cella*). The inscription is a grave and majestic narrative of the public life and work of Augustus. The original was written by the emperor in his 76th year (A.D. 13–14) to be engraved on two bronze tablets placed in front of his mausoleum in Rome, and as a mark of respect to his memory a copy was inscribed on the temple walls by the council of the Galatians. Thus has been preserved an absolutely unique historical document of great importance, recounting (1) the numerous public offices and honours conferred on him, (2) his various benefactions to the state, to the *plebs* and to his soldiers, and (3) his military and administrative services to the empire.

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SYNOD OF ANCYRA.—An important ecclesiastical synod was held at Ancyra, the seat of the Roman administration for the province of Galatia, in A.D. 314. The season was soon after Easter; the year may be safely deduced from the fact that the first nine canons are intended to repair havoc wrought in the church by persecution, which ceased after the overthrow of Maximinus in 313. The tenth canon tolerates the marriages of deacons who previous to ordination had reserved the right to take a wife; the thirteenth forbids *chorepiscopi* to ordain presbyters or deacons; the eighteenth safeguards the right of the people in objecting to the appointment of a bishop whom they do not wish.

See Mansi, ii. 514 ff. The critical text of R. B. Rackham (Oxford, 1891), *Studia biblica et ecclesiastica*, iii. 139 ff., is conveniently reprinted in Lauchert 29 ff. H. R. Percival translates and comments on an old text in the Nicene and Post-Nicene Fathers (2nd series), xiv. 61 ff. An elaborate discussion is found in Hefele, *Conciliengeschichte* (2nd ed.), i. 219 ff. (English translation, i. 199 ff.); more briefly in Herzog-Hauck (3rd ed.), i. 497. For full titles see COUNCIL. (W. W. R.*)

ANDALUSIA, or Andalucia, a captaincy-general, and formerly a province, of southern Spain; bounded on the N. by Estremadura and New Castile, E. by Murcia and the Mediterranean Sea, S. by the Mediterranean and Atlantic, and W. by Portugal. Pop. (1900) 3,563,606; area, 33,777 sq. m. Andalusia was divided in 1833 into the eight provinces of Almeria, Cadiz, Cordova, Granada, Jaén, Huelva, Malaga and Seville, which are described in separate articles. Its ancient name, though no longer used officially, except to designate a military district, has not been superseded in popular speech by the names of the eight modern divisions.

Andalusia consists of a great plain, the valley of the Guadalquivir, shut in by mountain ranges on every side except the S.W., where it descends to the Atlantic. This lowland, which is known as *Andalucia Baja*, or Lower Andalusia, resembles the valley of the Ebro in its slight elevation above sea-level (300-400 ft.), and in the number of brackish lakes or fens, and waste lands (*despoblados*) impregnated with salt, which seem to indicate that the whole surface was covered by the sea at no distant geological date. The barren tracts are, however, exceptional and a far larger area is richly fertile. Some districts, indeed, such as the Vega of Granada, are famous for the luxuriance of their vegetation. The Guadalquivir (*q.v.*) rises among the mountains of Jaén and flows in a south-westerly direction to the Gulf of Cadiz, receiving many considerable tributaries on its way. On the north, its valley is bounded by the wild Sierra Morena; on the south, by the mountains of the Mediterranean littoral, among which the Sierra Nevada (*q.v.*), with its peaks of Mulhacen (11,421 ft.)and Veleta(11,148 ft.), is the most conspicuous. These highlands, with the mountains of Jaén and Almería on the east, constitute *Andalucia Alta* or Upper Andalusia.

No part of Spain has greater natural riches. The sherry produced near Jeréz de la Frontera, the copper of the Rio Tinto mines and the lead of Almería are famous. But the most noteworthy characteristics of the province are, perhaps, the brilliancy of its climate, the beauty of its scenery (which ranges in character from the alpine to the tropical), and the interest of its art and antiquities. The climate necessarily varies widely with the altitude. Some of the higher mountains are covered with perpetual snow, a luxury which is highly prized by the inhabitants of the valleys, where the summer is usually extremely hot, and in winter the snow falls only to melt when it reaches the ground. Here the more common European plants and trees give place to the wild olive, the caper bush, the aloe, the cactus, the evergreen oak, the orange, the lemon, the palm and other productions of a tropical climate. On the coasts of the Mediterranean about Marbella and Malaga, the sugar-cane is successfully cultivated. Silk is produced in the same region. Agriculture is in a very backward state and the implements used are most primitive. The chief towns are Seville (pop. 1900, 148,315), which may be regarded as the capital, Malaga (130,109), Granada (75,900), Cadiz (69,382), Jeréz de la Frontera (63,473), Cordova (58,275) and Almería (47,326).

Andalusia has never been, like Castile or Aragon, a separate kingdom. Its history is largely a record of commercial and artistic development. The Guadalquivir valley is often, in part at least, identified with the biblical *Tarshish* and the classical *Tartessus*, a famous Phoenician mart. The port of *Agadir* or *Gaddir*, now Cadiz, was founded as early as 1100 B.C. Later Carthaginian invaders came from their advanced settlements in the Balearic Islands, about 516 B.C. Greek merchants also visited the coasts. The products of the interior were conveyed by the native Iberians to the maritime colonies, such as *Abdera* (Adra), *Calpe* (Gibraltar) or *Malaca* (Malaga), founded by the foreign merchants. The Punic wars transferred the supreme power from Carthage to Rome, and Latin civilization was established firmly when, in 27 B.C., Andalusia became the Roman province of *Baetica*—so called after its great waterway, the *Baetis* (Guadalquivir). In the 5th century the province was overrun by successive invaders—Vandals, Suevi and Visigoths—from the first of whom it may possibly derive its name. The forms *Vandalusia* and *Vandalitia* are undoubtedly ancient; many authorities, however, maintain that the name is derived from the Moorish *Andalus* or *Andalosh*, "Land of the West." The Moors first entered the province in 711, and only in 1492 was their power finally broken by the capture of Granada. Their four Andalusian kingdoms, Seville, Jaén, Cordova and Granada, developed a civilization unsurpassed at the time in Europe. An extensive literature, scientific, philosophical and historical, with four world-famous buildings—the Giralda and Alcázar of Seville, the Mezquita or cathedral of Cordova and the Alhambra at Granada—are its chief monuments. In the 16th and 17th centuries, painting replaced architecture as the distinctive art of Andalusia; and many of the foremost Spanish painters, including Velazquez and Murillo, were natives of this province.

Centuries of alien domination have left their mark upon the character and appearance of the Andalusians, a mixed race, who contrast strongly with the true Spaniards and possess many oriental traits. It is impossible to estimate the influence of the elder conquerors, Greek, Carthaginian and Roman; but there are clear traces of Moorish blood, with a less well-defined Jewish and gipsy strain. The men are tall, handsome and well-made, and the women are among the most beautiful in Spain; while the dark complexion and hair of both sexes, and their peculiar dialect of Spanish, so distasteful to pure Castilians, are indisputable evidence of Moorish descent. Their music, dances and many customs, come from the East. In general, the people are lively, good-humoured and ready-witted, fond of pleasure, lazy and extremely superstitious. In the literature and drama of his country, the Andalusian is traditionally represented as the Gascon of Spain, ever boastful and mercurial; or else as a picaresque hero, bull-fighter, brigand or smuggler. Andalusia is still famous for its bull-fighters; and every outlying hamlet has its legends of highwaymen and contraband.

In addition to the numerous works cited under the heading Spain, see *Curiosidades historicas de Andalucia*, by N. Diáz de Escovar (Malaga, 1900); *Histoire de la conquête de l'Andalousie*, by O. Houdas (Paris, 1889); *Andalousie et Portugal* (Paris, 1886); *El. Folk-Lore Andalus* (Seville, 1883); and *Nobleza de Andalucia*, by G. Argote de Molina (Seville, 1588).

ANDALUSITE, a mineral with the same chemical composition as cyanite and sillimanite, being a basic aluminium silicate, Al_2SiO_5. As in sillimanite, its crystalline form is referable to the orthorhombic system. Crystals of andalusite have the form of almost square prisms, the prism-angle being 89° 12′; they are terminated by a basal plane and sometimes by small dome-faces. As a rule the crystals are roughly developed and rude columnar masses are common, these being frequently altered partially to kaolin or mica. Such crystals, opaque, and of a greyish or brownish colour, occur abundantly in the mica-schist of the Lisens Alp near Innsbruck in Tirol, while the first noted of the many localities of the mineral is in Andalusia, from which place the mineral derives its name. The unaltered mineral is found as transparent pebbles with topaz in the gem-gravels of the Minas Novas district, in Minas Geraes, Brazil. These pebbles are usually green but sometimes reddish-brown in colour, and are remarkable for their very strong dichroism, the same pebble appearing green or reddish-brown according to the direction in which it is viewed. Such specimens make very effective gem-stones, the degree of hardness of the mineral ($H.=7\frac{1}{2}$) being quite sufficient for this purpose. Its specific gravity is 3·18; it is unattacked by acids and is infusible before the blowpipe.

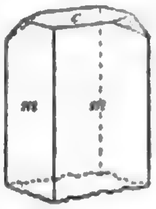


FIG. 1.

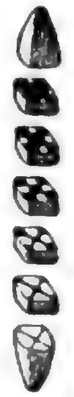


FIG. 2.—Transverse sections of a crystal of Chiastolite.

Andalusite is typically a mineral of metamorphic origin, occurring most frequently in altered clay-slates and crystalline schists, near the junction of these with masses of intrusive igneous rocks such as granite. It has been recognized also, however, as a primary constituent of granite itself.

A curious variety of andalusite known as chiastolite is specially characteristic of clay-slates near a contact with granite. The elongated prismatic crystals enclose symmetrically arranged wedges of carbonaceous material, and in cross-section show a black cross on a greyish ground. Cross-sections of such crystals are polished and worn as amulets or charms. Crystals of a size suitable for this purpose are found in Brittany and the Pyrenees, while still larger specimens have been found recently in South Australia. The name chiastolite is derived from the Greek χιάστος, crossed or marked with the letter χ: *cross-stone* and *macle* are earlier names, the latter having been given on account of the resemblance the cross-section of the stone bears to the heraldic macula or mascle. (L. J. S.)

ANDAMAN ISLANDS, a group of islands in the Bay of Bengal. Large and small, they number 204, and lie 590 m. from the mouth of the Hugli, 120 m. from Cape Negrais in Burma, the nearest point of the mainland, and 340 m. from the northern extremity of Sumatra. Between the Andamans and Cape Negrais intervene two small groups, Preparis and Cocos; between the Andamans and Sumatra lie the Nicobar Islands, the whole group stretching in a curve, to which the meridian forms a tangent between Cape Negrais and Sumatra; and though this curved line measures 700 m., the widest sea space is about 91 m. The extreme length of the Andaman group is 219 m. with an extreme width of 32 m. The main part of it consists of a band of five chief islands, so closely adjoining and overlapping each other that they have long been known collectively as "the great Andaman." The axis of this band, almost a meridian line, is 156 statute miles long. The five islands are in order from north to south: North Andaman (51 m. long); Middle Andaman (59 m.); South Andaman (49 m.); Baratang, running parallel to the east of the South Andaman for 17 m. from the Middle Andaman; and Rutland Island (11 m.). Four narrow straits part these islands: Austin Strait, between North and Middle Andaman; Homfray's Strait between Middle Andaman and Baratang, and the north extremity of South Andaman; Middle (or Andaman) Strait between Baratang and South Andaman; and Macpherson Strait between South Andaman and Rutland Island. Of these only the last is navigable by ocean-going vessels. Attached to the chief islands are, on the extreme N., Landfall Islands, separated by the navigable Cleugh Passage; Interview Island, separated by the very narrow but navigable Interview Passage, off the W. coast of the Middle Andaman; the Labyrinth Island off the S.W. coast of the South Andaman, through which is the safe navigable Elphinstone Passage; Ritchie's (or the Andaman) Archipelago off the E. coast of the South Andaman and Baratang, separated by the wide and safe Diligent Strait and intersected by Kwangtung Strait and the Tadma Juru (Strait). Little Andaman, roughly 26 m. by 16, forms the southern extremity of the whole group and lies 31 m. S. of Rutland Island across Duncan Passage, in which lie the Cinque and other islands, forming Manners Strait, the main commercial highway between the Andamans and the Madras coast. Besides these are a great number of islets lying off the shores of the main islands. The principal outlying islands are the North Sentinel, a dangerous island of about 28 sq. m., lying about 18 m. off the W. coast of the South Andaman; the remarkable marine volcano, Barren Island (1150 ft.), quiescent for more than a century, 71 m. N.E. of Port Blair; and the equally curious isolated mountain, the extinct volcano of Narcondam, rising 2330 ft. out of the sea, 71 m. E. of the North Andaman. The land area of the Andaman Islands is 2508 sq. m. About 18 m. to the W. of the Andamans are the dangerous Western Banks and Dalrymple Bank, rising to within a few fathoms of the surface of the sea and forming, with the two Sentinel Islands, the tops of a line of submarine hills parallel to the Andamans. Some 40 m. distant to the E. is the Invisible Bank, with one rock just awash; and 34 m. S.E. of Narcondam is a submarine hill rising to 377 fathoms below the surface of the sea. Narcondam, Barren Island and the Invisible Bank, a great danger of these seas, are in a line almost parallel to the Andamans inclining towards them from north to south.

Topography.—The islands forming Great Andaman consist of a mass of hills enclosing very narrow valleys, the whole covered by an exceedingly dense tropical jungle. The hills rise, especially on the east coast, to a considerable elevation: the chief heights being in the North Andaman, Saddle Peak (2400 ft.); in the Middle Andaman, Mount Diavolo behind Cuthbert Bay (1678 ft.); in the South Andaman, Koiob (1505 ft.), Mount Harriet (1193 ft.) and the Cholunga range (1063 ft.); and in Rutland Island, Ford's Peak (1422 ft.). Little Andaman, with the exception of the extreme north, is practically flat. There are no rivers and few perennial streams in the islands. The scenery is everywhere strikingly beautiful and varied, and the coral beds of the more secluded bays in its harbours are conspicuous for their exquisite colouring.

Harbours.—The coasts of the Andamans are deeply indented, giving existence to a number of safe harbours and tidal creeks, which are often surrounded by mangrove swamps. The chief harbours, some of which are very capacious, are (starting northwards from Port Blair, the great harbour of South Andaman) on the E. coast: Port Meadows, Colebrooke Passage, Elphinstone Harbour (Homfray's Strait), Stewart Sound and Port Cornwallis. The last three are very large. On the W. coast: Temple Sound, Interview Passage, Port Anson or Kwangtung Harbour (large), Port Campbell (large), Port Mouat and Macpherson Strait. There are besides many other safe anchorages about the coast, notably Shoal Bay and Kotara Anchorage in the South Andaman; Cadell Bay and the Turtle Islands in the North Andaman; and Outram Harbour and Kwangtung Strait in the archipelago. The whole of the Andamans and the outlying islands were completely surveyed topographically by the Indian Survey Department under Colonel Hobday in 1883–1886, and the surrounding seas were charted by Commander Carpenter in 1888–1889.

Geology.—The Andaman Islands, in conjunction with the other groups mentioned above, form part of a lofty range of submarine mountains, 700 m. long, running from Cape Negrais in the Arakan Yoma range of Burma, to Achin Head in Sumatra. This range separates the Bay of Bengal from the Andaman Sea; and it contains much that is geologically characteristic of the Arakan Yoma, and formations common also to the Nicobars and to Sumatra and the adjacent islands. The older rocks are early Tertiary or late Cretaceous but there are no fossils to indicate age. The newer rocks, common also to the Nicobars and Sumatra, are in Ritchie's Archipelago chiefly and contain radiolarians and foraminifera. There is coral along the coasts everywhere, and the Sentinel Islands are composed of the newer rocks with a superstructure of coral. A theory of a still continuing subsidence of the islands was formed by Kurz in 1866 and confirmed by Oldham in 1884. Signs of its continuance are found on the east coast in several places. Barren Island is a volcano of the general Sunda group which includes also the Pegu group to which Narcondam belongs. Barren Island was last in eruption in 1803, but there is still a thin column of steam from a sulphur bed at the top and a variable hot spring at the point where the last outburst of lava flowed into the sea.

Climate.—Rarely affected by a cyclone, though within the influence of practically every one that blows in the Bay of Bengal, the Andamans are of the greatest importance because of the accurate information relating to the direction and intensity of storms which can be communicated from them better than from any other point in the bay, to the vast amount of shipping in this part of the Indian Ocean. Trustworthy information also regarding the weather which may be expected in the north and east of India, is obtained at the islands, and this proves of the utmost value to the controllers of the great trades dependent upon the rainfall. A well-appointed meteorological station has been established at Port Blair since 1868. Speaking generally, the climate of the Andamans themselves may be described as normal for tropical islands of similar latitude. It is warm always, but tempered by pleasant sea-breezes; very hot when the sun is northing; irregular rainfall, but usually dry during the north-east, and very wet during the south-west monsoon. Not only does the rainfall at one place vary from year to year, but there is an extraordinary difference in the returns for places quite close to one another. The official figures in inches for the station at Port Blair, which is situated in by far the driest part of the settlement, were:—

1895.	1896.	1897.	1898.	1899.	1900.	1901.
125·64	107·28	136·41	127·22	87·01	83·28	132·50

A tidal observatory has also been maintained at Port Blair since 1880.

Flora.—A section of the Forest Department of India has been established in the Andamans since 1883, and in the neighbourhood of Port Blair 156 sq. m. have been set apart for regular forest operations which are carried on by convict labour. The chief timber of indigenous growth is padouk (*Pterocarpus dalbergioides*) used for buildings, boats, furniture, fine joinery and all purposes to which teak, mahogany, hickory, oak and ash are applied. This tree is widely spread and forms a valuable export to European markets. Other first-class timbers are koko (*Albizzia lebbeh*), white chuglam (*Terminalia bialata*), black chuglam (*Myristica irya*), marble or zebra wood (*Diospyros kurzii*) and satin-wood (*Murraya exotica*), which differs from the satin-wood of Ceylon (*Chloroxylon swietenia*). All of these timbers are used for furniture and similar purposes. In addition there are a number of second-and third-class timbers, which are used locally and for export to Calcutta. Gangaw (*Messua ferrea*) the Assam iron-wood, is suitable for sleepers; and didu (*Bombax insigne*) is used for tea-boxes and packing-cases. Among the imported flora are tea, Siberian coffee, cocoa, Ceara rubber (which has not done well), Manila hemp, teak, cocoanut and a number of ornamental trees, fruit-trees, vegetables and garden plants. Tea is grown in considerable quantities and the cultivation is under a department of the penal settlement. The general character of the forests is Burmese with an admixture of Malay types. Great mangrove swamps supply unlimited fire-wood of the best quality. The great peculiarity of Andaman flora is that, with the exception of the Cocos islands, no cocoanut palms are found in the archipelago.

Fauna.—Animal life is generally deficient throughout the Andamans, especially as regards mammalia, of which there are only nineteen separate species in all, twelve of these being peculiar to the islands. There is a small pig (*Sus andamanensis*), important to the food of the people, and a wild cat (*Paradoxurus tytleri*); but the bats(sixteen species) and rats(thirteen species) constitute nearly three-fourths of the known mammals. This paucity of animal life seems inconsistent with the theory that the islands were once connected with the mainland. Most of the birds also are derived from the distant Indian region, while the Indo-Burmese and Indo-Malayan regions are represented to a far less degree. Rasorial birds, such as peafowl, junglefowl, pheasants and partridges, though well represented in the Arakan hills, are rare in the islands; while a third of the different species found are peculiar to the Andamans. Moreover, the Andaman species differ from those of the adjacent Nicobar Islands. Each group has its distinct harrier-eagle, red-cheeked paroquet, oriole, sun-bird and bulbul. Fish are very numerous and many species are peculiar to the Andaman seas. Turtles are abundant and supply the Calcutta market. Of imported animals, cattle, goats, asses and dogs thrive well, ponies and horses indifferently, and sheep badly, though some success has been achieved in breeding them.

Population.—The Andaman Islands, so near countries that have for ages attained considerable civilization and have been the seat of great empires, and close to the track of a great commerce which has gone on at least 2000 years, are the abode of savages as low in civilization as almost any known on earth. Our earliest notice of them is in a remarkable collection of early Arab notes on India and China (A.D. 851) which accurately represents the view entertained of this people by mariners down to modern times. "The inhabitants of these islands eat men alive. They are black, with woolly hair, and in their eyes and countenances there is something quite frightful .... They go naked and have no boats. If they had, they would devour all who passed near them. Sometimes ships that are windbound and have exhausted their provision of water, touch here and apply to the natives for it; in such cases the crews sometimes fall into the hands of the latter and most of them are massacred." The traditional charge of cannibalism has been very persistent; but it is entirely denied by the islanders themselves, and is now and probably always has been untrue. Of their massacres of ship-wrecked crews, even in quite modern times, there is no doubt, but the policy of conciliation unremittingly pursued for the last forty years has now secured a friendly reception for shipwrecked crews at any port of the islands except the south and west of Little Andaman and North Sentinel Island. The Andamanese are probably the relics of a negro race that once inhabited the S.E. portion of Asia and its outlying islands, representatives of which are also still to be found in the Malay Peninsula and the Philippines. Their antiquity and their stagnation are attested by the remains found in their kitchen-middens. These are of great age, and rise sometimes to a height exceeding 15 ft. The fossil shells, pottery and rude stone implements, found alike at the base and at the surface of these middens, prove that the habits of the islanders have not varied since a remote past, and lead to the belief that the Andamans were settled by their present inhabitants some time during the Pleistocene period, and certainly no later than the Neolithic age. The population is not susceptible of accurate computation, but probably it has always been small. The estimated total at a census taken in 1901 was only 2000. Though all descended from one stock, there are twelve distinct tribes of the Andamanese, each with its own clearly-defined locality, its own distinct variety of the one fundamental language and to a certain extent its own separate habits. Every tribe is divided into septs fairly well defined. The tribal feeling may be expressed as friendly within the tribe, courteous to other Andamanese if known, hostile to every stranger, Andamanese or other. Another division of the natives is into *Aryauto* or long-shore-men, and the *Eremtaga* or jungle-dwellers. The habits and capacities of these two differ, owing to surroundings, irrespectively of tribe. Yet again the Andamanese can be grouped according to certain salient characteristics: the forms of the bows and arrows, of the canoes, of ornaments and utensils, of tattooing and of language. The average height of males is 4 ft. 10½ in.; of females, 4 ft. 6 in. Being accustomed to gratify every sensation as it arises, they endure thirst, hunger, want of food and bodily discomfort badly. The skin varies in colour from an intense sheeny black to a reddish-brown on the collar-bones, cheeks and other parts of the body. The hair varies from a sooty black to dark and light brown and red. It grows in small rings, which give it the appearance of growing in tufts, though it is really closely and evenly distributed over the whole scalp. The figures of the men are muscular and well-formed and generally pleasing; a straight, well-formed nose and jaw are by no means rare, and the young men are often distinctly good-looking. The only artificial deformity is a depression of the skull, chiefly among one of the southern tribes, caused by the pressure of a strap used for carrying loads. The pleasing appearance natural to the men is not a characteristic of the women, who early have a tendency to stoutness and ungainliness of figure, and sometimes to pronounced prognathism. They are, however, always bright and merry, are under no special social restrictions and have considerable influence. The women's heads are shaved entirely and the men's into fantastic patterns. Yellow and red ochre mixed with grease are coarsely smeared over the bodies, grey in coarse patterns and white in fine patterns resembling tattoo marks. Tattooing is of two distinct varieties. In the south the body is slightly cut by women with small flakes of glass or quartz in zigzag or lineal patterns downwards. In the north it is deeply cut by men with pig-arrows in lines across the body. The male matures when about fifteen years of age, marries when about twenty-six, begins to age when about forty, and lives on to sixty or sixty-five if he reaches old age. Except as to the marrying age, these figures fairly apply to women. Before marriage free intercourse between the sexes is the rule, though certain conventional precautions are taken to prevent it. Marriages rarely produce more than three children and often none at all. Divorce is rare, unfaithfulness after marriage not common and incest unknown. By preference the Andamanese are exogamous as regards sept and endogamous as regards tribe. The children are possessed of a bright intelligence, which, however, soon reaches its climax, and the adult may be compared in this respect with the civilized child of ten or twelve. The Andamanese are, indeed, bright and merry companions, busy in their own pursuits, keen sportsmen, naturally independent and not lustful, but when angered, cruel, jealous, treacherous and vindictive, and always unstable—in fact, a people to like but not to trust. There is no idea of government, but in each sept there is a head, who has attained that position by degrees on account of some tacitly admitted superiority and commands a limited respect and some obedience. The young are deferential to their elders. Offences are punished by the aggrieved party. Property is communal and theft is only recognized as to things of absolute necessity, such as arrows, pigs' flesh and fire. Fire is the one thing they are really careful about, not knowing how to renew it. A very rude barter exists between tribes of the same group in regard to articles not locally obtainable. The religion consists of fear of the spirits of the wood, the sea, disease and ancestors, and of avoidance of acts traditionally displeasing to them. There is neither worship nor propitiation. An anthropomorphic deity, Puluga, is the cause of all things, but it is not necessary to propitiate him. There is a vague idea that the "soul" will go somewhere after death, but there is no heaven nor hell, nor idea of a corporeal resurrection. There is much faith in dreams, and in the utterances of certain "wise men," who practise an embryonic magic and witchcraft. The great amusement of the Andamanese is a formal night dance, but they are also fond of simple games. The bows differ altogether with each group, but the same two kinds of arrows are in general use: (1) long and ordinary for fishing and other purposes; (2) short with a detachable head fastened to the shaft by a thong, which quickly brings pigs up short when shot in the thick jungle. Bark provides material for string, while baskets and mats are neatly and stoutly made from canes and buckets out of bamboo and wood. None of the tribes ever ventures out of sight of land, and they have no idea of steering by sun or stars. Their canoes are simply hollowed out of trunks with the adze and in no other way, and it is the smaller ones which are outrigged; they do not last long and are not good sea-boats, and the story of raids on Car Nicobar, out of sight across a stormy and sea-rippled channel, must be discredited. Honour is shown to an adult when he dies, by wrapping him in a cloth and placing him on a platform in a tree instead of burying him. At such a time the encampment is deserted for three months. The Andaman languages are extremely interesting from the philological standpoint. They are agglutinative in nature, show hardly any signs of syntactical growth though every indication of long etymological growth, give expression to only the most direct and the simplest thought, and are purely colloquial and wanting in the modifications always necessary for communication by writing. The sense is largely eked out by manner and action. *Mincopie* is the first word in Colebrooke's vocabulary for "Andaman Island, or native country," and the term—though probably a mishearing on Colebrooke's part for *Möngebe* ("I am an Önge," *i.e.* a member of the Önge tribe)—has thus become a persistent book-name for the people. Attempts to civilize the Andamanese have met with little success either among adults or children. The home established near Port Blair is used as a sort of free asylum which the native visits according to his pleasure. The policy of the government is to leave the Andamanese alone, while doing what is possible to ameliorate their condition.

Penal Settlement.—The point of enduring interest as regards the Andamans is the penal system, the object of which is to turn the life-sentence and few long-sentence convicts, who alone are sent to the settlement, into honest, self-respecting men and women, by leading them along a continuous course of practice in self-help and self-restraint, and by offering them every inducement to take advantage of that practice. After ten years' graduated labour the convict is given a ticket-of-leave and becomes self-supporting. He can farm, keep cattle, and marry or send for his family, but he cannot leave the settlement or be idle. With approved conduct, however, he may be absolutely released after twenty to twenty-five years in the settlement; and throughout that time, though possessing no civil rights, a quasi-judicial procedure controls all punishments inflicted upon him, and he is as secure of obtaining justice as if free. There is an unlimited variety of work for the labouring convicts, and some of the establishments are on a large scale. Very few experts are employed in supervision; practically everything is directed by the officials, who themselves have first to learn each trade. Under the chief commissioner, who is the supreme head of the settlement, are a deputy and a staff of assistant superintendents and overseers, almost all Europeans, and sub-overseers, who are natives of India. All the petty supervising establishments are composed of convicts. The garrison consists of 140 British and 300 Indian troops, with a few local European volunteers. The police are organized as a military battalion 643 strong. The number of convicts has somewhat diminished of late years and in 1901 stood at 11,947. The total population of the settlement, consisting of convicts, their guards, the supervising, clerical and departmental staff, with the families of the latter, also a certain number of ex-convicts and trading settlers and their families, numbered 16,106. The labouring convicts are distributed among four jails and nineteen stations; the self-supporters in thirty-eight villages. The elementary education of the convicts' children is compulsory. There are four hospitals, each under a resident medical officer, under the general supervision of a senior officer of the Indian medical service, and medical aid is given free to the whole population. The net annual cost of the settlement to the government is about £6 per convict. The harbour of Port Blair is well supplied with buoys and harbour lights, and is crossed by ferries at fixed intervals, while there are several launches for hauling local traffic. On Ross Island there is a lighthouse visible for 19 m. A complete system of signalling by night and day on the Morse system is worked by the police. Local posts are frequent, but there is no telegraph and the mails are irregular.

History.—It is uncertain whether any of the names of the islands given by Ptolemy ought to be attached to the Andamans; yet it is probable that his name itself is traceable in the Alexandrian geographer. Andaman first appears distinctly in the Arab notices of the 9th century, already quoted. But it seems possible that the tradition of marine nomenclature had never perished; that the Ἀγαθοῦ δαιμονος νῆσος was really a misunderstanding of some form like *Agdamān*, while Νῆσοι Βαρουσσαι survived as Lanka *Bālūs*, the name applied by the Arabs to the Nicobars. The islands are briefly noticed by Marco Polo, who probably saw without visiting them, under the name *Angamanain*, seemingly an Arabic dual, "The two Angamans," with the exaggerated but not unnatural picture of the natives, long current, as dog-faced Anthropophagi. Another notice occurs in the story of Nicolo Conti (*c.* 1440), who explains the name to mean "Island of Gold," and speaks of a lake with peculiar virtues as existing in it. The name is probably derived from the Malay Handuman, coming from the ancient Hanuman (monkey). Later travellers repeat the stories, too well founded, of the ferocious hostility of the people; of whom we may instance Cesare Federici (1569), whose narrative is given in Ramusio, vol. iii. (only in the later editions), and in Purchas. A good deal is also told of them in the vulgar and gossiping but useful work of Captain A. Hamilton (1727). In 1788–1789 the government of Bengal sought to establish in the Andamans a penal colony, associated with a harbour of refuge. Two able officers, Colebrooke of the Bengal Engineers, and Blair of the sea service, were sent to survey and report. In the sequel the settlement was established by Captain Blair, in September 1789, on Chatham Island, in the S.E. bay of the Great Andaman, now called Port Blair, but then Port Cornwallis. There was much sickness, and after two years, urged by Admiral Cornwallis, the government transferred the colony to the N.E. part of Great Andaman, where a naval arsenal was to be established. With the colony the name also of Port Cornwallis was transferred to this new locality. The scheme did ill; and in 1796 the government put an end to it, owing to the great mortality and the embarrassments of maintenance. The settlers were finally removed in May 1796. In 1824 Port Cornwallis was the rendezvous of the fleet carrying the army to the first Burmese war. In 1839, Dr Helfer, a German savant employed by the Indian government, having landed in the islands, was attacked and killed. In 1844 the troop-ships "Briton" and "Runnymede" were driven ashore here, almost close together. The natives showed their usual hostility, killing all stragglers. Outrages on shipwrecked crews continued so rife that the question of occupation had to be taken up again; and in 1855 a project was formed for such a settlement, embracing a convict establishment. This was interrupted by the Indian Mutiny of 1857, but as soon as the neck of that revolt was broken, it became more urgent than ever to provide such a resource, on account of the great number of prisoners falling into British hands. Lord Canning, therefore, in November 1857, sent a commission, headed by Dr F. Mouat, to examine and report. The commission reported favourably, selecting as a site Blair's *original* Port Cornwallis, but pointing out and avoiding the vicinity of a salt swamp which seemed to have been pernicious to the old colony. To avoid confusion, the name of *Port Blair* was given to the new settlement, which was established in the beginning of 1858. For some time sickness and mortality were excessively large, but the reclamation of swamp and clearance of jungle on an extensive scale by Colonel Henry Man when in charge (1868–1870), had a most beneficial effect, and the health of the settlement has since been notable. The Andaman colony obtained a tragical notoriety from the murder of the viceroy, the earl of Mayo, by a Mahommedan convict, when on a visit to the settlement on the 8th of February 1872. In the same year the two groups, Andaman and Nicobar, the occupation of the latter also having been forced on the British government (in 1869) by the continuance of outrage upon vessels, were united under a chief commissioner residing at Port Blair.

See Sir Richard Temple, *The Andaman and Nicobar Islands* (Indian Census, 1901); C. B. Kloss, *In the Andamans and Nicobars* (1903); E. H. Man, *Aboriginal Inhabitants of the Andaman Islands* (1883); M. V. Portman, *Record of the Andamanese* (11 volumes MS. in India Office, London, and Home Department, Calcutta), 1893–1898, *Andamanese Manual* (1887), *Notes on the Languages of the South Andaman Group of Tribes* (1898), and *History of our Relations with the Andamanese* (1899); S. Kurz, *Vegetation of the Andamans* (1867); G. S. Miller, *Mammals of the Andaman and Nicobar Islands* (vol. xxiv. of the *Proceedings of the National Museum*, U.S.A.); A. L. Butler, "Birds of the Andamans and Nicobars" (*Proc. Bombay Nat. Hist. Soc.*, vols. xii. and xiii.); and A. Alcock, *A Naturalist in Indian Seas* (1902).

ANDANTE (Ital. for "moving slowly," from *andare*, to go), a musical term to indicate pace, coming between *adagio* and *allegro*; it is also used of an independent piece of music or of the slow movement in a sonata, symphony, &c.

ANDERIDA, an ancient Roman fort at Pevensey, near Eastbourne in Sussex (England), built about A.D. 300 as part of a scheme of land-defence against the Saxon pirates; repaired, probably by the great Stilicho, about A.D. 400; and after the Norman Conquest utilized by William the Conqueror for a Norman castle. Its massive Roman enceinte still stands but little damaged.

ANDERNACH, a town of Germany, in the Prussian Rhine province, on the left bank of the Rhine, 10 m. N.W. of Coblenz by the main line to Cologne. Pop. (1900) 7889. Viewed from the river it makes a somewhat gloomy, though picturesque, impression, with its parish church (a basilica dating from the 12th century, with four towers), the round watch-tower on the Rhine, old walls in places 15 ft. thick, and a famous crane (erected 1554) for lading merchandise. Among other buildings are a Gothic Minorite church (now Protestant), a town hall, and a prison, formerly the castle of the archbishops of Cologne. Andernach has considerable industries, brewing and manufactures of chemicals and perfumes, and has also a trade in corn and wine. But its most notable article of commerce is that of mill-stones, made of lava and tufa-stone, a product much used by the Dutch in the construction of their dykes.

Andernach (*Antunnacum*) is the old Roman *Castellum ante Nacum*, founded by Drusus and fortified in the 3rd century A.D. In 1109 Andernach received civic rights, passed in 1167 to the electors of Cologne, in 1253 joined the confederation of the Rhine cities and was the most southern member of the Hanseatic league. Here in 1474 a treaty was signed between the emperor Frederick III., the four electors of the Rhine and France. In 1794 Andernach passed to France, but in 1815 was ceded, together with the left bank of the Rhine, to Prussia.

ANDERSEN, HANS CHRISTIAN (1805–1875), Danish poet and fabulist, was born at Odense, in Fünen, on the 2nd of April 1805. He was the son of a sickly young shoemaker of twenty-two, and his still younger wife: the whole family lived and slept in one little room. Andersen very early showed signs of imaginative temperament, which was fostered by the indulgence and superstition of his parents. In 1816 the shoemaker died and the child was left entirely to his own devices. He ceased to go to school; he built himself a little toy-theatre and sat at home making clothes for his puppets, and reading all the plays that he could borrow; among them were those of Holberg and Shakespeare. At Easter 1819 he was confirmed at the church of St Kund, Odense, and began to turn his thoughts to the future. It was thought that he was best fitted to be a tailor; but as nothing was settled, and as Andersen wished to be an opera-singer, he took matters into his own hand and started for Copenhagen in September 1819. There he was taken for a lunatic, snubbed at the theatres, and nearly reduced to starvation, but he was befriended by the musicians Christoph Weyse and Siboni, and afterwards by the poet Frederik Hoëgh Guldberg (1771–1852). His voice failed, but he was admitted as a dancing pupil at the Royal Theatre. He grew idle, and lost the favour of Guldberg, but a new patron appeared in the person of Jonas Collin, the director of the Royal Theatre, who became Andersen's life-long friend. King Frederick VI. was interested in the strange boy and sent him for some years, free of charge, to the great grammar-school at Slagelse. Before he started for school he published his first volume, *The Ghost of Palnatoke's Grave* (1822). Andersen, a very backward and unwilling pupil, actually remained at Slagelse and at another school in Elsinore until 1827; these years, he says, were the darkest and bitterest in his life. Collin at length consented to consider him educated, and Andersen came to Copenhagen. In 1829 he made a considerable success with a fantastic volume entitled *A Journey on Foot from Holman's Canal to the East Point of Amager*, and he published in the same season a farce and a book of poems. He thus suddenly came into request at the moment when his friends had decided that no good thing would ever come out of his early eccentricity and vivacity. He made little further progress, however, until 1833, when he received a small travelling stipend from the king, and made the first of his long European journeys. At Le Locle, in the Jura, he wrote *Agnete and the Merman*; and in October 1834 he arrived in Rome. Early in 1835 Andersen's novel, *The Improvisatore*, appeared, and achieved a real success; the poet's troubles were at an end at last. In the same year, 1835, the earliest instalment of Andersen's immortal *Fairy Tales* (Eventyr) was published in Copenhagen. Other parts, completing the first volume, appeared in 1836 and 1837. The value of these stories was not at first perceived, and they sold slowly. Andersen was more successful for the time being with a novel, *O.T.*, and a volume of sketches, *In Sweden*; in 1837 he produced the best of his romances, *Only a Fiddler*. He now turned his attention, with but ephemeral success, to the theatre, but was recalled to his true genius in the charming miscellanies of 1840 and 1842, the *Picture-Book without Pictures*, and *A Poet's Bazaar*. Meanwhile the fame of his *Fairy Tales* had been steadily rising; a second series began in 1838, a third in 1845. Andersen was now celebrated throughout Europe, although in Denmark itself there was still some resistance to his pretensions. In June 1847 he paid his first visit to England, and enjoyed a triumphal social success; when he left, Charles Dickens saw him off from Ramsgate pier. After this Andersen continued to publish much; he still desired to excel as a novelist and a dramatist, which he could not do, and he still disdained the enchanting *Fairy Tales*, in the composition of which his unique genius lay. Nevertheless he continued to write them, and in 1847 and 1848 two fresh volumes appeared. After a long silence Andersen published in 1857 another romance, *To be or not to be*. In 1863, after a very interesting journey, he issued one of the best of his travel-books, *In Spain*. His *Fairy Tales* continued to appear, in instalments, until 1872, when, at Christmas, the last stories were published. In the spring of that year Andersen had an awkward accident, falling out of bed and severely hurting himself. He was never again quite well, but he lived till the 4th of August 1875, when he died very peacefully in the house called Rolighed, near Copenhagen. (E. G.)

ANDERSON, ADAM (1692–1765), Scottish economist, was born in 1692, and died in London on the 10th of January 1765. He was a clerk for forty years in the South Sea House, where he published a work entitled *Historical and Chronological Deduction of the Origin of Commerce from the Earliest Accounts to the Present Time, containing a History of the Great Commercial Interests of the British Empire* (1762, 2 vols. fol.).

ANDERSON, ALEXANDER (*c.* 1582–1620?), Scottish mathematician, was born at Aberdeen. In his youth he went to the continent and taught mathematics at Paris, where he published or edited, between the years 1612 and 1619, various geometrical and algebraical tracts, which are conspicuous for their ingenuity and elegance. He was selected by the executors of Franciscus Vieta to revise and edit his manuscript works, a task which he discharged with great ability. The works of Anderson amount to six thin 4to volumes, and as the last of them was published in 1619, it is probable that the author died soon after that year, but the precise date is unknown.

ANDERSON, SIR EDMUND (1530–1605), English lawyer, descended from a Scottish family settled in Lincolnshire, was born in 1530 at Flixborough or Broughton in that county. After studying for a short time at Lincoln College, Oxford, he became in 1550 a student of the Inner Temple. In 1579 he was appointed serjeant-at-law to Queen Elizabeth, and also an assistant judge on circuit. As a reward for his services in the trial of Edmund Campian and his followers (1581), he was, on the death of Sir James Dyer, appointed lord chief justice of the Common Pleas (1582), and was knighted. He took part in all the leading state trials which agitated England during the latter years of Elizabeth's reign. Though a great lawyer and thoroughly impartial in civil cases, he became notorious by his excessive severity and harshness when presiding over the trials of catholics and nonconformists; more markedly so in those of Sir John Perrot, Sir Walter Raleigh, and John Udall the puritan minister. Anderson was also one of the commissioners appointed to try Mary queen of Scots in 1586. He died on the 1st of August 1605 at Eyworth in Bedfordshire. In addition to *Reports of Many Principal Cases Argued and Adjudged in the Time of Queen Elizabeth in the Common Bench*, published after his death, he drew up several expositions of statutes enacted in Elizabeth's reign which remain in manuscript in the British Museum.

ANDERSON, ELIZABETH GARRETT (1836–), English medical practitioner, daughter of Newson Garrett, of Aldeburgh, Suffolk, was born in 1836, and educated at home and at a private school. In 1860 she resolved to study medicine, an unheard-of thing for a woman in those days, and one which was regarded by old-fashioned people as almost indecent. Miss Garrett managed to obtain some more or less irregular instruction at the Middlesex hospital, London, but was refused admission as a full student both there and at many other schools to which she applied. Finally she studied anatomy privately at the London hospital, and with some of the professors at St Andrews University, and at the Edinburgh Extra-Mural school. She had no less difficulty in gaining a qualifying diploma to practise medicine. London University, the Royal Colleges of Physicians and Surgeons, and many other examining bodies refused to admit her to their examinations; but in the end the Society of Apothecaries, London, allowed her to enter for the License of Apothecaries' Hall, which she obtained in 1865. In 1866 she was appointed general medical attendant to St Mary's dispensary, a London institution started to enable poor women to obtain medical help from qualified practitioners of their own sex. The dispensary soon developed into the New hospital for women, and there she worked for over twenty years. In 1870 she obtained the Paris degree of M.D. The same year she was elected to the first London School Board, at the head of the poll for Marylebone, and was also made one of the visiting physicians of the East London hospital for children; but the duties of these two positions she found to be incompatible with her principal work, and she soon resigned them. In 1871 she married Mr J. G. S. Anderson (d. 1907), a London shipowner, but did not give up practice. She worked steadily at the development of the New hospital, and (from 1874) at the creation of a complete school of medicine in London for women. Both institutions have since been handsomely and suitably housed and equipped, the New hospital (in the Euston Road) being worked entirely by medical women, and the schools (in Hunter Street, W.C.) having over 200 students, most of them preparing for the medical degree of London University, which was opened to women in 1877. In 1897 Mrs Garrett Anderson was elected president of the East Anglian branch of the British Medical Association. In 1908 she was elected (the first lady) mayor of Aldeburgh. The movement for the admission of women to the medical profession, of which she was the indefatigable pioneer in England, has extended to every civilized country except Spain and Turkey.

ANDERSON, JAMES (1662–1728), Scottish genealogist, antiquary and historian, was born at Edinburgh on the 5th of August 1662. He was educated for the law, and became a writer to the signet in 1691. His profession gave him the opportunity of gratifying his taste for the study of ancient documents; and just before the union the Scottish parliament commissioned him to prepare for publication what remained of the public records of the kingdom, and in their last session voted a sum of £1040 sterling to defray his expenses. At this work he laboured for several years with great judgment and perseverance; but it was not completed at his death in 1728. The book was published posthumously in 1739, edited by Thomas Ruddiman, under the title *Selectus Diplomatum et Numismatum Scotiae Thesaurus*. The preparation of this great national work involved the author in considerable pecuniary loss; and soon after his death, the numerous plates, engraved by Sturt, were sold for £530. These plates are now lost, and the book has become exceedingly scarce. After the union of the crowns, Anderson was appointed in 1715 postmaster-general for Scotland, as some compensation for his labours; but in the political struggles of 1717 he was deprived of this office, and never again obtained any reward for his services. He died on the 3rd of April 1728. He published, during the controversy about the union, *An Historical Essay showing that the Crown and Kingdom of Scotland is Imperial and Independent* (Edin., 1705,), and later *Collections relating to the History of Mary Queen of Scotland* (in 4 vols., Edin., 1727–1728).

ANDERSON, JAMES (1739–1808), Scottish agriculturist and economist, was born at Hermiston, near Edinburgh, in 1739. While still a boy he undertook the working of a farm in Mid-Lothian which his family had occupied for several generations, and later he rented in Aberdeenshire a farm of 1300 acres of unimproved land. In 1783 he settled in Edinburgh, where in 1791 he projected a weekly publication called *The Bee*, which was largely written by himself, and of which eighteen volumes were published. In 1797 he began to reside at Isleworth, and from 1799 to 1802 he produced a monthly publication, *Recreations in Agriculture, Natural History, Arts and Miscellaneous Literature*. He was also the author of many pamphlets on agricultural and economical topics. He died on the 15th of October 1808.

ANDERSON, JOHN (1726–1796), Scottish natural philosopher, was born at Roseneath, Dumbartonshire, in 1726. In 1756 he became professor of oriental languages in the university of Glasgow, where he had finished his education; and in 1760 he was appointed to the more congenial post of professor of natural philosophy. He devoted himself particularly to the application of science to industry, instituting courses of lectures intended especially for artisans, and he bequeathed his property for the foundation of an institution for the furtherance of technical and scientific education in Glasgow, Anderson's College, now merged in the Glasgow and West of Scotland Technical College. He died in Glasgow on the 13th of January 1796. His *Institutes of Physics*, published in 1786, went through five editions in ten years.

ANDERSON, MARY (1859–), American actress, was born at Sacramento, California, on the 28th of July 1859. Her father, an officer in the Confederate service in the Civil War, died in 1863. She was educated in various Roman Catholic institutions, and at the age of thirteen, with the advice of Charlotte Cushman, began to study for the stage, making her first appearance at Louisville, Kentucky, as Juliet in 1875. Her remarkable beauty created an immediate success, and she played in all the large cities of the United States with increasing popularity. Between 1883 and 1889 she had several seasons in London, and was the Rosalind in the performance of *As You Like It* which opened the Shakespeare Memorial theatre at Stratford-on-Avon. Among her chief parts were Galatea (in W. S. Gilbert's *Pygmalion and Galatea*), Clarice (in his *Comedy and Tragedy*, written for her), Hermione, Perdita, and Julia (in *The Hunchback*). In 1889 she retired from the stage and in 1890 married Antonio de Navarro, and settled in England.

See William Winter's *Stage Life of Mary Anderson* (New York, 1886), and her own *A Few Memories* (New York, 1896).

ANDERSON, RICHARD HENRY (1821–1879), American soldier, was born in South Carolina on the 7th of October 1821. Graduating at West Point in 1842, he served in the Mexican War (in which he won the brevet of first lieutenant) and in the Kansas troubles of 1856–1857, becoming first lieutenant in 1848 and captain in 1855. At the outbreak of the Civil War in 1861 he resigned his commission in the U.S. army, and entered the Confederate service as a brigadier-general, being promoted major-general in August 1862 and lieutenant-general in May 1864. With the exception of a few months spent with the army under Bragg in 1862, Anderson's service was wholly in the Army of Northern Virginia. Under Lee and Longstreet he served as a divisional commander in nearly every battle from 1862 to 1864, winning especial distinction at Chancellorsville and Gettysburg. When Longstreet was wounded at the battle of the Wilderness, Anderson succeeded him in command of the 1st corps, which he led in the subsequent battles. His services at the battle of Spottsylvania (*q.v.*) were most important. He remained with the army, as a corps commander, to the close of the war, after which he retired into private life. He died at Beaufort S.C. on the 26th of June 1879.

ANDERSON, ROBERT (1750–1830), Scottish author and critic, was born at Carnwath, Lanarkshire, on the 7th of January 1750. He studied first divinity and then medicine at the university of Edinburgh, and subsequently, after some experience as a surgeon, took the degree of M.D. at St Andrews in 1778. He began to practise as a physician at Alnwick, but he became financially independent by his marriage with the daughter of Mr John Gray, and abandoned his profession for a literary life in Edinburgh. For several years his attention was occupied with his edition of *The Works of the British Poets, with Prefaces Biographical and Critical* (14 vols. 8vo, Edin., 1792–1807). His other publications were, *The Miscellaneous Works of Tobias Smollett, M.D., with Memoirs of his Life and Writings* (Edin., 1796); *Life of Samuel Johnson, LL.D., with Critical Observations on his Works* (Edin., 1815); *The Works of John Moore, M.D., with Memoirs of his Life and Writings* (Edin., 7 vols., 1820); and *The Grave and other Poems, by Robert Blair; to which are prefixed some Account of his Life and Observations on his Writings* (Edin., 1826). Dr Anderson died at Edinburgh on the 20th of February 1830.

ANDERSON, a city and the county-seat of Madison county, Indiana, U.S.A., situated on the west fork of the White river, about 35 m. N.E. of Indianapolis. Pop. (1880) 4126; (1890) 10,741; (1900) 20,178, of whom 1081 were foreign-born; (1910, census) 22,476. It is served by the Central Indiana, the Cleveland, Cincinnati, Chicago & St Louis, and the Pittsburg, Chicago & St Louis railways, and also by the Indiana Union Traction System (electric), the general offices and central power plant of which are situated there. Its importance as a manufacturing centre is due to its location in the natural gas region. In 1905 Anderson ranked first among the cities of the state in the manufacture of carriage and wagon material, and iron and steel. Among its many other manufactures are glass and glassware, paper, strawboards, crockery and tiles. In 1905 the total factory product was valued at $8,314,760. There is a good public library; much attention has been devoted to public improvements; and the water works and the electric lighting plants are owned and operated by the city. In connexion with the water works there is a good filtration plant. First settled about 1822, Anderson was incorporated in 1865.

ANDERSONVILLE, a village of Sumter county, Georgia, U.S.A., in the S.W. part of the state, about 60 m. S.W. of Macon, on the Central of Georgia railway. Pop. (1900) 245. From November 1863 until the close of the Civil War it was the seat of a Confederate military prison. A tract of 16½ acres of land near the village was cleared of trees and enclosed with a stockade. Prisoners began to arrive in February 1864, before the prison was completed and before adequate supplies had been received, and in May their number amounted to about 12,000. In June the stockade was enlarged so as to include 26½ acres, but the congestion was only temporarily relieved, and in August the number of prisoners exceeded 32,000. No shelter had been provided for the inmates: the first arrivals made rude sheds from the débris of the stockade; the others made tents of blankets and other available pieces of cloth, or dug pits in the ground. Owing to the slender resources of the Confederacy, the prison was frequently short of food, and even when this was sufficient in quantity it was of a poor quality and poorly prepared on account of the lack of cooking utensils. The water supply, deemed ample when the prison was planned, became polluted under the congested conditions. During the summer of 1864 the prisoners suffered greatly from hunger, exposure and disease, and in seven months about a third of them died. In the autumn, after the capture of Atlanta, all the prisoners who could be moved were sent to Millen, Georgia and Florence, South Carolina. At Millen better arrangements prevailed, and when, after Sherman began his march to the sea, the prisoners were returned to Andersonville, the conditions there were somewhat improved. During the war 49,485 prisoners were received at the Andersonville prison, and of these about 13,000 died. The terrible conditions obtaining there were due to the lack of food supplies in the Confederate States, the incompetence of the prison officials, and the refusal of the Federal authorities in 1864 to make exchanges of prisoners, thus filling the stockade with unlooked-for numbers. After the war Henry Wirz, the superintendent, was tried by a court-martial, and on the 10th of November 1865 was hanged, and the revelation of the sufferings of the prisoners was one of the factors that shaped public opinion regarding the South in the Northern states, after the close of the Civil War. The prisoners' burial ground at Andersonville has been made a national cemetery, and contains 13,714 graves of which 921 are marked "unknown."

There is an impartial account of the Andersonville prison in James F. Rhodes, *History of the United States* (vol. v., New York, 1904). The partisan accounts are numerous; see, for instance, A. C. Hamlin, *Martyria; or, Andersonville Prison* (Boston, 1866); and R. R. Stevenson, *The Southern Side; or, Andersonville Prison* (Baltimore, 1876).

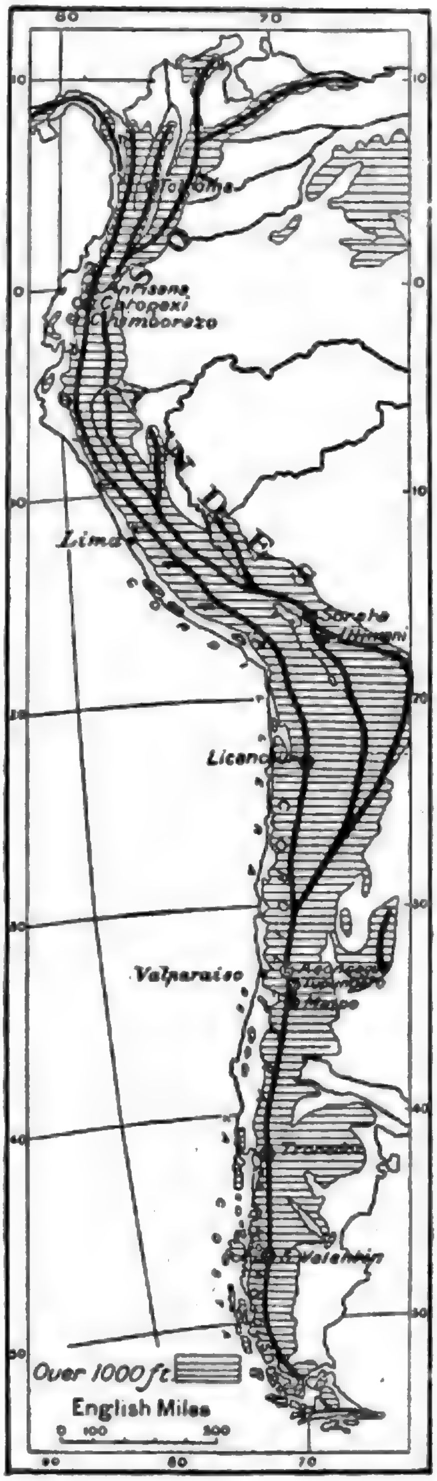
ANDES, a vast mountain system forming a continuous chain of highland along the western coast of South America. It is roughly 4400 m. long, 100 m. wide in some parts, and of an average height of 13,000 ft.[1] The connexion of this system with that of the Rocky Mountains, which has been pointed out by many writers, has received much support from the discovery of the extensive eruptions of granite during Tertiary times, extending from the southern extremity of South America to Alaska. The Andean range is composed of two great principal chains with a deep intermediate depression, in which, and at the sides of the great chains, arise other chains of minor importance, the chief of which is that called the Cordillera de la Costa of Chile. This starts from the southern extremity of the continent, and runs in a northerly direction, parallel with the coast, being broken up at its beginning into a number of islands, and afterwards forming the western boundary of the great central valley of Chile. To the north this coastal chain continues in small ridges or isolated hills along the Pacific as far as Colombia, always leaving the same valley more or less visible to the west of the western great chain.

Tierra del Fuego.

Of the two principal chains the eastern is generally called Los Andes, and the western La Cordillera, in Colombia, Peru and Bolivia, where the eastern is likewise known as Cordillera Real de los Andes, while to the south of parallel 23° S. lat. in Chile and Argentina, the western is called Cordillera de los Andes. The eastern disappears in the centre of Argentina, and it is therefore only the Cordillera de los Andes that is prolonged as far as the south-eastern extremity of the continent. The Cordillera de la Costa begins near Cape Horn, which is composed principally of crystalline rocks, and its heights are inconsiderable when compared with those of the true Cordillera of the Andes. The latter, as regards its main chain, is on the northern coast of the Beagle Channel, in Tierra del Fuego, bounded on the north by the deep depression of Lake Fagnano and of Admiralty Sound. Staten Island appears to be the termination to the east. The Cordillera of the Andes in Tierra del Fuego is formed of crystalline schists, and culminates in the snow-capped peaks of Mount Darwin and Mount Sarmiento (7200 ft.), which contains glaciers of greater extent than those of Mont Blanc. The extent of the glaciers is considerable in this region, which, geographically, is more complex than was formerly supposed. Although, in the explored portion of the Fuegian chain, the volcanoes which have been mentioned from time to time have not been met with, there seem to have existed to the south, on the islands, many neo-volcanic rocks, some of which appear to be contemporaneous with the basaltic sheet that covers a part of eastern Patagonia. The insular region between Mount Sarmiento and the Cordillera de los Andes, properly so called, *i.e.* that which extends from Magellan Strait northwards, is not fully explored, and all that is known of it is that it is principally composed of the same rocks as the Fuegian section, and that the greater part of its upper valleys is occupied by glaciers that reach down to the sea amid dense forest.

Chile-Argentina, 52°-38° S.

As Admiralty Sound and Lake Fagnano bound the Cordillera to the north in Tierra del Fuego, so at the eastern side of the Cordillera in the southernmost part of the continent there is a longitudinal depression which separates the Andes from some independent ridges pertaining to a secondary parallel broken chain called the pre-Cordillera. This depression is occupied in great part by a series of lakes, some of these filling transversal breaches in the range, whilst others are remains of glacial reservoirs, bordered by morainic dams, extending as far as the eastern tableland and corresponding in these cases with transversal depressions which reach the Atlantic Ocean. Between the larger lakes, fed by the Andine glaciers of the eastern slope of the Southern Andes, are Lakes Maravilla, 100 sq. m., and Sarmiento, 26 sq. m., 51° S. lat., which overflow into Last Hope Inlet; Argentino, 570 sq. m., 50° S. lat.; and Viedma, 450 sq. m., 49° 30′ S. lat., which empty into the river Santa Cruz; the fjordian Lake San Martin, 49° S. lat., and Lakes Nansen, 18 sq. m.; Azara, 8 sq. m.; and Belgrano, 18 sq. m., which are dependents of Lake San Martin (380 sq. m.), and Lakes Pueyrredon (98 sq. m.) and Buenos Aires (700° sq. m.), which now overflow into the Pacific, through one of the remarkable inlets that are found throughout the Cordillera, the Calen Inlet, which is the largest western fjord of Patagonia. To the north of Lake Buenos Aires there is Lake Elizalde, which, while situated on the eastern slope, sends its waters to the Pacific Ocean, and Lakes Fontana (30 sq. m.) and La Plata (34 sq. m.), 45° S. lat., which feed the river Senguerr, which flows to the Atlantic. Lake General Paz (66 sq. m.) on the eastern slope of the Andes, at 44° S. lat., is the principal source of the Palena river, which cuts all the Cordillera, while Lakes Fetalauquen (20 sq. m.) Menendez (28 sq. m.), Rivadavia (10 sq. m.), and other smaller lakes, also situated between 43° 30′, and 42° 30′ S. lat. on the eastern slope send their waters to the Pacific by the river Fetaleufu which cuts through the Andes by a narrow gorge. The waters of Lake Puelo (18 sq. m.) likewise flow into the same ocean through the river of that name, which also cuts the Cordillera, and of which the principal affluent likewise drains the waters of a system of small lakes, the largest of which, Lake Mascardi, measures 17 sq. m., which in comparatively recent times formed part of the basin of Lake Nahuel-Huapi (207 sq. m.), 41° S. lat. An extensive area of glacial deposits shows that a sheet of ice formerly covered the whole eastern slope to a great distance from the mountains. To the west another sheet reached at the same time the Pacific Ocean.



From the Strait of Magellan up to 52° S. lat., the western slope of the Cordillera does not, properly speaking, exist. Abrupt walls overlook the Pacific, and great longitudinal and transversal channels and fjords run right through the heart of the range, cutting it generally in a direction more or less oblique to its axis, the result of movements of the earth's crust.

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[1] As to the specific elevations of many of the peaks mentioned in this article, various authorities differ, and it is impossible in many cases to rate one estimate as of greater value than another.

The mountains forming the Cordillera between Magellan Strait and 41° S. lat. are higher than those previously mentioned in Tierra del Fuego. Generally composed of granite, gneiss and Palaeozoic rocks, covered in many parts by rugged masses of volcanic origin, their general height is not less than 6500 ft., while Mount Geikie is 7500 ft. and Mount Stokes 7100 ft. To the north are Mounts Mayo (7600 ft.), Agassiz (10,600 ft.), and Fitzroy, in 49° S. lat. (11,120 ft.). The section from 52° to 48° S. lat. is a continuous ice-capped mountain range, and some of the glaciers extend from the eastern lakes to the western channels, where they reach the sea-level. The level of the lakes begins at 130 ft. at Lake Maravilla and gradually ascends to nearly 700 ft. at Lake San Martin. Passing the breach through which Lake San Martin empties itself into Calen Inlet, in 48° S. lat., is found a wide oblique opening in the range, through which flows the river Las Heras, fed by Lake Pueyrredon, which is only 410 ft. above the sea-level to the east of the Andes, while Lake Buenos Aires, immediately to the north, is 710 ft. The Andes continue to be to the west an enormous rugged mass of ice and snow of an average height of 9000 ft., sending glaciers to all the eastern fjords.

Mount San Lorenzo, detached from the main chain in the pre-Cordillera, is 11,800 ft. high. Mount San Valentin (12,700 ft.) is the culminating point of the Andes in the region extending from 49° to 46° S. lat., a little north of which is the river Huemules which is followed by the breach of the river Aisen. These two rivers have emptied a large system of lakes, which in pre-Glacial times occupied the eastern zone, thus forming a region suitable for colonization in the broad valleys and hollows, where the rivers, as in the case with those in the north, cut through the Andes by narrow gaps, forming cataracts and rapids between the snowy peaks. Volcanic action is still going on in these latitudes, as the glaciers are at times covered by ashes, but the predominant rocks to the east are the Tertiary granite, while to the west gneiss, older granite and Palaeozoic rocks prevail. The highest peaks, however, seem to be of volcanic origin. Farther north, up to 41° S. lat., the water gaps are situated at a lesser distance one from the other, owing mainly to more continuous erosion, this section of the continent being the region of the maximum rainfall on the western coast to the south of the equator. Between the gaps of the river Aisen and river Cisnes or Frias, which also pierces the chain, is found a huge mountain mass, in which is situated Mount la Torre (7150 ft.). These form the continental watershed, but in this region erosion is taking place so rapidly that the day is not far distant when Lakes La Plata and Fontana, situated to the east at a height of 3000 ft. and now tributaries of the Atlantic, may become tributaries of the Pacific. Already filtrations from the former go to feed western affluents through the granitic masses. To the north of Mount la Torre flows in the river Cisnes, 44° 48′ S. lat., across another water gap, continuing the range to the north with high peaks, as Alto Nevado (7350 ft.) and Cacique (7000 ft.). The glaciers reach almost the western channels, as is the case at the river Quelal. The northern glaciers, descending nearly to sea-level, are situated at 43° 40′ S. lat. To the north 45° S. lat. a well-defined western longitudinal valley, at some recent time occupied by lakes and rivers, divides the Cordillera into two chains, the eastern being the main chain, to which belong Mounts Alto Nevado, Cacique, Dentista, Maldonado, Serrano, each over 7000 ft. high; and Torrecillas (7400 ft.), Ventisquero (7500 ft.), and Tronador (11,180 ft.); while the western chain, broken into imposing blocks, contains several high volcanic peaks such as Mounts Tanteles, Corcovado, Minchimahuida, Hornopiren and Yates. The rivers Palena, with its two branches, Pico and Carrenleufu, Fetaleufu, Puelo and Manso cut the two chains, while the rivers Reñihue, Bodadahue and Cochamo have their sources in the main eastern ridge. Mention has been made of active volcanoes in 51°, 49° and 47° S. lat., but these have not been properly located. The active volcanoes south of 41°, concerning which no doubt exists, are the Huequen, in 43° lat., and the Calbuco, both of which have been in eruption in modern times.

The surroundings of Mount Tronador, consisting of Tertiary granite and basalt, form one of the most interesting regions in the Patagonian Andes for the mountaineers of the future. To the east extends the large and picturesque lake of Nahuel-Huapi, to the west is Lake Todos Los Santos (50 sq. m.), to which the access is easy and of which the scenery is of surpassing beauty. Between 41° and 38° S. lat., among other smaller lakes, are Lakes Traful (45 sq. m.), Lacar (32 sq. m.), which, properly belonging to the system of Atlantic lakes, empties itself by the only water gap that occurs in this zone of the Cordillera into the river Valdivia, a tributary of the Pacific, Lake Lolog (15 sq. m.), Huechu-lafquen (45 sq. m.), and Lake Alumine (21 sq. m.). The volcanoes of Lanin (12,140 ft.), Quetropillan (9180 ft.), Villarica (10,400 ft.), Yaimas and Tolhuaca are all more or less active; the first is in the main chain, while the others are on the western slope. The scenery in the neighbourhood is magnificent, the snowy cones rising from amidst woods of araucaria, and being surrounded by blue lakes. While the scenery of the western slope of the Andes is exceedingly grand, with its deep fjords, glaciers and woods, yet the severity of its climate detracts considerably from its charm. The climate of the eastern slope, however, is milder, the landscapes are magnificent, with wooded valleys and beautiful lakes. The valleys are already partly settled by colonists. Between 52° and 40° S. lat. erosion has carried the watershed of the continent from the summit of the Cordillera to the eastern plains of Patagonia.

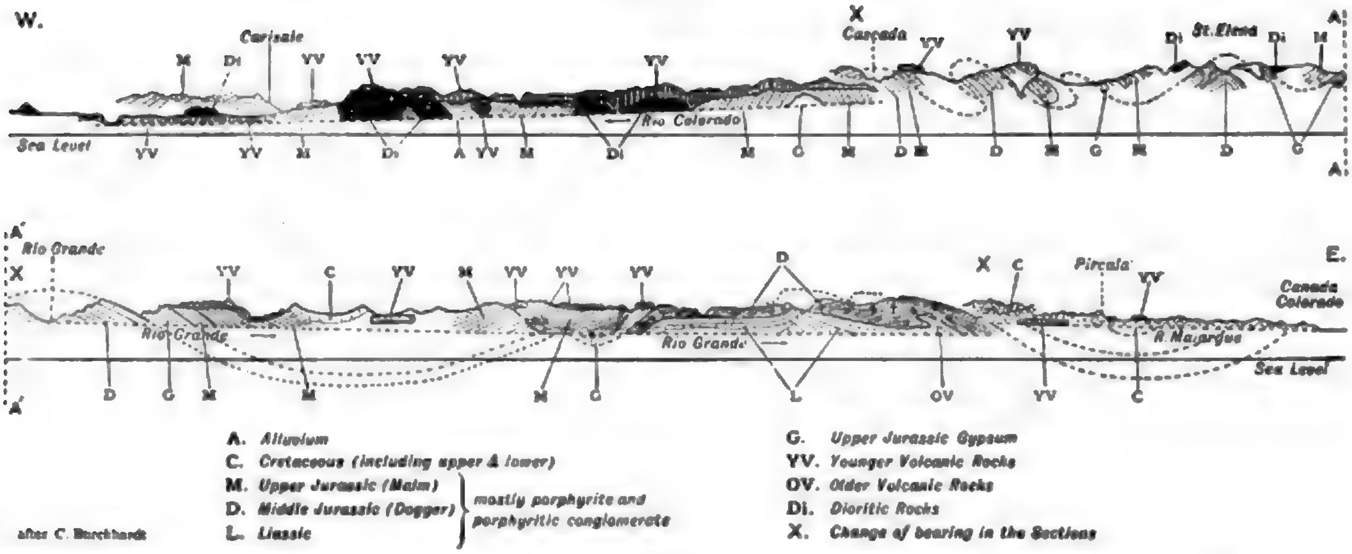
From 40° S. southward the Chile-Argentine Boundary Commission under Sir T. H. Holdich carried out important investigations in 1902; and between 38° and 33° S. lat. the Andes were somewhat extensively explored about the close of the 19th century by Argentine and Chilean Commissions. The highest peaks in the latter section are volcanic and their eruptions have sensibly modified the character of the primitive ridges. Outflows of lava and tufa cover the mountain sides and fill up the valleys. The Jurassic and Cretaceous formations, which in the Southern Cordillera are situated outside of the range to the east, form to a considerable extent the mass of the great range, together with quartz porphyry, the Tertiary, granite and other eruptive rocks, which have been observed along all the chain in South America up to Alaska in the north. Gneiss is seldom met with, but there are crystalline rocks, belonging chiefly to the pre-Cordillera of the eastern and to the Cordillera de la Costa on the western side.

Chile-Argentine from 38° S. northward.

About 38° S. the Andes take a great transversal extension; there are no wide intermediate valleys between the different ridges but the main ridge is perfectly defined. Volcanic cones continue to predominate, the old crystalline rocks almost disappear, while the Mesozoic rocks are most common. The higher peaks are in the main chain, while the Domuyo (15,317 ft.) belongs to a lateral eastern ridge. The principal peaks between this and Mount Tupungato at 33° S. lat. are: Mount Cochico (8255 ft.), Campanario, (13,140 ft.), Peteroa (13,207 ft.), Tinguiririca, Castillo (16,535 ft.), Volcano Maipu (17,576 ft.), Alvarado (14,600 ft.), Amarillo (15,321 ft.), Volcano San Jose (19,849 ft.), Piuquenes (17,815 ft.), and Volcano Bravard (19,619 ft.).

North of Maipu volcano, ascended by R. P. Güssfeldt in 1883, the Cordillera is composed of two huge principal ridges which unite and terminate in the neighbourhood of Mount Tupungato. The valley between them is 9000 ft. high; and in that part of the Cordillera are situated the highest passes south of 33° S. lat., one of which, the Piuquenes Pass, reaches 13,333 ft., whilst the easiest of transit and almost the lowest is that of Pichachen (6505 ft.), which is the most frequented during winter. Mount Tupungato reaches 22,320 ft., according to Argentine measurement. To the north of this mountain, situated at the watershed of the Andes, extends a lofty region comprising peaks such as Chimbote (18,645 ft.) and Mount Polleras (20,266 ft.). The Pircas Pass is situated at a height of 16,962 ft. The gaps of Bermejo and Iglesia, in the Uspallata road, the best known of all the passes between Argentina and Chile, are at 13,025 ft. and 13,412 ft. altitude respectively, while the nearest peaks, those of Juncal and Tolorsa, are 10,358 and 20,140 ft. high.

Mounts Tupungato, Aconcagua (23,393 ft.) and Mercedario



after C. Burckhardt

(21,982 ft.) are the highest peaks of the central Argentine-Chilean Andes. These three peaks are formed of eruptive rocks, surrounded by Jurassic beds which have undergone a thorough metamorphosis. While in the west of the Andes, from the latitude of Aconcagua, the central valley of Chile runs without any notable interruption to the south end of the continent, a valley which almost disappears to the north, leaving only some rare inflexions which are considered by Chilean geographers and geologists to be a continuation of the same valley; to the east in Argentina a longitudinal valley, perfectly characterized, runs along the eastern foot of the Cordillera, separating this from the pre-Cordillera, which is parallel to the Cordillera de la Costa of Chile. Between Aconcagua and Mercedario are the passes of Espinacito (14,803 ft.) and Los Patos or Valle Hermoso (11,736 ft.), chosen by the Argentine General San Martin, when he made his memorable passage across the chain during the War of Independence. North of Valle Hermoso the Andean ridges, while very high, are not abrupt, and the passes are more numerous than in the south; some of them descending 10,000 ft., but most of them between 13,000 and 14,000 ft. The pass of Quebrada Grande is 12,468 ft. in altitude; Cencerro, 12,944 ft.; Mercedario, 13,206 ft.; Ojota, 14,304 ft.; Pachon, 14,485 ft.; while Gordito is 10,318 ft. Farther north the passes are higher. Barahona Pass is 15,092 ft.; Ternera, 15,912 ft.; San Lorenzo, 16,420 ft., while the peak of the volcano reaches 18,143 ft.; Mount Olivares, 20,472 ft.; Porongos, 19,488 ft.; Tortolas, 20,121 ft.; and Potro, 19,357 ft.

Bolivia.

As far as 28° S. lat. the Cordillera de los Andes has been principally formed by two well-defined ridges, but to the north, recent volcanic action has greatly modified its orography. Only a single line of passes characterizes the main ridge, and amongst them are the passes of Ollita (15,026 ft.), Peñas Negras (14,435 ft.), Pircas Negras (13,615 ft.), La Gallina (16,240 ft.), Tres Quebradas (15,535 ft.), and Aguita (15,485 ft.). To the north of Mount Potro the peaks in the Cordillera are not very prominent as far as the great mass of Tres Quebradas, but here are to be met with some that may be considered as amongst the highest of the whole range. Mount Aguita is 20,600 ft., and the culminating peak of those of Tres Cruces reaches 22,658 ft. To the east of the eastern longitudinal valley, at 27° S. lat., begins a high volcanic plateau between the Cordillera and the southern prolongation of the Bolivian Cordillera Real, which contains lofty summits, such as Mount Veladero (20,098 ft.), Mount Bonete (21,980), Mount Reclus (20,670), Mount Pissis (22,146), Mount Ojo del Salado (21,653), and Incahuasi (21,719). To the north of Tres Cruces is a transversal depression in the Cordillera, which is considered to be the southern termination of the high plateau of the Puna de Atacama. The Cordillera of the Andes borders the Puna to the west, while the Bolivian Cordillera Real bounds it to the east. In that region the Cordillera of the Andes is of comparatively recent origin, being principally constituted by a line of high volcanoes, the chief summits being those of Juncal, Panteon de Aliste, Azufre or Listarria (18,636 ft.), Llullaillaco (21,720), Miñiques (19,357), Socompa (19,948), Licancaur (19,685), Viscachuelas (20,605), Tapaquilcha (19,520), Oyahua (19,242), Ancaquilcha (20,275), Olca (19,159), Miño (20,112), Sillilica (21,100), Perinacota (20,918), Sagama (22,339), Tacona (19,740), Misti (19,029); to the east closes in the intermediary high plateau which begins at 28° S. lat. in Argentina. The principal peaks of the Bolivian Andes and its prolongation from south to north, are Famatina, in the centre of Argentina, (20,340 ft.), Languna Blanca (18,307), Diamante (18,045), Cachi (20,000), Granadas, Lipez (19,680), Guadalupe (18,910), Chorolque (18,480), Cuzco (17,930), Enriaca (18,716), Junari (16,200), Michiga (17,410), Quimza-Cruz (18,280), Illimani (21,190) and Sorata (21,490).

While the western range of the Cordillera is principally formed by volcanic rocks, the eastern (to the east of the range is Cerro Potosi, 15,400 ft.) Andes of Bolivia are chiefly composed of old crystalline rocks. Between the ranges in the high plateau north to 27° are numerous isolated volcanoes which have been in activity in recent times, such as Peinado (18,898 ft.), San Pedro (18,701), Antuco (19,029), Antofalla (20,014), Rincon (17,881), Pastos Grandes (17,553), Zapalegui (17,553), Suniguira (19,258), Tahue (17,458); volcanoes which have been elevated from a lacustrine basin, which very recently occupied the whole extension, and the remains of which are, in the south, the Laguna Verde, at 28°, and in the north Lake Titicaca. The discovery of great Pampean mammals in the Pleistocene beds of that region shows that this upheaval of the latter is very recent, for in the heart of the Cordillera, as well as on the west coast of Bolivia and Peru, there have been discovered, in very recent deposits, the remains of some mammals which cannot have crossed the high range as it now exists.

Peru-Ecuador.

The two Cordilleras that formed the Andes to the north of 28° S. lat. are continued in Peru. The western, which reaches an altitude of about 10,000 ft., then ceases to exist as a continuous chain, there remaining only a short, high ridge, called by Edward Whymper the "Pacific range of the equator," and between this ridge and the crystalline Andean axis, the "avenue of volcanoes," to use his words, arises amidst majestic scenery. Chimborazo, which is not in the main chain, reaches 20,517 ft.; Cotopaxi (19,580), Antisana (19,260), Coyambo (19,200) are in the eastern range, with many other peaks over 16,000 ft. which still contain glaciers. Sangay (17,380 ft.), under the equator, according to Wolff, appears to be the most active volcano in the world. Pichincha (15,804 ft.) and Cotocachi (16,297 ft.) are the loftiest volcanoes of the western range. In Colombia the three principal chains are continuations of those under the equator, and show very slight traces of volcanic action,

Colombia.

In the western chain, which is remarkable for its regularity, the highest peak is 11,150 ft., and the lowest pass 6725 ft. The central chain, separated from the western chain by the valley of the Cauca and from the eastern by the valley of the Magdalena, is unbroken; it is the more important owing to its greater altitudes and is of volcanic character. To the south, near the equator, are Mounts Arapul (13,360 ft.) and Chumbul (15,720 ft.). The volcanoes Campainero (12, 470 ft.) and Pasto (14,000 ft.) are also in that zone. Farther north is the volcano Purace, which presents a height of 16,000 ft.; then come Huila (18,000), Santa Catalina (16,170), and Tolima (18,400), Santa Isabel (16,760), Ruiz (17,390) and Hervas (18,340). The eastern chain begins north of the equator at 6000 ft., gradually rises to the height of Nevado (14,146 ft.), Pan de Azucar (12,140 ft.), and in the Sierra Nevada de Cochi attains to peaks of 16,700 ft.

The snow-line of the Andes is highest in parts of Peru where it lies at about 16,500 ft. Its general range from the extreme north to Patagonia is 14,000 to 15,500 ft., but along the Patagonian frontier it sinks rapidly, until in Tierra del Fuego it lies at about 4900 ft.

Structure.—The structure of the Andes is least complex in the southern portion of the range. Between 33° and 36° S. the chain consists broadly of a series of simple folds of Jurassic and Cretaceous beds. It is probably separated on the east from the recent deposits of the pampas by a great fault, which, however, is always concealed by an enormous mass of scree material. The Cretaceous beds lie in a broad synclinal upon the eastern flank, but the greater part of the chain is formed of Jurassic beds, through which, on the western margin, rise the numerous andesitic volcanic centres. There is no continuous band of ancient gneiss, nor indeed of any beds older than the Jurassic. There is very little over-folding or faulting, and the structure is that of the Jura mountains rather than of the Alps. The inner or eastern ridge farther north of Argentina consists of crystalline rocks with infolded Ordovician and Cambrian beds, often overlaid unconformably by a sandstone with plant-remains (chiefly Rhaetic). In Bolivia this eastern ridge, separated from the western Cordillera by the longitudinal valley in which Lake Titicaca lies, is formed chiefly of Archaean and Palaeozoic rocks. All the geological systems, from the Cambrian to the Carboniferous, are represented and they are all strongly folded, the folds leaning over towards the west. West of the great valley the range is composed of Mesozoic beds, together with Tertiary volcanic rocks. (The Cordillera of Argentina and Chile is clearly the continuation of the western chain alone.) In Ecuador there is still an inner chain of ancient gneisses and schists and an outer chain composed of Mesozoic beds. The longitudinal valley which separates them is occupied mainly by volcanic deposits. North of Ecuador the structure becomes more complex. Of the three main chains into which the mountains are now divided, the western branch is formed mostly of Cretaceous beds; but the inner chains no longer consist exclusively of the older rocks, and Cretaceous beds take a considerable share in their formation.

The great volcanoes, active and extinct, are not confined to any one zone. Sometimes they rise from the Mesozoic zone of the western Cordillera, sometimes from the ancient rocks of the eastern zone. But they all lie within the range itself and do not, as in the Carpathians and the Apennines, form a fringe upon the inner border of the chain.

The curvature of the range around the Brazilian *massif*, and the position of the zone of older rocks upon the eastern flank, led Suess to the conclusion that the Andes owe their origin to an overthrust from east to west, and that the *Vorland* lies beneath the Pacific. In the south Wehrli and Burckhardt maintain that the thrust came from the west, and they look upon the ancient rocks of Argentina as the *Vorland*. In this part of the chain, however, there is but little evidence of overthrusting of any kind.

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ANDESINE, a member of the group of minerals known as *plagioclase felspars*, occupying a position in the isomorphous series about midway between albite ($NaAlSi_3O_8$) and anorthite ($CaAl_2Si_2O_8$); its chemical composition and physical characters are therefore intermediate between those of the two extremes of the series. Distinctly developed crystals or crystallized specimens are rarely met with, the mineral usually occurring as embedded crystals and grains in the igneous and gneissic rocks, of which it forms a component part. It occurs, for example, in the andesite of the Andes, from whence it derives its name.

ANDESITE, a name first applied by C. L. von Buch to a series of lavas investigated by him from the Andes, which has passed into general acceptance as the designation of a great family of rocks playing an important part in the geology of most of the volcanic areas of the globe. Not only the Andes but most of the Cordillera of Central and North America consist very largely of andesites; they occur also in great numbers in Japan, the Philippines, Java and New Zealand. They belong to all geological epochs, and are frequent among the Silurian and Devonian rocks of Britain, forming the ranges of the Cheviots, Ochils, Breidden Hills, and part of the Lake district. The well-known volcanoes, Montagne Pelée, the Soufrière of St Vincent, Krakatoa, Tarawera and Bandaisan have within recent years emitted great quantities of andesitic rocks with disastrous violence. No group of lavas is more widespread and more important from a geographical standpoint than the andesites.

They are typical intermediate rocks, containing on an average about 60% of silica, but showing a considerable range of composition. Most of them correspond to the plutonic diorites, but others more nearly represent the gabbros. Their essential distinguishing features are mineralogical and consist in the presence of much soda-lime felspar (ranging from oligoclase to bytownite and even anorthite), along with one or more of the ferro-magnesian minerals, biotite, hornblende, augite and hypersthene. Both olivine and quartz are typically absent, though in some varieties they occur in small quantity. Orthoclase is more common than these two, but is never very abundant. The andesites have mostly a porphyritic structure, and the larger felspars and ferro-magnesian minerals are often visible to the naked eye, lying in a finer groundmass, usually crystalline, but sometimes to a large extent vitreous. When very fresh they are dark-coloured if they contain much glass, but paler in colour, red, grey or pinkish when more thoroughly crystallized. They weather to various shades of dark brown, reddish-brown, green, grey and yellow. Many of them are highly vesicular or amygdaloidal.

The older (pre-Tertiary) andesites are grouped together by many German, and formerly by British petrologists, under the term porphyrites, but are distinguished only by being, as a rule, in a less fresh condition. Apart from this there are three great subdivisions of this family of rocks, the quartz-andesites or dacites, the hornblende-and biotite-andesites, and the augite and hypersthene-andesites (or pyroxene-andesites). The dacites, a term first applied by Karl Heinrich Hektor Guido Stache (b. 1833) to quartz-bearing andesite of Transylvania or Dacia, contain primary quartz, and are the most siliceous members of the family; their quartz may appear in small blebs (or phenocrysts), or may occur only as minute interstitial grains in the groundmass; other dacites are very vitreous (dacitic-pitchstones). In many of their structural peculiarities they closely simulate the rhyolites, from which they differ in containing less potash and more soda, and in consequence less orthoclase felspar and more plagioclase. The hornblende- and biotite-andesites, like the dacites, have in most cases a pale colour (pink, yellow or grey), being comparatively rich in felspar. They resemble the trachytes both in appearance and in structure, but their felspar is mostly plagioclase, not sanidine. The biotite and hornblende have much the same characters in both of these groups of rocks, and are often surrounded by black borders produced by corrosion and partial resorption by the magma. A pale green augite is common in these andesites, but bronzite or hypersthene is comparatively rare. The pyroxene-andesites are darker, more basic rocks, with a higher specific gravity, and approach closely to the basalts and dolerites, especially when they contain a small amount of olivine. They are probably the commonest types of andesite, both at the present time and in former geological periods. Often their groundmass consists of brownish glass, filled with small microliths of augite and felspar, and having a velvety, glistening lustre when observed in a good light (hyalopilitic structure).

In addition to the accessory minerals, zircon, apatite and iron oxides, which are practically never absent, certain others occur which, on account of their rarity and importance, are of special interest. Sharply-formed little crystals of cordierite are occasionally found in andesites (Japan, Spain, St Vincent, Cumberland); they seem to depend on more or less complete digestion of fragments of gneiss and other rocks in the molten lava. Garnet and sapphire have also been found in andesites, and perhaps have the same signification; a rose-red variety of epidote (withamite) is known as a secondary product in certain andesites (Glencoe, Scotland), and the famous red porphyry (*porfido rosso*) of the ancients is a rock of this type. Ore deposits very frequently occur in connexion with andesitic rocks (Nevada, California, Hungary, Borneo, &c.), especially those of gold and silver. They have been laid down in fissures as veins of quartz, and the surrounding igneous rocks are frequently altered and decomposed in a peculiar way by the hot ascending metalliferous solutions. Andesites affected in this manner are known as propylites. The alteration is one of those post-volcanic, pneumatolytic processes, so frequent in volcanic districts. Propylitization consists in the replacement of the original minerals of the andesite by secondary products such as kaolin, epidote, mica, chlorite, quartz and chalcedony, often with the retention of the igneous structures of the rocks.

In microscopic characters the andesites present considerable variety; their porphyritic felspars are usually of tabular shape with good crystalline outlines, but often filled with glass enclosures. Zonal structure is exceedingly common, and the central parts of the crystals are more basic (bytownite, &c.) than the edges (oligoclase). Sanidine occurs with considerable frequency, but not in notable amount. The biotite and hornblende are yellow or brown and richly pleochroic. The hypersthene is nearly always idiomorphic, with a distinct pleochroism ranging from salmon-pink to green. Augite may be green in the more acid andesites, but is pale brown in the pyroxene-andesites. The apatite is often filled with minute dust-like enclosures. In the dacites felsitic groundmasses are by no means rare, but microcrystalline types consisting of plagioclase and sanidine with quartz are more prevalent. The hornblende- and mica-andesites have groundmasses composed mainly of acid plagioclase with little orthoclase or glassy base (pilotaxitic groundmass). Clear brown glass with many small crystals of plagioclase and pale brown augite (hyalopilitic groundmass) is very frequent in pyroxene-andesites. Vitreous rocks belonging to all of the above groups are well known though not very common, and exhibit the perlitic, pumiceous, spherulitic and other structures, characteristic to volcanic obsidians and pitchstones. (J. S. F.)

ANDIJAN, a town of Russian Turkestan, Province of Ferghana, eastern terminus of the Transcaspian railway, 84 m. by rail E.N.E. of Khokand, on the left bank of the upper Syr-darya. Altitude 1630 ft. Pop. (1900) 49,682. It was formerly the residence of the khans of Khokand, and has beautiful gardens and a large park in the middle of the town. Andijan is a centre for the trade in raw cotton and has cotton factories. All over Central Asia, West Turkestan merchants are known generally as Andijani. The town was destroyed by an earthquake on the 16th-17th of December 1902, when 5000 persons perished and 16,000 houses were demolished. It has since been rebuilt.

ANDIRON (older form *anderne*; med. Lat. *andena*, *anderia*), a horizontal iron bar, or bars, upon which logs are laid for burning in an open fireplace. Andirons stand upon short legs and are usually connected with an upright guard. This guard, which may be of iron, steel, copper, bronze, or even silver, is often elaborately ornamented with conventional patterns or heraldic ornaments, such as the *fleur-de-lys*, with sphinxes, grotesque animals, mythological statuettes or caryatides supporting heroic figures or emblems. Previously to the Italian Renaissance, andirons were almost invariably made entirely of iron and comparatively plain, but when the ordinary objects of the household became the care of the artist, the metal-worker lavished skill and taste upon them, and even such a man as Jean Bérain, whose fancy was most especially applied to the ornamentation of Boulle furniture, sometimes designed them. Indeed the fire-dog or *chenet* reached its most artistic development under Louis XIV. of France, and the first extant examples—often of cast-iron—are to be found in French museums and royal palaces. Fire-dogs, with little or no ornament, were also used in kitchens, with ratcheted uprights for the spits. Very often these uprights branched out into arms or hobs for stewing or keeping the viands hot.

ANDKHUI, a town and khanate in Afghan Turkestan. The town (said to have been founded by Alexander the Great) stands between the northern spurs of the Paropamisus and the Oxus; it is 100 m. due west of Balkh on the edge of the Turkman desert. The khanate is of importance as being one of the most northern in Afghanistan, on the Russian border. Until 1820 it was subject to Bokhara, but in that year Mahmud Khan besieged it for four months, took it by storm and left it a heap of ruins. To preserve himself from utter destruction the khan threw himself into the arms of the Afghans. The tract in which Andkhui stands is fertile, but proverbially unhealthy; the Persians account it "a hell upon earth" by reason of its scorching sands, brackish water, flies and scorpions. The population, estimated at 15,000, consists principally of Turkmans with a mixture of Uzbegs and a few Tajiks. The district was allotted to Afghanistan by the Russo-Afghan boundary commission of 1885.

ANDOCIDES, one of the "ten" Attic orators, was born about 440 B.C. Implicated in the mutilation of the Hermae (415), although he saved his life by turning informer, he was condemned to partial loss of civil rights and went into exile. He engaged in commercial pursuits, and after two unsuccessful attempts returned to Athens under the general amnesty that followed the restoration of the democracy (403), and filled some important offices. In 391 he was one of the ambassadors sent to Sparta to discuss peace terms, but the negotiations failed, and after this time we hear no more of him. Oligarchical in his sympathies, he offended his own party and was distrusted by the democrats. Andocides was no professional orator; his style is simple and lively, natural but inartistic.

Speeches extant:—*De Reditu*, plea for his return and removal of civil disabilities; *De Mysteriis*, defence against the charge of impiety in attending the Eleusinian mysteries; *De Pace*, advocating peace with Sparta; *Contra Alcibiadem*, generally considered spurious. Text:—Blass, 1880, Lipsius, 1888; *De Myst.*, with notes by Hickie, 1885; *De Red.* and *De Myst.*, with notes by Marchant, 1889; see Jebb, *Attic Orators*; L. L. Forman, *Index Andocideus*, 1897.

ANDORRA, or ANDORRE, a small, neutral, autonomous, and semi-independent state, on the Franco-Spanish frontier, and chiefly on the peninsular side of the eastern Pyrenees. Pop. (1900) about 5500; area about 175 sq. m. Andorra is surrounded by mountains, and comprises one main valley, watered by the Gran Balira, Valira or Balire, a tributary of the Segre, which itself flows into the Ebro; with several smaller valleys, the most important being that of the Balira del Orien, which joins the Gran Balira on the left. The territory was once densely wooded, and is said to derive its name from the Moorish *Aldarra*, "the place thick with trees"; but almost all the forests have been destroyed for fuel. The climate is generally cold, with very severe winters. The land is chiefly devoted to pasture for the numerous flocks and herds; but on the more sheltered southern slopes it is carefully cultivated, and produces grain, potatoes, fruit and tobacco. Game and trout are plentiful; milk, butter, hams, hides and wool are exported, principally to France. The local industries are of the most primitive kind, merely domestic, as in the middle ages. Lack of capital, of coal, and of good means of communication prevents the inhabitants from making use of the iron and lead in their mountains. During the coldest winter months their communications are much easier with Spain than through the snow-clad passes leading into Ariège. The only roads are bridle-paths, and one municipal road by the Balira valley, connecting Andorra with the high road to Seo de Urgel and Manresa; but in 1904 France and Spain agreed to build a railway from Ax to Ripoll, which would greatly facilitate traffic.

The Andorrans are a robust and well-proportioned race, of an independent spirit, simple and severe in their manners. They are all Roman Catholics. Apart from the wealthier landowners, who speak French fluently, and send their children to be educated in France, they use the Catalan dialect of Spanish. Andorra comprises the six parishes or communes of Andorra Vieilla, Canillo, Encamp, La Massana, Ordino and San Julian de Loria, which are subdivided into fifty-two hamlets or *pueblos*.

Preserved from innovations by the mutual jealousy of rival potentates, as well as by the conservative temper of a pastoral population, Andorra has kept its medieval usages and institutions almost unchanged. In each parish two *consuls*, assisted by a local council, decide matters relating to roads, police, taxes, the division of pastures, the right to collect wood, &c. Such matters, as well as the general internal administration of the territory, are finally regulated by a Council General of 24 members (4 to each parish), elected since 1866 by the suffrages of all heads of families, but previously confined to an aristocracy composed of the richest and oldest families, whose supremacy had been preserved by the principle of primogeniture. A general syndic, with two inferior syndics, chosen by the Council General, constitutes the supreme executive of the state. Two *viguiers*—one nominated by France, and the other by the bishop of Urgel—command the militia, which consists of about 600 men, although all capable of bearing arms are liable to be called out. This force is exempt from all foreign service, and the chief office of the *viguiers* is the administration of criminal justice, in which their decisions, given simply according to their judgment and conscience, there being no written laws, are final. Civil cases, on the other hand, are tried in the first instance before one of the two aldermen, who act as deputies of the *viguiers*; the judgment of this court may be set aside by the civil judge of appeal, an officer nominated by France and the bishop of Urgel alternately; the final appeal is either to the Court of Cassation at Paris or to the Episcopal College at Urgel. The French *viguier* is taken from the French department of Ariège and appointed for life, but the *viguier* of the bishop must be an Andorran, holding office for three years and re-eligible. There are notaries and clerks, auditors for each parish elected by the heads of families, police agents and bailiffs, chosen and sworn in, like all the above officers, by the Council General. The archives are mostly kept in the "house of the valley" in the capital, Andorra Vieilla, a struggling village of 600 inhabitants. In this government house the Council General meets and has a chapel. Here also the aldermen, *viguiers* and judge of appeal administer justice and assemble for all purposes of administration. Two magistrates, styled *rahanadores*, are appointed by the Council General to see that *viguiers* and judges preserve the customs and privileges of Andorra. The parishes have a permanent patrol of six armed men besides the militia. Spain and the bishop of Urgel are very jealous of French encroachments, and claim to have a better right ultimately to annex the little state. In the meanwhile it continues to pay each of the suzerain powers £40 a year, levied by a tax on pastures.

Andorra is the sole surviving specimen of the independence possessed in medieval times by the warlike inhabitants of many Pyrenean valleys. Its privileges have remained intact, because the suzerainty of the district became equally and indivisibly shared in 1278 between the bishops of Urgel and the counts of Foix, the divided suzerainty being now inherited by the French crown and the present bishop of Urgel; and the two powers have mutually checked innovations, while the insignificant territory has not been worth a dispute. Thus Andorra is not a republic, but is designated in official documents as the *Vallées et Suzerainetés*. Before 1278 it was under the suzerainty of the neighbouring counts of Castelbo, to whom it had been ceded in 1170 by the counts of Urgel. A marriage between the heiress of Castelbo and Roger Bernard, count of Foix, carried the rights of the above-named Spanish counts into the house of Foix, and hence subsequently to the crown of France, when the heritage of the feudal system was absorbed by the sovereign; but the bishops of Urgel claimed certain rights, which after long disputes were satisfied by the "Act of Division" executed in 1278. The claims of the bishopric dated from Carolingian times, and the independence of Andorra, like most other Pyrenean anomalies, has been traditionally ascribed to Charlemagne (742–814).

Authorities.—With the exception of *Études géographiques sur la vallée d'Andorre*, by J. Bladé (Paris, 1875), the standard books on Andorra deal mainly with its history and institutions. They comprise the following:—*The Valley of Andorra*, translated from the French of E. B. Berthet by F. H. Deverell (Bristol, 1886); J. Aviles Arnau, *El Pallás y Andorra* (Barcelona, 1893); L. Dalmau de Baquer, *Historia de la Republica de Andorra* (Barcelona, 1849); C. Baudon de Mony, *Origines historiques de la question d'Andorre* (in the *Bibliothèque de l'École des Chartes*, vol. 46, Paris, 1885). See also C. Baudon de Mony, *Relations politiques des comtes de Foix avec la Catalogne, jusqu'au commencement du XIVe siècle* (Paris, 1896). A fair map was published by A. Hartleben, of Vienna, in 1898.

ANDOVER, a market-town and municipal borough in the Andover parliamentary division of Hampshire, England, 67 m. W.S.W. of London by the London & South Western railway, served also by the Midland & South Western Junction railway. Area 8663 acres. Pop. (1901) 6509. It is pleasantly situated on the river Anton, a tributary of the Test, in a hilly district. The church of St Mary replaced an ancient one in 1848; a Norman doorway is preserved from the original structure. The site of a Norman priory can be traced. Several early earthworks are seen in the vicinity, among which the circular camp on Bury Hill, S.W. of the town, is a very fine example. It is probably of British origin. Andover is the centre of a large agricultural district. Malting is carried on and there is a large iron-foundry; but the silk manufactures, once prosperous, are now extinct. The corporation consists of a mayor, 4 aldermen and 12 councillors.

There are numerous Roman villas in the district, but Andover itself is not a Roman site. The town, the name of which appears in the forms Andefeian, Andieura and Andever, probably owes much of its importance to the neighbourhood of the Roman road from Silchester to Old Sarum. It is mentioned in King Edred's will, a document of doubtful authenticity, dated *c.* 955. Later the Witenagemot met here, and it is the traditional scene of the meeting of Æthelred and Olaf the Dane. Andover existed as a borough before 1176, and Henry II. exempted its inhabitants from toll and passage. In 1201 King John increased the farm paid by the burgesses, while Henry III. granted them return of writs, probate of wills and other privileges. The corporation was reconstituted in 1599 and again in 1682. From 1295 till 1305 the burgesses returned two members to parliament but then ceased to do so till 1586. After the reform of 1867 they returned only one member and in 1885 the borough was disfranchised. A gild merchant is mentioned as early as 1175. The cattle-market was granted in 1682, and there is an ancient corn-market, probably held by prescription. The November sheep-fair dates from 1205, and the neighbouring fair at Weyhill (since 1599 a part of the borough) was formerly among the most important in England. The town possessed an iron-market early in the 14th century. At that date the wool-trade also was very prosperous, and the manufactures of silk and parchment are among the extinct industries of the town.

ANDOVER, a township of Essex county, Massachusetts, U.S.A., pleasantly situated on the S. side of the Merrimac Valley. Pop. (1890) 6142; (1900) 6813; (1910, U. S. census) 7301. The Shawsheen river supplies power for a considerable manufacturing industry (twine, woollens and rubber goods being manufactured) in the villages of Andover, Ballardville and Frye. Andover, the principal village, is about 23 m. N. of Boston and is served by the western division of the Boston & Maine railway and by interurban electric railways. The township is noteworthy for its educational institutions. Abbot Academy, opened in 1829, is said to be the oldest existing academy in the United States incorporated for the education of girls alone; an art gallery, given to the academy by Mrs John Byers, was opened in 1907. Phillips Academy, opened in 1778 (incorporated in 1780), was the first incorporated academy of the state; it was founded through the efforts of Samuel Phillips (1752–1802, president of the Massachusetts senate in 1785–1787 and in 1788–1801, and lieutenant-governor of Massachusetts in 1801–1802), by his father, Samuel Phillips (1715–1790), and his uncle, John Phillips (1719–1795), "for the purpose of instructing youth, not only in English and Latin grammar, writing, arithmetic and those sciences wherein they are commonly taught, but more especially to learn them the great end and real business of living." It is one of the largest secondary schools in New England and enjoys a wide and high reputation. An archaeological department, with an important collection in American archaeology, was founded by Robert S. Peabody and his wife in 1901. The Academy grounds include those occupied in 1808–1909 by the Andover Theological Seminary before its removal to Cambridge (*q.v.*). Andover was settled about 1643 and was incorporated in 1646, being named from the English town of Andover, Hampshire, whence some of the chief settlers had migrated; the first settlement was made in what is now the township of North Andover (pop. 5529 in 1910), which was separated from Andover in 1855. Simon Bradstreet (1603–1697), important among the early men of Massachusetts, was one of the founders; and his wife, Anne Dudley Bradstreet (1612–1672), was the first woman versifier of America; the Bradstreet house in North Andover, said to have been built about 1667, is still standing. Andover was a prominent centre in the witchcraft trials of 1692. Elizabeth Stuart Phelps-Ward was born and lived for many years in Andover, and Harriet Beecher Stowe lived here from 1852 to 1864 and is buried here.

See S. L. Bailey, *Historical Sketches of Andover* (Boston, 1880); John L. Taylor, *Memoir of Samuel Phillips* (Boston, 1856); and Philena and Phebe F. M'Keen, *History of Abbot Academy* (Andover, 1880).

ANDRADA, DIEGO DE PAIVA DE (1528–1575), Portuguese theologian, was born at Coimbra, son of the grand treasurer of John III. His original bent was towards foreign mission. He earned distinction in 1562 at the council of Trent as envoy of King Sebastian. Between 1562 and 1567 he published many controversial tracts, especially against the Lutheran, Martin Chemnitz (*q.v.*). His first tract, *De Societatis Jesu Origine*, led to his being erroneously presumed a Jesuit (P. Alegambe, *Biblioth. Scriptorum S. J.*, 1676, p. 177). His *De Conciliorum Auctoritate* was welcomed at Rome as exalting the papal authority. Posthumous were his *Defensio Tridentinae Fidei*, 1578 (remarkable for its learned statement of various opinions regarding the Immaculate Conception), and three sets of his sermons in Portuguese.

His nephew, DIEGO, the younger (1586–1660), produced *Chauleidos* (1628) and other Latin poems, including sacred dramas; a novel, *Casamento Perfeito* (1630); and shone as a historical critic.

See *Bibliographie Universelle* (1811); N. Antonio, *Biblioth. Hisp. Nova* (1783), i. 304; and for the nephew, life by A. Dos Reys in *Corp. Illust. Poet. Lat.* (1745) iii.

ANDRADA E SYLVA, BONIFACIO JOZÉ D' (1765–1838), Brazilian statesman and naturalist, was born at Villa de Santos, near Rio Janeiro. In 1800 he was appointed professor of geology at Coimbra, and soon after inspector-general of the Portuguese mines; and in 1812 he was made perpetual secretary of the Academy of Lisbon. Returning to Brazil in 1819, he urged Dom Pedro to resist the recall of the Lisbon court, and was appointed one of his ministers in 1821. When the independence of Brazil was declared, Andrada was made minister of the interior and of foreign affairs; and when it was established, he was again elected by the Constituent Assembly, but his democratic principles resulted in his dismissal from office, July 1823. On the dissolution of the Assembly in November, he was arrested and banished to France, where he lived in exile near Bordeaux till, in 1829, he was permitted to return to Brazil. But being again arrested in 1833, and tried for intriguing on behalf of Dom Pedro I., he passed the rest of his days in retirement till he died at Nictheroy in 1838.

ANDRÁSSY, JULIUS (GYULA), COUNT (1823–1890), Hungarian statesman, the son of Count Károly Andrássy and Etelka Szapáry, was born at Kassa in Hungary on the 8th of March 1823. The son of a Liberal father, who belonged to the Opposition at a time when to be in opposition was to be in danger, Andrássy at a very early age threw himself into the political struggles of the day, adopting at the outset the patriotic side. Count István Széchenyi was the first adequately to appreciate his capacity, when in 1845 the young man first began his public career as president of the society for the regulation of the waters of the Upper Theiss. In 1846 he attracted attention by his bitter articles against the government in Kossuth's paper, the *Pesti Hirlap*, and was returned as one of the Radical candidates to the diet of 1848, where his generous, impulsive nature made him one of the most thorough-going of the patriots. When the Croats under Jellachich invaded Hungary, Andrássy placed himself at the head of the gentry of his county, and served with distinction at the battles of Pákozd and Schwechat, as Görgei's adjutant (Sept. 1848). Towards the end of the war Andrássy was sent to Constantinople by the revolutionary government to obtain at least the neutrality of Turkey during the struggle. After the catastrophe of Világós he migrated first to London and then to Paris. On the 21st of September 1851 he was hanged in effigy by the Austrian government for his share in the Hungarian revolt. He employed his ten years of exile in studying politics in what was then the centre of European diplomacy, and it is memorable that his keen eye detected the inherent weakness of the second French empire beneath its imposing exterior. Andrássy returned home from exile in 1858, but his position was very difficult. He had never petitioned for an amnesty, steadily rejected all the overtures both of the Austrian government and of the Magyar Conservatives (who would have accepted something short of full autonomy), and clung enthusiastically to the Deák party. On the 21st of December 1865 he was chosen vice-president of the diet, and in March 1866 became president of the sub-committee appointed by the parliamentary commission to draw up the Composition (commonly known as the *Ausgleich*) between Austria and Hungary, of which the central idea, that of the "Delegations," originated with him. It was said at that time that he was the only member of the commission who could persuade the court of the justice of the national claims. After Königgrätz he was formally consulted by the emperor for the first time. He advised the re-establishment of the constitution and the appointment of a responsible ministry.

On the 17th of February 1867 the king appointed him the first constitutional Hungarian premier. It was on this occasion that Deák called him "the providential statesman given to Hungary by the grace of God." As premier, Andrássy by his firmness, amiability and dexterity as a debater, soon won for himself a commanding position. Yet his position continued to be difficult, inasmuch as the authority of Deák dwarfed that of all the party leaders, however eminent. Andrássy chose for himself the departments of war and foreign affairs. It was he who reorganized the Honved system, and he used often to say that the regulation of the military border districts was the most difficult labour of his life. On the outbreak of the Franco-German War of 1870, Andrássy resolutely defended the neutrality of the Austrian monarchy, and in his speech on the 28th of July 1870 warmly protested against the assumption that it was in the interests of Austria to seek to recover the position she had held in Germany before 1863. On the fall of Beust (6th of November 1871), Andrássy stepped into his place. His tenure of the chancellorship was epoch-making. Hitherto the empire of the Habsburgs had never been able to dissociate itself from its Holy Roman traditions. But its loss of influence in Italy and Germany, and the consequent formation of the Dual State, had at length indicated the proper, and, indeed, the only field for its diplomacy in the future—the near East, where the process of the crystallization of the Balkan peoples into nationalities was still incomplete. The question was whether these nationalities were to be allowed to become independent or were only to exchange the tyranny of the sultan for the tyranny of the tsar. Hitherto Austria had been content either to keep out the Russians or share the booty with them. She was now, moreover, in consequence of her misfortunes deprived of most of her influence in the councils of Europe. It was Andrássy who recovered for her her proper place in the European concert. First he approached the German emperor; then more friendly relations were established with the courts of Italy and Russia by means of conferences at Berlin, Vienna, St Petersburg and Venice.

The "Andrássy Note."

The recovered influence of Austria was evident in the negotiations which followed the outbreak of serious disturbances in Bosnia in 1875. The three courts of Vienna, Berlin and St Petersburg had come to an understanding as to their attitude in the Eastern question, and their views were embodied in the despatch, known as the "Andrássy Note," addressed on the 30th of December 1875 by Count Andrássy to Count Beust, now Austrian ambassador to the court of St James's. In it he pointed out that the efforts of the powers to localize the revolt seemed in danger of failure, that the rebels were still holding their own, and that the Ottoman promises of reform, embodied in various *firmans*, were no more than vague statements of principle which had never had, and were probably not intended to have, any local application. In order to avert the risk of a general conflagration, therefore, he urged that the time had come for concerted action of the powers for the purpose of pressing the Porte to fulfil its promises. A sketch of the more essential reforms followed: the recognition rather than the toleration of the Christian religion; the abolition of the system of farming the taxes; and, in Bosnia and Herzegovina, where the religious was complicated by an agrarian question, the conversion of the Christian peasants into free proprietors, to rescue them from their double subjection to the great Mussulman landowners. In Bosnia and Herzegovina also elected provincial councils were to be established, irremovable judges appointed and individual liberty guaranteed. Finally, a mixed commission of Mussulmans and Christians was to be empowered to watch over the carrying out of these reforms. The fact that the sultan would be responsible to Europe for the realization of his promises would serve to allay the natural suspicions of the insurgents.[1]

To this plan both Great Britain and France gave a general assent, and the Andrássy Note was adopted as the basis of negotiations. When war became inevitable between Russia and the Porte, Andrássy arranged with the Russian court that, in case Russia prevailed, the *status quo* should not be changed to the detriment of the Austrian monarchy. When, however, the treaty of San Stefano threatened a Russian hegemony in the near East, Andrássy concurred with the German and British courts that the final adjustment of matters must be submitted to a European congress. At the Berlin Congress in 1878 he was the principal Austrian plenipotentiary, and directed his efforts to diminish the gains of Russia and aggrandize the Dual Monarchy. The latter object was gained by the occupation of Bosnia-Herzegovina under a mandate from the congress. This occupation was most unpopular in Hungary, both for financial reasons and because of the strong philo-Turk sentiments of the Magyars, but the result brilliantly justified Andrássy's policy. Nevertheless he felt constrained to bow before the storm, and placed his resignation in the emperor's hands (8th of October 1879). The day before his retirement he signed the offensive-defensive alliance with Germany, which placed the foreign relations of Austria-Hungary once more on a stable footing.

After his retirement, Andrássy continued to take an active part in public affairs both in the Delegations and in the Upper House. In 1885 he warmly supported the project for the reform of the House of Magnates, but on the other hand he jealously defended the inviolability of the Composition of 1867, and on the 5th of March 1889 in his place in the Upper House spoke against any particularist tampering with the common army. In the last years of his life he regained his popularity, and his death on the 18th of February 1890 was universally mourned as a national calamity. He was the first Magyar statesman who, for centuries, had occupied a European position. Breadth of view, swift resourcefulness, and an intimate knowledge of men and things were his distinguishing qualities as a statesman. Personally he was the most amiable of men; it has been well said that he united in himself the Magyar magnate with the modern gentleman. His motto was: "It is hard to promise, but it is easy to perform." If Deák was the architect, Andrássy certainly was the master-builder of the modern Hungarian state.

By his wife, the countess Katinka Kendeffy, whom he married in Paris in 1856, Count Andrássy left two sons, and one daughter, Ilona (b. 1859), who married Count Lajos Batthyány. Both the sons gained distinction in Hungarian politics. The eldest, Tivador (Theodore) Andreas (b. 10th of July 1857), was elected vice-president of the Lower House of the Hungarian parliament in 1890. The younger, Gyula (Julius, b. 30th of June 1860), became under-secretary in the Wekerle ministry in 1892; in 1893 he became minister of education, and in June 1894 was appointed minister in attendance on the king, retiring in 1895 with Wekerle; in 1898, with his elder brother, he left the Liberal party, but returned to it again after the fall of the Bánffy ministry; he is the author of *Ungarns Ausgleich mit Österreich vom Jahre 1867* (Ger. ed., Leipzig, 1897), and a work in Hungarian on the origins of the Hungarian state and constitution (Budapest, 1901).

See Andrássy's *Speeches* (Hung.) edited by Béla Lederer (Budapest, 1891); *Memoir* (Hung.) by Benjamin Kállay (Budapest, 1891); *Necrology* (Hung.) in the *Akad. Ertesitö*, Evf. 14 (Budapest, 1891); *Recollections of Count Andrássy* (Hung.), by Máno Kónyi (Budapest, 1891). (R. N. B.)

ANDRÉ, JOHN (1751–1780), British soldier, was born in London in 1751 of Genevese parents. Accident brought him in 1769 to Lichfield, where, in the house of the Rev. Thomas Seward, whose daughter Anna was the centre of a literary circle, he met the beautiful Miss Honora Sneyd. A strong attachment sprang up between the two, but their marriage was disapproved of by Miss Sneyd's family, and André was sent to cool his love in his father's counting-house in London and on a business tour to the continent. Commerce was, however, too tame an occupation for his ambitious spirit, and in March 1771 he obtained a commission in a regiment destined for America, the theatre at that time of the War of Independence. Here his character, conduct and accomplishments gained him rapid promotion. Miss Sneyd in 1773 married R. L. Edgeworth, the father of the novelist, Maria Edgeworth, having previously refused Thomas Day, the author of *Sandford and Merton*; but André remained faithful to his love for her. In a letter to Anna Seward, written shortly after being taken prisoner by the Americans at the capitulation of St John's on the 3rd of November 1775, he states that he has been "stripped of everything except the picture of Honora, which I concealed in my mouth. Preserving this I yet think myself fortunate." Exchanged towards the close of 1776, André became in succession aide-de-camp to General Grey and to the commander-in-chief of the British forces, Sir Henry Clinton, who raised him to the rank of major and appointed him adjutant-general of the forces in 1778. Early in 1780 the American general, Benedict Arnold (*q.v.*), thinking himself injuriously treated by his colleagues, made overtures to the British to betray to them the important fortress of West Point on the Hudson river, the key of the American position, of which he was commandant. This seemed to Sir Henry Clinton a favourable opportunity for concluding the war, and Major André was appointed to negotiate with Arnold. For this purpose he landed from a vessel bearing a flag of truce and had an interview with Arnold, who delivered to him full particulars and plans of the fortress of West Point, and arranged with him to co-operate with the British during an attack which was to be made in a few days. Unfortunately for André, the British vessel was fired on before the negotiations were finished and obliged to drop down the river. André, therefore, could not return by the way he came and was compelled to pass the night within the American lines. After making the fatal mistake of exchanging his uniform for a civilian disguise, he set out next day by land for New York, provided by Arnold with a passport, and succeeded in passing the regular American outposts undetected. Next day, however, just when all danger seemed to be over, André was stopped by three American militiamen, to whom he gave such contradictory answers that, in spite of Arnold's pass, they searched him and discovered in his boots the fatal proofs of his negotiations for the betrayal of West Point. Notwithstanding his offer of a large sum for his release, his captors delivered him up to the nearest American officer. Washington, although admitting that André was "more unfortunate than criminal," sent him before a court-martial, by which, notwithstanding a spirited defence, he was, in consequence of his own admissions, condemned to death as a spy. In spite of the protests and entreaties of Sir Henry Clinton and the threats of Arnold he was hanged at Tappan on the 2nd of October 1780. Arnold, warned by the unfortunate André, escaped by flight the punishment he so richly merited. The justice of André's execution has been a fruitful theme for discussion, but both British and American military writers are agreed that he undoubtedly acted in the character of a spy, although under orders and entirely contrary to his own feelings. Washington's apparent harshness in refusing the condemned man a soldier's death by shooting has also been censured, but it is evident that no other course was open to the American commander, since a mitigation of the sentence would have implied a doubt as to its justice. Besides courage and distinguished military talents, Major André was a proficient in drawing and in music, and showed considerable poetic talent in his humorous *Cow-chase*, a kind of parody on *Chevy-chase*, which appeared in three successive parts at New York, the last on the very day of his capture. His fate excited universal sympathy both in America and Europe, and the whole British army went into mourning for him. A mural sculptured monument to his memory was erected in Westminster Abbey by the British government when his remains were brought over and interred there in 1821; and a memorial has been erected to him by Americans on the spot where he was taken. André's military journal, giving an interesting account of the British movements in America from June 1777 to the close of 1778, was taken to England in 1782 by General Grey, whose descendant, Earl Grey, discovered it in 1902 and disposed of it to an American gentleman.

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[1] Hertslet, *Map of Europe by Treaty*, No. 456, vol. iv. p. 2418.

See *The Life and Career of Major John André, &c.*, by Winthrop Sargent (new ed., New York, 1902); *André's Journal* (Boston, Mass., The Bibliophile Society, 1904).

ANDREA, GIOVANNI (1275–1348), Italian canonist, was born at Mugello, near Florence, about 1275. He studied canon law at Bologna, where he distinguished himself in this subject so much that he was made professor at Padua, and later at Pisa and Bologna, rapidly acquiring a high reputation for his learning and his moral character. Curious stories are told of him; for instance, that by way of self-mortification he lay every night for twenty years on the bare ground with only a bear's skin for a covering; that in an audience he had with Pope Boniface VIII. his extraordinary shortness of stature led the pope to believe he was kneeling, and to ask him three times to rise, to the immense merriment of the cardinals; and that he had a daughter, Novella, so accomplished in law as to be able to read her father's lectures in his absence, and so beautiful, that she had to read behind a curtain lest her face should distract the attention of the students. He is said to have died at Bologna of the plague in 1348, and an epitaph in the church of the Dominicans in which he was buried, calling him *Rabbi Doctorum, Lux, Censor, Normaque Morum*, testifies to the public estimation of his character. Andrea wrote a *Gloss on the Sixth Book of the Decretals*, *Glosses on the Clementines* and a *Commentary on the Rules of Sextus*. His additions to the *Speculum* of Durando are a mere adaptation from the *Consilia* of Oldradus, as is also the book *De Sponsalibus et Matrimonio*, from J. Anguisciola.

ANDREA DEL SARTO (1487–1531). This celebrated painter of the Florentine school was born in Gualfonda, Florence, in 1487, or perhaps 1486, his father Agnolo being a tailor (*sarto*): hence the nickname by which the son is constantly designated. There were four other children. The family, though of no distinction, can be traced back into the 14th century. Vannucchi has since 1677 been constantly given as the surname—according to some modern writers, without any authority. It has recently been said that the true name is Andrea d'Agnolo di Francesco di Luca di Paolo del Migliore. But this only gives, along with our painter's Christian name, the Christian names of his antecessors for five generations, and is in no way his own surname. In 1494 Andrea was put to work under a goldsmith. This occupation he disliked. He took to drawing from his master's models, and was soon transferred to a skilful woodcarver and inferior painter named Gian Barile, with whom he remained until 1498. Barile, though a coarse-grained man enough, would not stand in the way of the advancement of his promising pupil, so he recommended him to Piero di Cosimo as draughtsman and colourist. Piero retained Andrea for some years, allowing him to study from the famous cartoons of Leonardo da Vinci and Michelangelo. Finally Andrea agreed with his friend Franciabigio, who was somewhat his senior, that they would open a joint shop; at a date not precisely defined they took a lodging together in the Piazza del Grano. Their first work in partnership may probably have been the "Baptism of Christ," for the Florentine Compagnia dello Scalzo, a performance of no great merit, the beginning of a series, all the extant items of which are in monochrome chiaroscuro. Soon afterwards the partnership was dissolved. From 1509 to 1514 the brotherhood of the Servites employed Andrea, as well as Franciabigio and Andrea Feltrini, the first-named undertaking in the portico of the Annunziata three frescoes illustrating the life of the Servite saint Filippo Benizzi (d. 1285). He executed them in a few months, being endowed by nature with remarkable readiness and certainty of hand and unhesitating firmness in his work, although in the general mould of his mind he was timid and diffident. The subjects are the saint sharing his cloak with a leper, cursing some gamblers, and restoring a girl possessed with a devil. The second and third works excel the first, and are impulsive and able performances. These paintings met with merited applause, and gained for their author the pre-eminent title "Andrea senza errori" (Andrew the unerring)—the correctness of the contours being particularly admired. After these subjects the painter proceeded with two others—the death of S. Filippo and the children cured by touching his garment,—all the five works being completed before the close of 1510. The youth of twenty-three was already in technique about the best fresco-painter of central Italy, barely rivalled by Raphael, who was the elder by four years. Michelangelo's Sixtine frescoes were then only in a preliminary stage. Andrea always worked in the simplest, most typical and most trying method of fresco—that of painting the thing once and for all, without any subsequent dry-touching. He now received many commissions. The brotherhood of the Servites engaged him to do two more frescoes in the Annunziata at a higher price; he also painted, towards 1512, an Annunciation in the monastery of S. Gallo.

The "Tailor's Andrew" appears to have been an easy-going plebeian, to whom a modest position in life and scanty gains were no grievances. As an artist he must have known his own value; but he probably rested content in the sense of his superlative powers as an executant, and did not aspire to the rank of a great inventor or leader, for which, indeed, he had no vocation. He led a social sort of life among his compeers of the art, was intimate with the sculptor Rustici, and joined a jolly dining-club at his house named the Company of the Kettle, also a second club named the Trowel. At one time, Franciabigio being then the chairman of the Kettle-men, Andrea recited, and is by some regarded as having composed, a comic epic, "The Battle of the Frogs and Mice"—a rechauffé, as one may surmise, of the Greek *Batrachomyomachia*, popularly ascribed to Homer. He fell in love with Lucrezia (del Fede), wife of a hatter named Carlo Recanati; the hatter dying opportunely, the tailor's son married her on the 26th of December 1512. She was a very handsome woman and has come down to us treated with great suavity in many a picture of her lover-husband, who constantly painted her as a Madonna and otherwise; and even in painting other women he made them resemble Lucrezia in general type. She has been much less gently handled by Vasari and other biographers. Vasari, who was at one time a pupil of Andrea, describes her as faithless, jealous, overbearing and vixenish with the apprentices. She lived to a great age, surviving her husband forty years.

By 1514 Andrea had finished his last two frescoes in the court of the Servites, than which none of his works was more admired—the "Nativity of the Virgin," which shows the influence of Leonardo, Domenico Ghirlandajo and Fra Bartolommeo, in effective fusion, and the "Procession of the Magi," intended as an amplification of a work by Baldovinetti; in this fresco is a portrait of Andrea himself. He also executed at some date a much-praised head of Christ over the high altar. By November 1515 he had finished at the Scalzo the allegory of Justice, and the "Baptist preaching in the desert,"—followed in 1517 by "John baptizing," and other subjects. Before the end of 1516 a "Pietà" of his composition, and afterwards a Madonna, were sent to the French court. These were received with applause; and the art-loving monarch Francis I. suggested in 1518 that Andrea should come to Paris. He journeyed thither towards June of that year, along with his pupil Andrea Sguazzella, leaving his wife in Florence, and was very cordially received, and for the first and only time in his life was handsomely remunerated. Lucrezia, however, wrote urging his return to Italy. The king assented, but only on the understanding that his absence from France was to be short; and he entrusted Andrea with a sum of money to be expended in purchasing works of art for his royal patron. The temptation of having a goodly amount of pelf in hand proved too much for Andrea's virtue. He spent the king's money and some of his own in building a house for himself in Florence. This necessarily brought him into bad odour with Francis, who refused to be appeased by some endeavours which the painter afterwards made to reingratiate himself. No serious punishment, however, and apparently no grave loss of professional reputation befell the defaulter.

In 1520 he resumed work in Florence, and executed the "Faith" and "Charity" in the cloister of the Scalzo. These were succeeded by the "Dance of the Daughter of Herodias," the "Beheading of the Baptist," the "Presentation of his head to Herod," an allegory of Hope, the "Apparition of the Angel to Zacharias" (1523), and the monochrome of the Visitation. This last was painted in the autumn of 1524, after Andrea had returned from Luco in Mugello,—to which place an outbreak of plague in Florence had driven him, his wife, his step-daughter and other relatives. In 1525 he painted the very famous fresco named the "Madonna del Sacco," a lunette in the cloisters of the Servites; this picture (named after a sack against which Joseph is represented propped) is generally accounted his masterpiece. His final work at the Scalzo was the "Birth of the Baptist" (1526), executed with some enhanced elevation of style after Andrea had been diligently studying Michelangelo's figures in the sacristy of S. Lorenzo. In the following year he completed at S. Salvi, near Florence, a celebrated "Last Supper," in which all the personages seem to be portraits. This also is a very fine example of his style, though the conception of the subject is not exalted. It is the last monumental work of importance which Andrea del Sarto lived to execute. He dwelt in Florence throughout the memorable siege, which was soon followed by an infectious pestilence. He caught the malady, struggled against it with little or no tending from his wife, who held aloof, and he died, no one knowing much about it at the moment, on the 22nd of January 1531, at the comparatively early age of forty-three. He was buried unceremoniously in the church of the Servites.

Various portraits painted by Andrea are regarded as likenesses of himself, but this is not free from some doubt. One is in London, in the National Gallery, an admirable half-figure, purchased in 1862. Another is at Alnwick Castle, a young man about twenty years of age, with his elbow on a table. Another at Panshanger may perhaps represent in reality his pupil Domenico Conti. Another youthful portrait is in the Uffizi Gallery, and the Pitti Gallery contains more than one. Among his more renowned works not already specified are the following. The Virgin and Child, with St Francis and St John the Evangelist and two angels, now in the Uffizi, painted for the church of S. Francesco in Florence; this is termed the "Madonna di S. Francesco," or "Madonna delle Arpie," from certain figures of harpies which are decoratively introduced, and is rated as Andrea's masterpiece in oil-painting. The altar-piece in the Uffizi, painted for the monastery of S. Gallo, the "Fathers disputing on the doctrine of the Trinity"—SS. Augustine, Dominic, Francis, Lawrence, Sebastian and Mary Magdalene—a very energetic work. Both these pictures are comparatively early—towards 1517. The "Charity" now in the Louvre (perhaps the only painting which Andrea executed while in France). The "Pietà," in the Belvedere of Vienna; this work, as well as the "Charity," shows a strong Michelangelesque influence. At Poggio a Caiano a celebrated fresco (1521) representing Julius Caesar receiving tribute, various figures bringing animals from foreign lands—a striking perspective arrangement; it was left unfinished by Andrea and was completed by Alessandro Allori. Two very remarkable paintings (1523) containing various incidents in the life of the patriarch Joseph, executed for the Borgherini family. In the Pitti Gallery two separate compositions of the "Assumption of the Virgin," also a fine "Pietà." In the Madrid museum the "Virgin and Child," with Joseph, Elizabeth, the infant Baptist and an Archangel. In the Louvre the "Holy Family," the Baptist pointing upwards. In Berlin a portrait of his wife. In Panshanger a fine portrait named "Laura." The second picture in the National Gallery ascribed to Andrea, a "Holy Family," is by some critics regarded as the work rather of one of his scholars—we hardly know why. A very noticeable incident in the life of Andrea del Sarto relates to the copy, which he produced in 1523, of the portrait group of Leo X. by Raphael; it is now in the Naples Museum, the original being in the Pitti Gallery. Ottaviano de' Medici, the owner of the original, was solicited by Frederick II., duke of Mantua, to present it to him. Unwilling to part with so great a pictorial prize and unwilling also to disoblige the duke, Ottaviano got Andrea to make the copy, which was consigned to the duke as being the original. So deceptive was the imitation that even Giulio Romano, who had himself manipulated the original to some extent, was completely taken in; and, on showing the supposed Raphael years afterwards to Vasari, who knew the facts, he could only be undeceived when a private mark on the canvas was named to him by Vasari and brought under his eye. It was Michelangelo who had introduced Vasari in 1524 to Andrea's studio. He is said to have thought very highly of Andrea's powers, saying on one occasion to Raphael, "There is a little fellow in Florence who will bring sweat to your brow if ever he is engaged in great works."

Andrea had true pictorial style, a very high standard of correctness and an enviable balance of executive endowments. The point of technique in which he excelled least was perhaps that of discriminating the varying textures of different objects and surfaces. There is not much elevation or ideality in his works—much more of reality. His chiaroscuro is not carried out according to strict rule, but is adjusted to his liking for harmony of colour and fused tone and transparence; in fresco more especially his predilection for varied tints appears excessive. It may be broadly said that his taste in colouring was derived mainly from Fra Bartolommeo, and in form from Michelangelo; and his style partakes of the Venetian and Lombard, as well as the Florentine and Roman—some of his figures are even adapted from Albert Dürer. In one way or other he continued improving to the last. In drawing from nature, his habit was to sketch very slightly, making only such a memorandum as sufficed to work from. The scholars of Andrea were very numerous; but, according to Vasari, they were not wont to stay long, being domineered over by his wife; Pontormo and Domenico Puligo may be mentioned.

In this account of Andrea del Sarto we have followed the main lines of the narrative of Crowe and Cavalcaselle, supplemented by Vasari, Lanzi and others.

There are biographies by Biadi (1829), by von Reumont (1831), by Baumann (1878), and by Guinness (1899). (W. M. R.)

ANDREANI, ANDREA, Italian engraver on wood, in chiaroscuro, was born at Mantua about 1540 (Brulliot says 1560) and died at Rome in 1623. His engravings are scarce and valuable, and are chiefly copies of Mantegna, Dürer and Titian. The most remarkable of his works are "Mercury and Ignorance," the "Deluge," "Pharaoh's host drowned in the Red Sea" (after Titian), the "Triumph of Caesar" (after Mantegna), and "Christ retiring from the judgment-seat of Pilate."

ANDREE, KARL (1808–1875), German geographer, was born at Brunswick on the 20th of October 1808. He was educated at Jena, Göttingen and Berlin. After having been implicated in a students' political agitation he became a journalist, and in 1851 founded the *Bremer Handelsblatt*. From 1855, however, he devoted himself entirely to geography and ethnography, working successively at Leipzig and at Dresden. In 1862 he founded the important geographical periodical *Globus*. His works include *Nordamerika in geographischen und geschichtlichen Umrissen* (Brunswick, 1854), *Geographische Wanderungen* (Dresden, 1859), and *Geographie des Welthandels* (Stuttgart, 1867–1872). He died at Wildungen on the 10th of August 1875.

His son Richard, born on the 26th of February 1835, followed his father's career, devoting himself especially to ethnography. He wrote numerous books on this subject, dealing notably with the races of his own country, while an important general work was *Ethnographische Parallelen und Vergleiche* (Stuttgart, 1878). He also took up cartography, having a chief share in the production of the *Physikalisch-statistische Atlas des deutschen Reiches* (Leipzig, 1877), *Allgemeine Handatlas* (first ed., 1881), and other atlases; and he continued the editorship of the *Globus*.

ANDRÉE, SALOMON AUGUST (1854–1897?), Swedish engineer, was born at Grenna, on Lake Vetter, on the 18th of October 1854. After education at the Stockholm technical college, he studied aeronautics, and in 1895 elaborated a plan for crossing the north polar region by a balloon which should be in some degree dirigible by sails and trailing ropes. After an abortive effort in 1896, the winds being contrary, he started with two companions from Danes Island, Spitsbergen, on the 11th of July 1897. The party was never seen again, nor is the manner of its fate known. Of several expeditions sent in search of it, the first started in November 1897, on the strength of a report of cries of distress heard by shipwrecked sailors at Spitsbergen; in 1898 and 1899 parties searched the north Asiatic coast and the New Siberia Islands; and in May 1899 Dr Nathorst headed an expedition to eastern Greenland. None was successful, and only scanty information was obtained or inferred from the discovery of a few buoys (on the west of Spitsbergen, northern Norway, Iceland, &c.) which the balloonists had arranged to drop, and a message taken from a carrier pigeon despatched from the balloon two days after its ascent. There were also messages in two of the buoys, but they dated only from the day of the ascent. The others were empty.

ANDREINI, FRANCESCO, Italian actor, was born at Pistoia in the last half of the 16th century. He was a member of the company of the *Gelosi* which Henry IV. summoned to Paris to please his bride, the young queen Marie de' Medici. His wife Isabella Andreini (1562–1604) was a member of her husband's company, distinguished alike for her acting and her character,—commemorated in the medal struck at Lyons in the year of her death, with her portrait on one side, and the figure of Fame on the reverse with the words *aeterna fama*. She was also known in literature, her books including a pastoral, *Mirtilla* (Verona, 1588), a volume of songs, sonnets and other poems (Milan, 1601), and a collection of letters, published after her death. She inspired many of the French poets, notably Isaac du Ryer (d. *c.* 1631). Her son Giambattista Andreini (1578–1650) was born in Florence, and had a great success as a comedian in Paris under the name of Leylio. He was a favourite with Louis XIII., and also with the public, especially as the young lover. He left a number of plays full of extravagant imagination. The best known are *L'Adamo* (Milan, 1613), *The Penitent Magdalene* (Mantua, 1617), and *The Centaur* (Paris, 1622). From the first of these three volumes, which are extremely rare, Italians have often asserted that Milton, travelling at that time in their country, took the idea of *Paradise Lost*.

ANDRÉOSSY, ANTOINE-FRANÇOIS, Count (1761–1828), French soldier and diplomatist, was born at Castelnaudary, in Languedoc, on the 6th of March 1761. He was of Italian extraction, and his ancestor François Andréossy (1633–1688) had been concerned with Riquet in the construction of the Languedoc Canal in 1669. He had a brilliant career at the school of artillery at Metz, obtained his commission in 1781, and became captain in 1788. On the outbreak of the Revolution he adopted its principles. He saw active service on the Rhine in 1794 and in Italy in 1795, and in the campaign of 1796–97 was employed in engineer duties with the Army of Italy. He became *chef de brigade* in December 1796 and general of brigade in 1798, in which year he accompanied Bonaparte to Egypt. He served in the Egyptian campaign with distinction, and was selected as one of Napoleon's companions on his return to Europe. Andréossy took part in the *coup d'état* of the 18th of Brumaire, and on the 6th of January 1800 was made general of division. Of particular importance was his term of office as ambassador to England during the short peace which followed the treaties of Amiens and Lunéville. It had been shown (Coquille, *Napoleon and England*, 1904) that Andréossy repeatedly warned Napoleon that the British government desired to maintain peace but must be treated with consideration. His advice, however, was disregarded. When Napoleon became emperor he made Andréossy inspector-general of artillery and a count of the empire. In the war of 1805 Andréossy was employed on the headquarters staff of Napoleon. From 1808 to 1809 he was French ambassador at Vienna, where he displayed a hostility to Austria which was in marked contrast to his friendliness to England in 1802–1803. In the war of 1809, Andréossy was military governor of Vienna during the French occupation. In 1812 he was sent by Napoleon as ambassador to Constantinople, where he carried on the policy initiated by Sébastiani. In 1814 he was recalled by Louis XVIII. Andréossy now retired into private life, till the escape of his former master from Elba once again called him forth. In 1826 he was elected to the *Académie des Sciences*, and in the following year was deputy for the department of the Aude. His numerous works included the following:—on artillery (with which arm he was most intimately connected throughout his military career), *Quelques idées relatives à l'usage de l'artillerie dans l'attaque et . . . la défense des places* (Metz); *Essai sur le tir des projectiles creux* (Paris, 1826); and on military history, *Campagne sur le Main et la Rednits de l'armée gallo-batave* (Paris, 1802); *Opérations des pontonniers en Italie . . . 1795–1796* (Paris, 1843). He also wrote scientific memoirs on the mouth of the Black Sea (1818–1819); on certain Egyptian lakes (during his stay in Egypt); and in particular the history of the Languedoc Canal (*Histoire du canal du Midi*, 2nd ed., Paris, 1804), the chief credit of which he claimed for his ancestor. Andréossy died at Montauban in 1828.

See Marion, *Notice nécrologique sur le Lt.-Général Comte Andréossy*.

ANDRÉS, JUAN (1740–1817), Spanish Jesuit, was born at Planes in the province of Valencia, and became professor of literature at Gandia and finally royal librarian at Naples. He died at Rome on the 12th of January 1817. He is the author of many miscellaneous treatises on science, music, the art of teaching the deaf and dumb, &c. But his chief work, the labour of fully twenty years, is entitled *Dell' origine, progressi, e stato attuale d' ogni Letteratura* (7 vols., Parma, 1782–1799). A Spanish translation by his brother Carlos appeared at Madrid between 1784 and 1806, and an abridgment in French (1838–1846) was compiled by the Jesuit Alexis Nerbonne. The original was frequently reprinted during the first half of the 19th century.

See C. Sommervogel, *Bibliothèque de la compagnie de Jésus, première partie* (Brussels and Paris), vol. i. col. 342-350.

ANDREW (Gr. Ἀνδρέας, manly), the Christian Apostle, brother of Simon Peter, was born at Bethsaida on the Lake of Galilee. He had been a disciple of John the Baptist (John i. 37-40) and was one of the first to follow Jesus. He lived at Capernaum (Mark i. 29). In the gospel story he is referred to as being present on some important occasions as one of the disciples more closely attached to Jesus (Mark xiii. 3; John vi. 8, xii. 22); in Acts there is only a bare mention of him (i. 13). Tradition relates that he preached in Asia Minor and in Scythia, along the Black Sea as far as the Volga. Hence he became a patron saint of Russia. He is said to have suffered crucifixion at Patras (Patrae) in Achaea, on a cross of the form called *Crux decussata* (X) and commonly known as "St Andrew's cross." According to tradition his relics were removed from Patras to Constantinople, and thence to St Andrews (see below). The apocryphal book, *The Acts of Andrew*, mentioned by Eusebius, Epiphanius and others, is generally attributed to Leucius the Gnostic. It was edited and published by C. Tischendorf in the *Acta Apostolorum apocrypha* (Leipzig, 1821). This book, as well as a *Gospel of St Andrew*, was declared apocryphal by a decree of Pope Gelasius. Another version of the Andrew legend is found in the *Passio Andreae*, published by Max Bonnet (*Supplementum II Codicis apocryphi*, Paris, 1895). On this was founded an Anglo-Saxon poem (" Andreas und Elene," first published by J. Grimm, 1841; cf. C. W. Goodwin, *The Anglo-Saxon Legends of S. Andreas and S. Veronica*, 1851). The festival of St Andrew is held on the 30th of November.

See APOCRYPHAL LITERATURE; also Lipsius, *Die apokryphen Apostelgeschichten und Apostellegenden*, vol. i. (1883), and Hastings' *Dictionary of the Bible*, s.v.

Scottish Legends.—About the middle of the 8th century Andrew became the patron saint of Scotland. Concerning this there are several legends which state that the relics of Andrew were brought under supernatural guidance from Constantinople to the place where the modern St Andrews stands (Pictish, Muckross; Gaelic, Kilrymont). The oldest stories (preserved in the Colbertine MSS., Paris, and the Harleian MSS. in the British Museum) state that the relics were brought by one Regulus to the Pictish king Angus (or Ungus) Macfergus (*c.* 731–761). The only historical Regulus (*Riagail* or *Rule*, whose name is preserved by the tower of St Rule) was an Irish monk expelled from Ireland with St Columba; his date, however, is *c.* 573–600. There are good reasons for supposing that the relics were originally in the collection of Acca, bishop of Hexham, who took them into Pictland when he was driven from Hexham (*c.* 732), and founded a see, not, according to tradition, in Galloway, but on the site of St Andrews. The connexion with Regulus is, therefore, due in all probability to the desire to date the foundation of the church at St Andrews as early as possible.

See A. Lang, *St Andrews* (London, 1893), pp. 4 ff.; W. F. Skene, *Celtic Scotland*; also the article ST ANDREWS.

ANDREW II. (1175–1235), king of Hungary, son of Bela III., king of Hungary, succeeded his nephew, the infant Ladislaus III., in 1205. No other Magyar king, perhaps, was so mischievous to his country. Valiant, enterprising, pious as he was, all these fine qualities were ruined by a reckless good nature which never thought of the morrow. He declares in one of his decrees that the generosity of a king should be limitless, and he acted up to this principle throughout his reign. He gave away everything, money, villages, domains, whole counties, to the utter impoverishment of the treasury, thereby rendering the crown, for the first time in Hungarian history, dependent upon the great feudatories, who, in Hungary as elsewhere, took all they could get and gave as little as possible in return. In all matters of government, Andrew was equally reckless and haphazard. He is directly responsible for the beginnings of the feudal anarchy which well-nigh led to the extinction of the monarchy at the end of the 13th century. The great feudatories did not even respect the lives of the royal family, for Andrew was recalled from a futile attempt to reconquer Galicia (which really lay beyond the Hungarian sphere of influence), through the murder of his first wife Gertrude of Meran (September 24, 1213), by rebellious nobles jealous of the influence of her relatives. In 1215 he married Iolanthe of France, but in 1217 was compelled by the pope to lead a crusade to the Holy Land, which he undertook in hopes of being elected Latin emperor of Constantinople. The crusade excited no enthusiasm in Hungary, but Andrew contrived to collect 15,000 men together, whom he led to Venice; whence, not without much haggling and the surrender of all the Hungarian claims upon Zara, about two-thirds of them were conveyed to Acre. But the whole expedition was a forlorn hope. The Christian kingdom of Palestine was by this time reduced to a strip of coast about 440 sq. m. in extent, and after a drawn battle with the Turks on the Jordan (November 10), and fruitless assaults on the fortresses of the Lebanon and on Mount Tabor, Andrew started home (January 18, 1218) through Antioch, Iconium, Constantinople and Bulgaria. On his return he found the feudal barons in the ascendant, and they extorted from him the Golden Bull (see HUNGARY, *History*). Andrew's last exploit was to defeat an invasion of Frederick of Austria in 1234. The same year he married his third wife, Beatrice of Este. Besides his three sons, Bela, Coloman and Andrew, Andrew had a daughter Iolanthe, who married the king of Aragon. He was also the father of St Elizabeth of Hungary.

No special monograph for the whole reign exists, but there is a good description of Andrew's crusade in Reinhold Roehricht, *Geschichte des Königreiches Jerusalem* (Innsbruck, 1898). The best account of Andrew's government is in László Szalay's *History of Hungary* (Hung.). vol. i. (Leipzig and Pest, 1851–1862). (R. N. B.)

ANDREW OF LONGJUMEAU (Longumeau, Lonjumel, &c.), a French Dominican, explorer and diplomatist. He accompanied the mission under Friar Ascelin, sent by Pope Innocent IV. to the Mongols in 1247; at the Tatar camp near Kars he met a certain David, who next year (1248) appeared at the court of King Louis IX. of France in Cyprus. Andrew, who was now with St Louis, interpreted to the king David's message, a real or pretended offer of alliance from the Mongol general Ilchikdai (Ilchikadai), and a proposal of a joint attack upon the Islamic powers for the conquest of Syria. In reply to this the French sovereign despatched Andrew as his ambassador to the great Khan Kuyuk; with Longjumeau went his brother (a monk) and several others—John Goderiche, John of Carcassonne, Herbert "le sommelier," Gerbert of Sens, Robert a clerk, a certain William, and an unnamed clerk of Poissy. The party set out about the 16th of February 1249, with letters from King Louis and the papal legate, and rich presents, including a chapel-tent, lined with scarlet cloth and embroidered with sacred pictures. From Cyprus they went to the port of Antioch in Syria, and thence travelled for a year to the khan's court, going ten leagues a day. Their route led them through Persia, along the southern and eastern shores of the Caspian (whose inland character, unconnected with the outer ocean, their journey helped to demonstrate), and probably through Talas, north-east of Tashkent. On arrival at the supreme Mongol court—either that on the Imyl river (near Lake Ala-kul and the present Russo-Chinese frontier in the Altai), or more probably at or near Karakorum itself, south-west of Lake Baikal—Andrew found Kuyuk Khan dead, poisoned, as the envoy supposed, by Batu's agents. The regent-mother Ogul Gaimish (the "Camus" of Rubruquis) seems to have received and dismissed him with presents and a letter for Louis IX., the latter a fine specimen of Mongol insolence. But it is certain that before the friar had quitted "Tartary," Mangu Khan, Kuyuk's successor, had been elected. Andrew's report to his sovereign, whom he rejoined in 1251 at Caesarea in Palestine, appears to have been a mixture of history and fable; the latter affects his narrative of the Mongols' rise to greatness, and the struggles of their leader, evidently Jenghiz Khan, with Prester John; it is still more evident in the position assigned to the Tatar homeland, close to the prison of Gog and Magog. On the other hand, the envoy's account of Tatar manners is fairly accurate, and his statements about Mongol Christianity and its prosperity, though perhaps exaggerated (*e.g.* as to the 800 chapels on wheels in the nomadic host), are based on fact. Mounds of bones marked his road, witnesses of devastations which other historians record in detail; Christian prisoners. from Germany, he found in the heart of "Tartary" (at Talas); the ceremony of passing between two fires he was compelled to observe, as a bringer of gifts to a dead khan, gifts which were of course treated by the Mongols as evidence of submission. This insulting behaviour, and the language of the letter with which Andrew reappeared, marked the mission a failure: King Louis, says Joinville, "se repenti fort."

We only know of Andrew through references in other writers: see especially William of Rubruquis in *Recueil de voyages*, iv. (Paris, 1839), pp. 261, 265, 279, 296, 310, 353, 363, 370; Joinville, ed. Francisque Michel (1858, &c.), pp. 142, &c.; Jean Pierre Sarrasin, in same vol., pp. 254-255; William of Nangis in *Recueil des historiens des Gaules*, xx. 359-367; Rémusat, *Mémoires sur les relations politiques des princes chrétiens . . . avec les . . . Mongols* (1822, &c.), p. 52. (C. R. B.)

ANDREW, JOHN ALBION (1818–1867), American political leader, "war governor" of Massachusetts, was born at Windham, Maine, on the 31st of May 1818. He graduated at Bowdoin College in 1837, studied law in Boston, was admitted to the Suffolk bar in 1840, and practised his profession in Boston. He also took a deep interest in religious matters, was a prominent member of the Church of the Disciples (Unitarian; founded in Boston by the Rev. James Freeman Clarke), and was assistant editor for some time of *The Christian World*, a weekly religious paper. With ardent anti-slavery principles, he entered political life as a "Young Whig" opposed to the Mexican War; he became an active Free-Soiler in 1848, and in 1854 took part in the organization in Massachusetts of the new Republican party. He served one term, in 1858, in the state House of Representatives, and in 1859 declined an appointment to a seat on the bench of the state supreme court. In this year he took such an active part in raising funds to defend John Brown, then on trial in Virginia, that he aroused the suspicions of a senatorial committee investigating Brown's raid, and was summoned to Washington to tell what he knew of the affair. In 1860 he was chairman of the Massachusetts delegation to the Republican national convention at Chicago, which nominated Lincoln for the presidency; and from 1861 to January 1866, throughout the trying period of the Civil War, he was governor of Massachusetts, becoming known as one of the ablest, most patriotic and most energetic of the remarkable group of "war governors" in the North. Immediately after his inauguration he began filling the militia regiments with young men ready for active service, saw that they were well drilled and supplied them with good modern rifles. As a result, Massachusetts was the only northern state in any way prepared for war when the Confederates fired on Fort Sumter; and her troops began to muster in Boston on the 16th of April, the very day after President Lincoln's call for volunteers. On the next day the Sixth Massachusetts Volunteer Infantry started south for the defence of Washington, and was the first fully armed and equipped volunteer regiment to reach the capital. Within six days after the call, nearly four thousand Massachusetts volunteers had departed for Washington. In 1863, at Governor Andrew's own request, the secretary of war authorized him to raise several regiments of negro troops, with white commissioned officers, and the Fifty-fourth Massachusetts Infantry was the first regiment of free negroes raised in the North. Governor Andrew's example was quickly followed in other states, and before the end of the year 36,000 negroes had been enrolled in the Union armies. When the war department ruled that the negro troops were entitled to pay only as "labourers" and not as soldiers, Governor Andrew used all his influence with the president and the secretary of war to secure for them the same pay as white troops, and was finally successful. Notwithstanding his loyal support of the administration during the struggle, he did not fully approve of its conduct of the war, which he deemed shifting and timid; and it was with great reluctance that he supported Lincoln in 1864 for a second term. In 1865 he rejected the more radical views of his party as to the treatment to be accorded to the late Confederate states, opposed the immediate and unconditional enfranchisement of freedmen, and, though not accepting President Johnson's views in their entirety, he urged the people of Massachusetts to give the new president their support. On retiring from the governor's office he declined the presidency of Antioch College, at Yellow Springs, Ohio, and various positions in the service of the Federal government, and resumed the practice of law, at once achieving great success. In 1865 he presided at the first national convention of the Unitarian Church. He died suddenly of apoplexy, at Boston, on the 30th of October 1867.

See Henry G. Pearson's *Life of John A. Andrew* (2 vols., Boston and New York, 1904).

ANDREWES, LANCELOT (1555–1626), English divine, was born in 1555 in London. His family was an ancient Suffolk one; his father, Thomas, became master of Trinity House. Lancelot was sent to the Cooper's free school, Ratcliff, in the parish of Stepney, and then to the Merchant Taylors' school under Richard Mulcaster. In 1571 he was entered as a Watts scholar at Pembroke Hall, Cambridge, where in 1574–1575 he graduated B.A., proceeding M.A. in 1578. In 1576 he had been elected fellow of Pembroke. In 1580 he took orders; in 1581 he was incorporated M.A. at Oxford. As catechist at his college he read lectures on the Decalogue, which, both on their delivery and on their publication (in 1630), created much interest. He also gained much reputation as a casuist. After a residence in the north as chaplain to Henry Hastings, earl of Huntingdon, President of the North, he was made vicar of St Giles's, Cripplegate, in 1588, and there delivered his striking sermons on the temptation in the wilderness and the Lord's prayer. In a great sermon on the 10th of April (Easter week) 1588, he stoutly vindicated the Protestantism of the Church of England against the Romanists, and, oddly enough, adduced "Mr Calvin" as a new writer, with lavish praise and affection. Andrewes was preferred to the prebendal stall of St Pancras in St Paul's, London, in 1589, and on the 6th of September of the same year became master of his own college of Pembroke, being at the time one of the chaplains of Archbishop Whitgift. From 1589 to 1609 he was also prebendary of Southwell. On the 4th of March 1590, as one of the chaplains of Queen Elizabeth, he preached before her a singularly outspoken sermon, and in October gave his introductory lecture at St Paul's, undertaking to comment on the first four chapters of Genesis. These seem to have been worked up later into a compilation called *The Orphan Lectures* (1657). Andrewes was an incessant worker as well as preacher, and often laboured beyond his strength. He delighted to move among the people, and yet found time to meet with a society of antiquaries, of which Raleigh, Sidney, Burleigh, Arundel, the Herberts, Saville, Stow and Camden were members. In 1598 he declined the two bishoprics of Ely and Salisbury, as the offers were coupled with a proposal to alienate part of the revenues of those sees. On the 23rd of November 1600 he preached at Whitehall a remarkable sermon on justification, which gave rise to a memorable controversy. On the 4th of July 1601 he was appointed dean of Westminster and gave much attention to the school there. He assisted at the coronation of James I. and in 1604 took part in the Hampton Court conference. His name is the first on the list of divines appointed to make the authorized version of the Bible. In 1605 he was consecrated bishop of Chichester and made lord almoner. In 1609 he published *Tortura Torti*, a learned work which grew out of the Gunpowder

Plot controversy and was written in answer to Bellarmine's *Matthaeus Tortus*, which attacked James I.'s book on the oath of allegiance. After his translation to Ely (1609), he again controverted Bellarmine in the *Responsio ad Apologiam*, a treatise never answered. In 1617 he accompanied James I. to Scotland with a view to persuading the Scots that Episcopacy was preferable to Presbyterianism. In 1618 he attended the synod of Dort, and was soon after made dean of the Chapel Royal and translated to Winchester, a diocese which he administered with loving prudence and the highest success. He died on the 26th of September 1626, mourned alike by leaders in church and state.

Two generations later, Richard Crashaw caught up the universal sentiment, when, in his lines "Upon Bishop Andrewes' Picture before his Sermons," he exclaims:—

> "This reverend shadow cast that setting sun,
> Whose glorious course through our horizon run,
> Left the dim face of this dull hemisphere,
> All one great eye, all drown'd in one great teare."

Andrewes was distinguished in many fields. At court, though no trifler or flatterer, he was a favourite counsellor in three successive reigns, but he never meddled much in civil or temporal affairs. His learning made him the equal and the friend of Grotius, and of the foremost contemporary scholars. His preaching was a unique combination of rhetorical splendour and scholarly richness; his piety that of an ancient saint, semi-ascetic and unearthly in its self-denial. As a churchman he is typically Anglican, equally removed from the Puritan and the Roman positions. He stands in true succession to Richard Hooker in working out the principles of the English Reformation, though while Hooker argued mainly against Puritanism, Andrewes chiefly combated Romanism. A good summary of his position is found in his *First Answer to Cardinal Perron*, who had challenged James I.'s use of the title "Catholic." His position in regard to the Eucharist is naturally more mature than that of the first reformers. "As to the Real Presence we are agreed; our controversy is as to the *mode* of it. As to the mode we define nothing rashly, nor anxiously investigate, any more than in the Incarnation of Christ we ask how the human is united to the divine nature in One Person. There is a real change in the elements—we allow *ut panis iam consecratus non sit panis quem natura formavit; sed, quem benedictio consecravit, et consecrando etiam immutavit*" (*Responsio*, p. 263). Adoration is permitted, and the use of the terms "sacrifice" and "altar" maintained as being consonant with scripture and antiquity. Christ is "a sacrifice—so, to be slain; a propitiatory sacrifice—so, to be eaten" (*Sermons*, vol. ii. p. 296). "By the same rules that the Passover was, by the same may ours be termed a sacrifice. In rigour of speech, neither of them; for to speak after the exact manner of divinity, there is but one only sacrifice, *veri nominis*, that is Christ's death. And that sacrifice but once actually performed at His death, but ever before represented in figure, from the beginning; and ever since repeated in memory to the world's end. That only absolute, all else relative to it, representative of it, operative by it. . . . Hence it is that what names theirs carried, ours do the like, and the Fathers make no scruple at it—no more need we" (*Sermons*, vol. ii. p. 300). As to reservation, "it needeth not: the intent is had without it," since an invalid may always have his private communion. Andrewes declares against the invocation of saints, the apparent examples in patristic literature are "rhetorical outbursts, not theological definitions." His services to his church have been summed up thus:—(1) he has a keen sense of the proportion of the faith and maintains a clear distinction between what is fundamental, needing ecclesiastical commands, and subsidiary, needing only ecclesiastical guidance and suggestion; (2) as distinguished from the earlier protesting standpoint, *e.g.* of the Thirty-nine Articles, he emphasized a positive and constructive statement of the Anglican position.

LITERATURE.—Of his works the *Manual of Private Devotions* is the best known, for it appeals to Christians of every church. One of the many good modern editions is that by Alex. Whyte (1900). Andrewes's other works occupy eight volumes in the Library of Anglo-Catholic Theology (1841–1854). Of biographies we have those by H. Isaacson (1650), A. T. Russell (1863), R. L. Ottley (1894), and Dean Church's essay in *Masters in English Theology*. See also W. H. Frere, *Lancelot Andrewes as a Representative of Anglican Principles* (1898; Church Hist. Soc. Publications, No. 44).

ANDREWS, JAMES PETTIT (*c.* 1737–1797), English historian and antiquary, was the younger son of Joseph Andrews, of Shaw House, Newbury, Berkshire, where he was born. He was educated privately, and having taken to the law was one of the magistrates at the police court in Queen Square, Westminster, from 1792 to his death. He developed a taste for literature, and his miscellaneous works include *The Savages of Europe* (London, 1764), a satire on the English which he translated from the French, and *Anecdotes Ancient and Modern* (London, 1789), an amusing collection of gossip. His chief work was a *History of Great Britain connected with the Chronology of Europe from Caesar's Invasion to Accession of Edward VI.*, in 2 vols. (London, 1794–1795). Its plan is somewhat singular, as a portion of the history of England is given on one page, and a general sketch of the contemporaneous history of Europe on the opposite page. He also wrote a *History of Great Britain from Death of Henry VIII. to Accession of James VI. of Scotland*, a continuation of Robert Henry's *History of Great Britain*, published in 1796 and again in 1806. Andrews died at Brompton on the 6th of August 1797, and was buried in Hampstead Church. He married Anne Penrose, daughter of a rector of Newbury.

ANDREWS, THOMAS (1813–1885), Irish chemist and physicist, was born on the 19th of December 1813 at Belfast, where his father was a linen merchant. After attending the Belfast Academy and also the Academical Institution, he went to Glasgow in 1828 to study chemistry under Professor Thomas Thomson, and thence migrated to Trinity College, Dublin, where he gained distinction in classics as well as in science. Finally, he graduated as M.D. at Edinburgh in 1835, and settled down to a successful medical practice in his native place, also giving instruction in chemistry at the Academical Institution. Ten years later he was appointed vice-president of the newly established Queen's College, Belfast, and professor of chemistry, and these two offices he held till 1879, when failing health compelled his retirement. He died on the 26th of November 1885. Andrews first became known as a scientific investigator by his work on the heat developed in chemical actions, for which the Royal Society awarded him a Royal medal in 1844. Another important research, undertaken with P. G. Tait, was devoted to ozone. But the work on which his reputation mainly rests, and which best displayed his skill and resourcefulness in experiment, was concerned with the liquefaction of gases. He carried out a very complete inquiry into the laws expressing the relations of pressure, temperature and volume in carbonic dioxide, in particular establishing the conceptions of critical temperature and critical pressure, and showing that the gas passes from the gaseous to the liquid state without any breach of continuity.

His scientific papers were published in a collected form in 1889, with a memoir by Professors Tait and Crum Brown.

ANDRIA, a town and episcopal see of Apulia, Italy, in the province of Bari; 35m. W. of the town of Bari by steam tramway, and 6 m. S.S.E. of Barletta. Pop. (1901) 49,569. It was founded probably about 1046 by Peter, the first Norman count of Andria. It was a favourite residence of the emperor Frederick II., whose second and third wives, Iolanthe and Isabella of England, were buried in the cathedral dedicated to St Richard, who is believed to have come from England in 492; their tombs, however, no longer exist. There are several other fine churches of the 13th century. The Castel del Monte, 9½ m. S. of Andria, was constructed by Frederick II., who frequently resided here; it is an octagonal building in two storeys with octagonal towers at each angle, and was further surrounded by three outer walls. Despite its massive and imposing exterior, its details are fine.

See E. Rocchi in *L'Arte*, i. (1898) 121.

ANDRIEU, BERTRAND (1761–1822), French engraver of medals, was born at Bordeaux. He is considered as the restorer of the art in France, which had declined after the time of Louis XIV.; and during the last twenty years of his life he was entrusted by the French government with the execution of every work of importance. Many of his medals are figured in the *Medallic History of Napoleon*.

ANDRIEUX, FRANÇOIS GUILLAUME JEAN STANISLAS (1759–1833), French man of letters, was born at Strassburg on the 6th of May 1759. He was educated at Strassburg and proceeded to Paris to study law. There he became a close friend of Collin d'Harleville. He became secretary to the duke of Uzès, and practised at the bar, but his attention was divided between his profession and literature. His plays are of the 18th century style, comedies of intrigue, but they rank with those of Collin d'Harleville among the best of the period next to those of Beaumarchais. *Les Étourdis*, his best comedy, was represented in 1788 and won for the author the praise of La Harpe. Andrieux hailed the beginning of the Revolution with delight and received a place under the new government, but at the beginning of the Terror he retreated to Mévoisins, the patrimony of his friend Collin d'Harleville. Under the Convention he was made civil judge in the Court of Cassation, and was one of the original members of the Institute. A moderate statesman, he was elected secretary and finally president of the Tribunat, but with other of his colleagues he was expelled for his irreconcilable attitude towards the establishment of the civil code. On his retirement he again turned to write for the stage, producing *Le Trésor* and *Molière avec ses amis* in 1804. He became librarian to Joseph Bonaparte and to the Senate, was professor of grammar and literature at the École Polytechnique and eventually at the Collège de France. As a professor he was extraordinarily successful, and his lectures, which have unhappily not been preserved, attracted mature men as well as the ordinary students. He was rigidly classical in his tastes, and an ardent opponent of romanticism, which tended in his opinion to the subversion of morals. Among his other plays are *La Comédienne* (1816), one of his best comedies, and a tragedy, *Lucius Junius Brutus* (1830). Andrieux was the author of some excellent stories and fables: *La Promenade de Fénelon*, *Le Bulle d'Alexandre VI.* and the *Meunier de Saint-Souci*. In 1829 he became perpetual secretary to the Academy, and in fulfilment of his functions he worked hard at the completion of the Dictionary. He died on the 9th of May 1833 in Paris.

See also A. H. Taillandier, *Notice sur la vie et les ouvrages d'Andrieux* (1850); Sainte-Beuve, *Portraits littéraires*, vol. i.

ANDRISCUS, often called the "pseudo-Philip," a fuller of Adramyttium, who claimed to be a son of Perseus, last king of Macedonia. He occupied the throne for a year (140–148 B.C.). Unable to obtain a following in Macedonia, he applied to Demetrius Soter of Syria, who handed him over to the Romans. He contrived, however, to escape; reappeared in Macedonia with a large body of Thracians; and, having completely defeated the praetor Publius Juventius (140), he assumed the title of king. His conquest of Thessaly and alliance with Carthage made the situation dangerous. Eventually he was defeated by Q. Caecilius Metellus (148), and fled to Thrace, whose prince gave him up to Rome. He figured in the triumph of Metellus (146), who received the title of "Macedonicus" for his victory. Andriscus's brief reign was marked by cruelty and extortion. After this Macedonia was formally reduced to a province.

Velleius Paterculus i. 11; Florus ii. 14; Livy, *Epit.* 49, 50, 52; Diod. Sic. xxxii. 9.

ANDROCLUS, a Roman slave who lived about the time of Tiberius. He is the hero of a story told by Aulus Gellius (v. 14), which states that Androclus had taken refuge from the cruelties of his master in a cave in Africa, when a lion entered the cave and showed him his swollen paw, from which Androclus extracted a large thorn. The grateful animal subsequently recognized him when he had been captured and thrown to the wild beasts in the circus, and, instead of attacking him, began to caress him (Aelian, *De Nat. An.* vii. 48).

ANDROMACHE, in Greek legend, the daughter of Eëtion, prince of Thebe in Mysia, and wife of Hector. Her father and seven brothers fell by the hands of Achilles when their town was taken by him; her mother, ransomed at a high price, was slain by Artemis (*Iliad*, vi. 414). During the Trojan War her husband was slain by Achilles, and after the capture of the city her son Astyanax (or Scamandrius) was hurled from the battlements (Eurip. *Troades*, 720). When the captives were allotted, Andromache fell to Neoptolemus (Pyrrhus), the son of Achilles, whom she accompanied to Epirus, and to whom she bore three sons. When Neoptolemus was slain at Delphi, he left his wife and kingdom to Helenus, the brother of Hector (Virgil, *Aen.* iii. 294). After the death of her third husband, Andromache returned to Asia Minor with her youngest son Pergamus, who there founded a town named after himself. Andromache is one of the finest characters in Homer, distinguished by her affection for her husband and child, her misfortunes and the resignation with which she endures them. The death of Astyanax, and the farewell scene between Andromache and Hector (*Iliad*, vi. 323), were represented in ancient works of art, while Andromache herself is the subject of tragedies by Euripides and Racine.

ANDROMEDA, in Greek legend, the daughter of Cepheus and Cassiopeia (Cassiope, Cassiepeia), king and queen of the Ethiopians. Cassiopeia, having boasted herself equal in beauty to the Nereids, drew down the vengeance of Poseidon, who sent an inundation on the land and a sea-monster which destroyed man and beast. The oracle of Ammon having announced that no relief would be found until the king exposed his daughter Andromeda to the monster, she was fastened to a rock on the shore. Here Perseus, returning from having slain the Gorgon, found her, slew the monster, set her free, and married her in spite of Phineus, to whom she had before been promised. At the wedding a quarrel took place between the rivals, and Phineus was turned to stone by the sight of the Gorgon's head (Ovid, *Metam.* v. 1). Andromeda followed her husband to Tiryns in Argos, and became the ancestress of the family of the Perseidae. After her death she was placed by Athena amongst the constellations in the northern sky, near Perseus and Cassiopeia. Sophocles and Euripides (and in modern times Corneille) made the story the subject of tragedies, and its incidents were represented in numerous ancient works of art.

Apollodorus ii. 4; Hyginus, *Fab.* 64; Ovid, *Metam.* iv. 662; Fedde, *De Perseo et Andromeda* (1860).

The Greeks personified the constellation Andromeda as a woman with her arms extended and chained. Its Latin names are *Persea*, *Mulier catenata* ("chained woman"), *Virgo devota*, &c.; the Arabians replaced the woman by a seal; Wilhelm Schickard (1592–1635) named the constellation "Abigail"; Julius Schiller assigned to it the figure of a sepulchre, naming it the "Holy Sepulchre." In 1786 Johann Elert Bode formed a new constellation, named the "Honours of Frederick," after his patron Frederick II., out of certain stars situated in the arm of Ptolemy's Andromeda; this innovation found little favour and is now discarded.

Twenty-three stars are catalogued by Ptolemy and Tycho Brahe; Hevelius increased this number to forty-seven, while Flamsteed gave sixty-six. The most brilliant stars are α *Andromedae* or "Andromeda's head," and β *Andromedae* in the girdle (Arabic *mirach* or *mizar*), both of the second magnitude; γ *Andromedae* in the foot (*alamak* or *alhames*), of the third magnitude. Scientific interest centres mainly on the following:—the nebula in Andromeda, one of the finest in the sky (see NEBULA); γ *Andromedae*, the finest binary in the heavens, made up of a yellow star of magnitude 2½, and a blue-green of magnitude 5½, the latter being itself binary; *Nova Andromedae*, a "new" star, discovered in the nebula by C. E. A. Hartwig in 1885, and subsequently spectroscopically examined by many observers; *R Andromedae*, a regularly variable star; and the *Andromedids*, a meteoric swarm, associated with Biela's comet, and having their radiant in this constellation (see METEOR).

ANDRON (Gr. ἀνδρών), that part of a Greek house which was reserved for men, as distinguished from the gynaeceum (γυναικεῖον), the women's quarters.

ANDRONICUS I. (COMNENUS), emperor of the East, son of Isaac, and grandson of Alexius I. Comnenus, was born about the beginning of the 12th century. He was endowed by nature with the most remarkable gifts both of mind and body. He was handsome and eloquent, but licentious; and at the same time active, hardy, courageous, a great general and an able politician. His early years were spent in alternate pleasure and military service. In 1141 he was taken captive by the Turks (Seljuks) and remained in their hands for a year. On being ransomed he went to Constantinople, where was held the court of his cousin, the emperor Manuel, with whom he was a great favourite. Here the charms of his niece, the princess Eudoxia, attracted him. She became his mistress, while her sister Theodora stood in a similar relation to the emperor Manuel. In 1152, accompanied by Eudoxia, he set out for an important command in Cilicia. Failing in his principal enterprise, an attack upon Mopsuestia, he returned, but was again appointed to the command of a province. This second post he seems also to have left after a short interval, for he appeared again in Constantinople, and narrowly escaped death at the hands of the brothers of Eudoxia. About this time (1153) a conspiracy against the emperor, in which Andronicus participated, was discovered and he was thrown into prison. There he remained for about twelve years, during which time he made repeated but unsuccessful attempts to escape. At last, in 1165, he was successful; and, after passing through many dangers, reached the court of Yaroslav, grand prince of Russia, at Kiev. While under the protection of the grand prince, Andronicus brought about an alliance between him and the emperor Manuel, and so restored himself to the emperor's favour. With a Russian army he joined Manuel in the invasion of Hungary and assisted at the siege of Semlin. After a successful campaign they returned together to Constantinople (1168); but a year after, Andronicus refused to take the oath of allegiance to the prince of Hungary, whom Manuel desired to become his successor. He was removed from court, but received the province of Cilicia. Being still under the displeasure of the emperor, Andronicus fled to the court of Raymund, prince of Antioch. While residing here he captivated and seduced the beautiful daughter of the prince, Philippa, sister of the empress Maria. The anger of the emperor was again roused by this dishonour, and Andronicus was compelled to fly. He took refuge with Amalric, king of Jerusalem, whose favour he gained, and who invested him with the town of Berytus, now Beirut. In Jerusalem he saw Theodora, the beautiful widow of the late king Baldwin and niece of the emperor Manuel. Although Andronicus was at that time fifty-six years old, age had not diminished his charms, and Theodora became the next victim of his artful seduction. To avoid the vengeance of the emperor, she fled with him to the court of the sultan of Damascus; but not deeming themselves safe there, they continued their perilous journey through Persia and Turkestan, round the Caspian Sea and across Mount Caucasus, until at length they settled among the Turks on the borders of Trebizond. Into that province Andronicus, with a body of adventurers, made frequent and successful incursions. While he was absent upon one of them, his castle was surprised by the governor of Trebizond, and Theodora with her two children were captured and sent to Constantinople. To obtain their release Andronicus made abject submission to the emperor; and, appearing in chains before him, implored pardon. This he obtained, and was allowed to retire with Theodora into banishment in the little town of Oenoe, on the shores of the Black Sea. In 1180 the emperor Manuel died, and was succeeded by his son Alexius II., who was under the guardianship of the empress Maria. Her conduct excited popular indignation; and the consequent disorders, amounting almost to civil war, gave an opportunity to the ambition of Andronicus. He left his retirement, secured the support of the army and marched upon Constantinople, where his advent was stained by a cruel massacre of the Latin inhabitants. Alexius was compelled to acknowledge him as colleague in the empire, but was soon put to death. Andronicus, now (1183) sole emperor, married Agnes, widow of Alexius II., a child eleven years of age. His short reign was characterized by strong and wise measures. He resolved to suppress many abuses, but, above all things, to check feudalism and limit the power of the nobles. The people, who felt the severity of his laws, at the same time acknowledged their justice, and found themselves protected from the rapacity of their superiors. The aristocrats, however, were infuriated against him, and summoned to their aid William of Sicily. This prince landed in Epirus with a strong force, and marched as far as Thessalonica, which he took and destroyed; but he was shortly afterwards defeated, and compelled to return to Sicily. Andronicus seems then to have resolved to exterminate the aristocracy, and his plans were nearly crowned with success. But in 1185, during his absence from the capital, his lieutenant ordered the arrest and execution of Isaac Angelus, a descendant of the first Alexius. Isaac escaped and took refuge in the church of St Sophia. He appealed to the populace, and a tumult arose which spread rapidly over the whole city. When Andronicus arrived he found that his power was overthrown, and that Isaac had been proclaimed emperor. Isaac delivered him over to his enemies, and for three days he was exposed to their fury and resentment. At last they hung him up by the feet between two pillars. His dying agonies were shortened by an Italian soldier, who mercifully plunged a sword into his body. He died on the 12th of September 1185.

ANDRONICUS II. (PALAEOLOGUS) (1260–1332), eastern Roman emperor, was the elder son of Michael Palaeologus, whom he succeeded in 1282. He allowed the fleet, which his father had organized, to fall into decay; and the empire was thus less able than ever to resist the exacting demands of the rival powers of Venice and Genoa. During his reign the Turks under Osman conquered nearly the whole of Bithynia; and to resist them the emperor called in the aid of Roger di Flor, who commanded a body of Spanish adventurers. The Turks were defeated, but Roger was found to be nearly as formidable an enemy to the imperial power. He was assassinated by Andronicus's son and colleague, the emperor Michael IX., in 1305. His adventurers (known as the Catalan Grand Company) declared war upon Andronicus, and, after devastating Thrace and Macedonia, conquered the duchy of Athens and Thebes. From 1320 onwards the emperor was engaged in war with his grandson Andronicus (see below). He abdicated in 1328 and died in 1332.

ANDRONICUS III. (*c.* 1296–1341), eastern Roman emperor, was the son of Michael, son of Andronicus II. His conduct during youth was so violent that, after the death of his father Michael in 1320, his grandfather resolved to deprive him of his right to the crown. Andronicus rebelled; he had a powerful party, and the first period of civil war ended in his being crowned and accepted as colleague by his grandfather, 1325. The quarrel broke out again and, notwithstanding the help of the Bulgarians, the older emperor was compelled to abdicate, 1328. During his reign Andronicus III. was engaged in constant war, chiefly with the Turks, who greatly extended their conquests. He annexed large regions in Thessaly and Epirus, but they were lost before his death to the rising power of Servia under Stephen Dušan. He did something for the reorganization of the navy, and recovered Lesbos and Chios from the Genoese. He died in 1341.

ANDRONICUS OF CYRRHUS, Greek astronomer, flourished about 100 B.C. He built a *horologium* at Athens, the so-called "tower of the winds," a considerable portion of which still exists. It is octagonal, with figures carved on each side, representing the eight principal winds. A brazen Triton on the summit, with a rod in his hand, turned round by the wind, pointed to the quarter from which it blew. From this model is derived the custom of placing weathercocks on steeples.

ANDRONICUS OF RHODES (*c.* 70 B.C.), the eleventh scholarch of the Peripatetics. His chief work was the arrangement of the writings of Aristotle and Theophrastus with materials supplied to him by Tyrannion. Besides arranging the works, he seems to have written paraphrases and commentaries, none of which is extant. Two treatises are sometimes erroneously attributed to him, one on the Emotions, the other a commentary on Aristotle's *Ethics* (really by Constantine Palaeocappa in the 16th century, or by John Callistus of Thessalonica).

ANDROPHAGI (Gr. for "man-eaters"), an ancient nation of cannibals north of Scythia (Herodotus iv. 18, 106), probably in the forests between the upper waters of the Dnieper and Don. They were most likely Finns (Samoyed has the same meaning) and perhaps the ancestors of the Mordvinians (*q.v.*).

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